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Smallholder farmers' mindset of transformative thinking relevant for sustainable agriculture in rural Malawi

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MSc International Environmental Studies

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Declaration

I, Emmanuel Anokye, declare that this thesis is the outcome of my research investigations and discoveries. Other people's sources of information have been recognised, and a reference list has been included. This work has not been previously submitted to any other university for the award of any form of academic degree.

Signature: Emmanuel Anokye

Date: 15-05-2023

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ABSTRACT

Land restoration, low agricultural productivity of key crops, and food insecurity remain significant concerns in Sub Sahara Africa (SSA). A growing population, depleting resources, and a changing climate exacerbate these issues. Many agricultural innovations (AIs) exist around the world as means of increasing agricultural productivity, sustainability, and food security, but they have had limited success in these countries of which Malawi is part. The possible barriers could also be an unexamined mindset of all actors. To improve inner transformation thereby advancing sustainable agriculture, Farmer Field School (FFS) has shown to be a key strategy for knowledge impact. The findings revealed that FFS improved farming practices and had less of an effect on agroecology, also study participants (both FFS and non-FFS members) demonstrated partial adoption of technological change. An existing FFS area was chosen to examine the barriers that prevent smallholder farmers from acquiring knowledge, and the findings suggested that cost and technical know-how were significant barriers. Agricultural knowledge can be easily transferred through Farmer Field School (FFS) and lead Farmer approach as Malawi's current extension services (extension-farmer ratio) are shortcomings as shown by this study. This study used a participation technique that included two focus group discussions and a semi-structured interview with a total of 80 smallholder farmers in rural Malawi.

Keywords: Farmer Field School; Knowledge Transfer; Agricultural Innovation; Sustainability; Inner Transformation; Malawi

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Abbreviations

AESA	Agro-ecosystem analysis
DAESS	district-based agricultural extension services system
FGD	Focus group discussion.
FFS	Farmer field school
IPM	Integrated pest management
OPV	Open pollinated varieties
UNFPA	United Nations Population Fund
SMEs	Small and medium-sized enterprises
SAPs	Sustainable agricultural practices
SSA	Sub Sahara Africa

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Introduction

1.1 Background

Agriculture is a significant and valued economic sector in Malawi, given its climate-sensitive share of the economy, the number of people employed in the sector, and its relevance in terms of food security. Malawi is a country located in Sub-Saharan Africa. It is a landlocked country in southeastern Africa and is bordered by Zambia to the northwest, Tanzania to the northeast and Mozambique to the east, south and west. In Sub-Saharan Africa (SSA), the prevalence of food insecurity and poverty remains a major concern. Food insecurity is exacerbated by stagnant and low yields of key crops, rising population, deforestation, and changing climatic conditions (Otsuka and Kijima 2010). Agriculture provides a path to lengthy food security, alleviation of poverty, and rural development in SSA because it is the key cause of the rural economy and livelihood (Otsuka and Muraoka 2017). However, since the early 1960s, key crop yields in SSA have remained significantly lower than what can be achieved through good agronomic practices (Otsuka and Muraoka 2017).

The mindset and beliefs of farmers can have a significant impact on their agricultural development in Africa. Farmers who have a positive attitude towards change, a good understanding of their environment, a willingness to take calculated risks, and a strong sense of purpose are more likely to achieve success and improve their livelihoods through agriculture. Farmers do have a difficult time changing their mindset (Moss 2019) because their ancestors instilled in them a farming lifestyle that has served as the foundation of agriculture for most smallholder farmers in Africa. The farming practice of their ancestors may have worked for them because the population was small, but farming

should now be done on a sustainable basis due to the large population, particularly in Africa. A mindset shift is required, which is a fundamental shift from limiting way of thinking for them. Farmers' mindset can be expressed simply as what they believe, at times spirituality, and the human-nature relationship. Farmers base their expectations and goals on their perceptions of the nature of situations; belief is a major component of the mindset; thus, low agricultural yields may be linked to the farmer mindset. Farmers' mindsets may benefit from changes in their inner transformation, which is defined as being concerned with various aspects of human existence and interactions such as consciousness, mindsets, values, worldviews, beliefs, spirituality, and human-nature connection (Woiwode, Schöpke, et al. 2021).

Malawi has an agrarian economy that is heavily reliant on smallholder farmers, who account for roughly 80% of total agricultural production (FAO 2003). Even though most people in Malawi are farmers, food insecurity is a problem. While Malawi's total cultivated land under agriculture increased, key crop yields remained low and stagnant (Greenberg and Jones). Deforestation is estimated to be responsible for the loss of 33,000 hectares per year in Malawi and is primarily caused by agricultural expansion (Ngwira and Watanabe 2019), Most African farmers believe in the shifting cultivation system of farming that their ancestors practiced for years.

Given that local communities, including smallholder farmers, are local agents of change in many sustainable processes (Erbaugh, Pradhan, et al. 2020), smallholder farmers' attitudes toward transformational change to promote and reshape the landscape is still limited, though agricultural extension workers are working hard by sharing ideas to promote sustainable agriculture in these African countries.

Knowledge is a crucial element in raising agricultural productivity in developing countries to improve the standard of living. It has long been difficult to produce and disseminate knowledge about sustainable farming methods to support rural development, especially in Africa. Farmers Field School (FFS) method of learning, technology development, and dissemination is based on adult learning principles such as experimental. FFS introduced into Sub-Saharan Africa in the Mid-1990s by the Food and Agriculture Organization that created the FFS in the 1980s as a novel approach to farmer education with the goal of promoting integrated pest management (IPM) and extending farmers' knowledge (Pemsl, Waibel, et al. 2006). Studies in several Asian nations have shown that FFS can be effective in reducing the overuse of chemical pesticides (Tripp, Wijeratne, et al. 2005). FFS has also been shown to help farmers become more knowledgeable (Godtland, Sadoulet, et al. 2004).

The Farmer Field School (FFS) method arose from a specific urgent matter. Farmers in Indonesia started placing their crops, health, and environment in grave danger at the close of the twentieth century due to the widespread usage of very hazardous pesticides encouraged strongly by the corporate sector and the government. Pest species developed resistance and, in certain cases, resurfaced. What was needed was a sizable, dispersed education program for farmers so that they could become "skilled" in controlling the ecology of their farms, resulting in higher yields, fewer issues, more earnings, as well as less danger to their environment and health (Braun and Duveskog 2011). The Farmer Field Schools strategy is a participatory and supplementary way of highlighting traditional agricultural advisory services, assisting smallholder farmers in acquiring new skills and knowledge, as well as becoming more climate resilient. FFS initiatives can also contribute to inner transformation among smallholder farmers in Malawi. This is because FFS

promotes a participatory and inclusive learning environment that allows farmers to reflect on their attitudes, beliefs, and behaviours towards farming. FFS can help farmers to recognize the need for change, adopt new practices, and develop a positive mindset towards farming. Farmers learn how to analyse problems and make appropriate decisions about how to adapt their practices to the conditions and contexts of their surroundings. The FFS concept is based on learning-by-doing principles that consider various innovations and indigenous knowledge, standard FFS group of 25 to 30 farmers (Bartlett 2005). They can make informed decisions by analyzing and understanding the local agro-ecosystem through regular agro-ecosystem analysis (AESAs) and considering existing capacities. Malawi's smallholder farmers are equally vulnerable to the effects of climate change (Makate, Makate, et al. 2019) as well as food insecurity due to their low adoption rate of technologies (Simtowe, Asfaw, et al. 2016) and how transformative they are after acquiring knowledge. This necessitates an investigation into why vulnerable smallholder farmers are not adopting transformative approaches that will enable them to sustainably manage and use natural resources while also restoring land and encouraging diversification. In addition to identifying some of the changes that various types of farmers would need to make in order to significantly diverge agriculture from its current paths, this article will also attempt to identify the required levers to encourage and promote adaptation and change.

1.2 Theoretical framework

The FFS's lack of formal education with lectures and emphasis on experiential (learning-by-doing), participatory, and hands-on learning are important contributors to its success. This advances the theory and practice of adult learning. Each activity has a process for action, observation, analysis, and decision-making. The importance of "why" as well

as "how" is stressed. Expertise has shown that after the FFS itself is complete, planned, useful activities provide a strong foundation for ongoing innovation and local adaptation. (Braun and Duveskog 2011). It is one of the main reasons farmer facilitators find it simple to lead FFSs because, once they learn how to facilitate an activity, the results are clear from the exercise itself. According to Karimi and Niknami (2020), the FFS program has proven to impact the knowledge, social, economic, and production of a participant in Iran. As to whether farmer field school can impact inner transformation in farmers in rural Malawi are yet to be found.

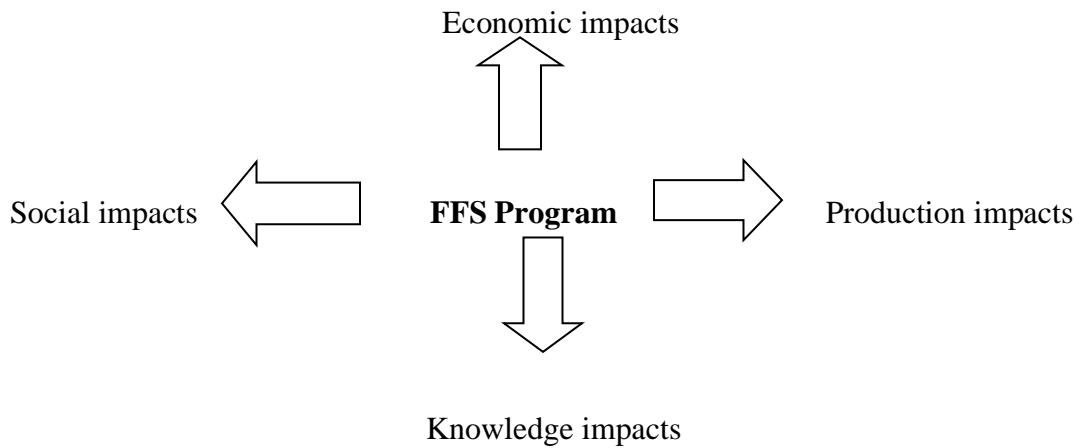


Figure 1: Showing FFS program impacts.

1.3 Conceptual Model

Farmers Field School encourages self-empowerment, environmental awareness, knowledge of climate change and inner transformation among farmers. These factors are further assisted by technical, social, production and knowledge perception and this further helps in development of personal transformation.

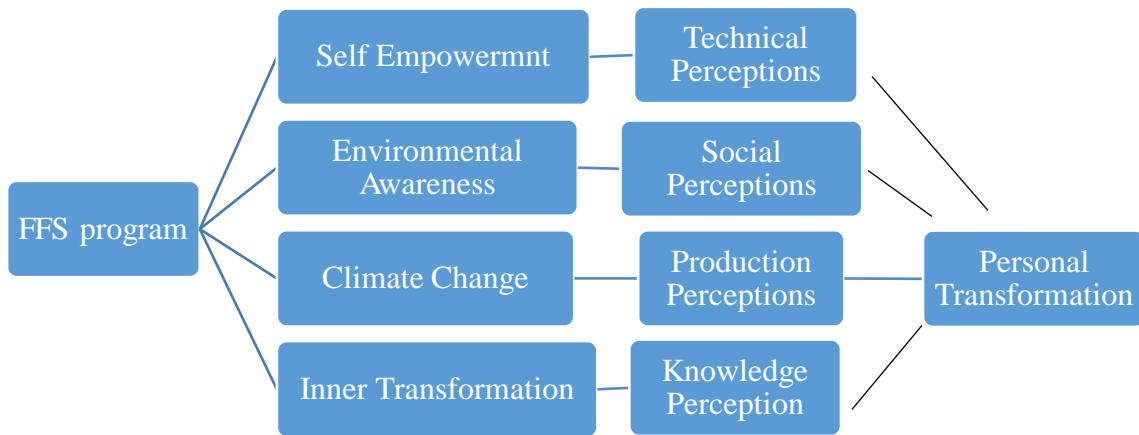


Figure 2: FFS conceptual model

This leads to understanding the technology used by farmers, how FFS initiatives will impact smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry. Furthermore, it can also be identifying how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability. Lastly is important to determine if there are gaps in the current extension services for inner transformation on sustainability. This will be helpful to initiate better understanding for development of personal transformation among farmers.

1.4 Justification

Every country in the world is seeking to supply enough food to feed its people to maintain food security, which is a major issue that the 2030 Sustainable Development Goal will address through agriculture. Agriculture has both negative effects on the environment, such as pollution and soil degradation, as well as positive effects, such as capturing greenhouse gases in crops and soil (Gregorich, Rochette et al. 2005), restoring the natural

vegetation and lowering flood risks with specific farming practices. Therefore, there is a need for the right mindset because farmers' beliefs and thoughts influence how they behave in their farming activities. Having the right mindset is essential for success in agriculture. Farmers with the right mindset will find it easier to adopt agricultural technologies because they want to live a better life, which will have a positive impact on the sustainability issue because most of these agricultural technologies take sustainability into account. The right mindset is essential for success in agriculture in Malawi because it enables farmers to take calculated risks, innovate, think long-term, and engage in continuous learning. Farmers who have the right mindset are better equipped to overcome the challenges facing the agricultural sector in Malawi and achieve success in their farming practices.

Both outer and inner barriers to the right and context responsive mindset of farmers are important to know because they can significantly impact the success of agricultural practices.

Outer barriers to the right mindset of farmers may include external factors such as limited access to resources, poor infrastructure, inadequate extension services, and climate change. These factors can negatively impact farmers' ability to adopt new technologies and practices, take calculated risks, and engage in continuous learning. For example, farmers who do not have access to credit or irrigation may not be able to invest in new technologies, which can limit their productivity and income.

Inner barriers to the right mindset of farmers include personal attitudes, beliefs, and behaviours towards farming. These factors can influence farmers' willingness to take risks, innovate, think long-term, and engage in continuous learning. Inner barriers can be related to a lack of self-confidence, fear of failure, resistance to change, or a negative attitude

towards innovation. For example, some farmers may be hesitant to try new technologies or farming practices because they are unsure of their efficacy or have had negative experiences in the past.

Discovering both outer and inner barriers to the right mindset of farmers is important because it can help policymakers and development organizations to design appropriate interventions to support farmers. For example, addressing outer barriers such as inadequate infrastructure or extension services can improve farmers' access to information and resources, which can help to overcome inner barriers such as a negative attitude towards innovation. On the other hand, addressing inner barriers such as a lack of self-confidence or resistance to change can help to promote a positive mindset and encourage farmers to take risks, innovate, and engage in continuous learning.

Inner barriers will also be considered in this study, which seems to affect farmers when it comes to transformation or adoption. One inner barrier for most smallholder farmers could be fear of change because they have been with some practice for a longer period and believe they are satisfied but do not know what the new practice will bring on board. The main crops grown by Malawi's subsistence farmers are maize and tobacco, which deplete the soil, but most farmers have not implemented any measures to ensure the land's sustainability. With the introduction of the FFS program, which has proven to have a lot of positive impact on participants, this study will focus on how FFS programs have changed farmers' mindset on food production, as studies show that agriculture is one of the main causes of climate change. However, the farmer mindset of transformative thinking may be relevant to Malawi's sustainable agriculture.

1.5 Significance of the study

This study will be helpful for farmer associations to understand and comprehend that since different types of farmers start from different positions and are impacted by global trends in different ways, they require various pathways for adaptation and sustainable development. In addition, this study will pave the way for future researchers to adopt and develop a proper plan for farmers to adopt transformations. Moreover, the findings of the study will also be helpful for global leaders who want to take action through their governance decisions, they have a range of options that provide opportunities for action over various time frames and can support food producers and consumers across the board.

For theoretical implications, this study will enhance the understanding of the domains being investigated in this study. The findings of the study will indicate whether adaptation of transformation is helping farmers or not. Moreover, this study will emphasize the importance of knowledge among farmers.

1.6 Aims and Objectives

Despite most studies concentrating on the adoption of technological innovations, little research has been conducted on farmers' mindset of transformative thinking for sustainable agriculture. This study examines how knowledge is an exchange between researchers and smallholder farmers, and vice versa, using an FFS approach in rural Malawi since FFS is a bottom-up approach to problem-solving among smallholder farmers around the world.

1.7 Objectives

1. To review current technology uses by farmers currently, how FFS initiatives have impact smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry.
2. To identify how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability.
3. To determine if there are gaps in the current extension services for inner transformation on sustainability,
4. To review the theories related to transformation process for human beings.

1.8 Research questions

The research will answer the following questions:

1. How does the mindset of smallholder farmers change or altered as they gain knowledge?
2. In what ways can Farmer Field Schools in rural Malawi be a transformative learning tool?
3. How does the current extension service affect smallholder farmers' acquisition of knowledge?

Structure of the thesis

The thesis will be divided into 5 chapters. Chapter 1 includes a description of the study background, justification for the study, the significance of the study, objectives of the study, and research questions of the study. The second chapter will be investigating the

study variables in detail. The third chapter will include an explanation of the research method. The fourth chapter will demonstrate the study findings. And the last chapter will include a discussion of the results along with a conclusion and recommendations.

Literature Review

Introduction

This paper is aimed to analyze and investigate in what ways current technology is used by farmers, how FFS initiatives impact smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry. In addition to that it is aimed to analyze how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability. In this chapter efforts were made to demonstrate the information related to study variables. This chapter attempts to explain how modernity might lead to uncertainty of food and resources for small holder farmers. In addition to those technologies being adopted by farmers in 20th century is also being explained. It is followed by how knowledge impacts a person's perception.

2.1 Modernity and unsustainability crisis

To understand the problems of unsustainability, it is necessary to conceive the current crisis as a civilizing crisis, which crosses the border of the local due to its global nature.

Authors such as Valdez-De-Leon, (2019) and Benitez et al., (2020) argue that modern industrialized society is undermining global ecosystem connections on whose maintenance the very existence of humanity depends, and they highlight that a crisis of civilization is characterized by coinciding with a historical moment in which to a critical point, not only socioeconomic structures, but also political and cultural institutions, and the value system that shapes and gives meaning to a given culture.

Benitez et al., (2020), exposes the characteristics that account for the crisis through a historical review of how it has been generated from the "evolution" of the Western economic model. He studies it from the Neolithic to today's neoliberal capitalist model and highlights a connection between all dimensions of the crisis (sociocultural, political, ecological, economic, and institutional). He asserts that the guidelines of the development model followed up to now by industrialized societies cannot be prolonged.

Prokopowicz, and Gołębiowska, A. (2021) goes further by explaining why the current crisis is more than a temporary concatenation of various crises financial, economic, state debt, ecological, food, securities, energy, military and spiritual- and considers that all these crises are grounded in a kind of rationality and values that go back to the dominant Western civilization of the last three or four hundred years. The authors assure that such rationality is plagued by a series of assumptions incompatible with life and accentuates the origin of these crises in two transcendental factors: on the one hand, the historical process of globalization or globalized western model in the last 50 years, especially through the ideology of developmentalism and consumerism. And on the other hand, the acceleration of the fictitious speculative economy to the detriment of a real economy, in most of the northern hemisphere.

So, what are the characteristics of unsustainability problems, at an economic, ecological, political, sociocultural, and institutional level?

Quintero-Angel, and González-Acevedo, (2018) summarizes them as follows: a) demographic growth, in one hundred years (from 1900 to 2000), the population grew more than four times that of that time; b) the world economy that, in the same period of one hundred years, increased fourteen times; c) energy consumption, based on oil, increased

sixteen times; d) water consumption increased nine times; e) Carbon dioxide (CO₂) emissions increased by more than thirteen times and f) industrial emissions increased forty times.

For his part, Loures et al., (2020), classifies them into three: a) Energy crisis: end of the era of cheap oil, and destabilization of the planet's climate; b) Ecological crisis: hecatomb of biodiversity. c) Economic crisis: the war of the rich against the poor called neoliberalism continues basically without control, in which the greatest characteristic is reflected in the dominance of financial capital over classical industrial capital.

By studying the problems of unsustainability and trying to find their origin, it could be located in the invention of agriculture. The need for greater capacity to produce food arises from a larger population and, in turn, represented a restructuring of society. The food surplus allowed a new form of social and political organization and, at the same time, derived in taxes that contributed to the training of professional soldiers and bureaucrats (Diamond, 1998).

Advances in agriculture made it possible to support denser and more centralized populations than hunter-gatherers and gave rise to the formation of a new culture around food production.

On the contrary, in a technocracy, tools play a basic role in the image of the world that culture produces. The symbolic and social world is more frequently submitted to the demands of the development of tools. So, they do not integrate into the culture, but rather attack it and challenge it to become the culture itself.

The birth of modern science has its roots after the publication of Descartes' Discourse on the Method, in 1637. Descartes' philosophy is fundamentally focused on finding solutions to problems in timeless and universal terms (Davies, 2020). At the same time, for Bacon it was necessary to find a new method for science, which would allow the human being to see reality without distortions, "subjecting it to the facts."

Bacon's attempt was aimed at controlling sensitive human experience, subject to error, and organizing experimentation in such a way that, from precise observation of facts, general laws could be obtained. Bacon proposed rigorous observation as the master key to a new method of knowledge that should prevail over traditional knowledge (Bacon et al., 2020).

Thus, Descartes and Bacon were the philosophers who, in the 17th century, provided modern thought with the two pillars that will sustain it in these almost 400 years of Modernity: Rationalism and Empiricism. Although these doctrines maintain very different positions, both coincide in their criticism of the old model of humanist thought of the Renaissance, which they hold responsible for the backwardness of science (Baskin, 2020; Birat, 2021).

In 1642 Isaac Newton was born, another scientist whose life and work will be decisive for the constitution of the mechanistic paradigm and the consolidation of the foundations of modern thought. The combination of Cartesian rationalism and Baconian empiricism, along with Newtonian mechanism, went on to become a broad model of thought.

Adam Smith (1723-1790) is another of the builders of Modernity. Smith assumes the Newtonian mechanistic vision of the world and sets out the challenge of applying it to the search for economic laws. His key ideas place human labor as the source of all wealth. This leads him to the conclusion that the best method to organize the economy is the one based on the spontaneous regulation of the market (the invisible hand), on not intervening and allowing individuals to act freely under the sole criteria of their personal interest (Camagni, 2023).

Parallel to this modern technocracy arises the idea of progress, growth and development, key concepts in Modernity that have acted as motors in the planning of economic, political, social and scientific activity. The idea of progress weakened the links with tradition, whether they were political or spiritual. Technocracy, then, filled the air with the promise of new freedoms and new forms of social organization. It also sped up the world; his concern was to invent new machinery.

Morris (2022), in this order of ideas, asserts that Modernity is born from the division between matter and spirit; science and religion; reason and intuition and between what is communicable and what can only be contemplated through a serene participatory consciousness. All of the above with a predominance of the first term of each of these pairs, relegating the second to the private sphere.

In this regard, Archer (2014) relates the idea of progress with mechanism and linearity, and with a firm faith in rationalism for the control of the process where the future appears as a mere extrapolation of the technological possibilities of the present to economic growth, with its quantitative aspect, avoiding non-linear complexities of organic evolution.

These approaches turn the notion of development into something deterministic, fragmentary, homogenizing and centralizing. Deterministic, because the future margin of variability occurs only within the framework of scientific and technological possibilities. It perpetuates the causal chains that lead from rational knowledge to rational knowledge. Its nature is the expansion of techno-science at the expense of ecosystems, which is logically irrational because it is not assumed that such expansion cannot be unlimited knowing that natural resources are not.

It is fragmentary when it believes that the totality of reality can be understood by the simple juxtaposition of the parts that make up that totality. It is homogenizing and directed from a part that concentrates the means of control over the rest, this becomes even more noticeable in this latest phase of globalization. It is not directed to work with the latent capacities of the peoples of the Earth. On the contrary, it forces the population to serve a process that imitates industrialized nations and destroys any form of biodiversity.

In short, considering the complex relationships between society, culture and technology, a new culture is generated. The first evidence of the cultural change of society is noted with the invention of agriculture. However, unsustainability problems begin to arise in the cultural leap from Renaissance Humanism to Modernity, with the emergence of the new Cartesian and Newtonian paradigm (reductionist, deterministic, fragmentary, and linear) under which the world is perceived and studied their phenomena (natural, social, and economic) from a reduced observable and predictable "object of study" that exists independently of the observers.

In the light of this new Cartesian and Newtonian paradigm, economic science was born, which puts economic values before social ones; The individual prevails before the

collective and the market works and evolves according to objective laws and automatic mechanisms that regulate independent decisions and actions, coordinating them in a rational macroeconomic structure (Zrudlo, 2022).

Also, under the protection of Modernity, the development current of the 20th century arises, which carries with it the idea of progress, growth, and development, and brings with it some assumptions that, implicitly or explicitly, have been key elements in the constitution of environmental problems: the devaluation of the present and of tradition. The idea that growing up is always better; the conception of nature as an infinite source of resources; adopting a linear, cumulative model. All this in a climate of faith in which, supposedly, science and technology would have the solution for the well-being and physical and spiritual health of all human beings (Khadse, & Rosset, 2019).

Smallholder farmers run out of food only five months after harvest, well prior to the next harvest, which may be attributed to the traditional way of farming in which these farmers own seed from previous harvests and use it for planting (e.g., maize) (van den Berg et al., 2020). The farmers field schools (FFS) has demonstrated its ability to improve rural communities' human, social, natural, and financial capital (van den Berg et al., 2020). Human capital was created through critical thinking, innovation, confidence, and a high quality of life. Improvements in field practices, food production, agricultural diversification, and food security increased natural capital. Financial capital was increased through increased income and profits, savings and loan schemes, and the potential for poverty reduction.

In order to help Asian rice farmers, understand complex systems and modify their Integrated Pest Management (IPM) decisions based on an understanding of agroecological

processes, Food and Agriculture Organization (FAO) and other partners created Farmer Field Schools in the late 1980s (Gallagher et al. 2009). The FFS was developed using tried-and-true educational principles that seek to empower participants (Pontius et al. 2002). The FFS placed a major emphasis on ecological learning, systems analysis, and experimentation for groups of farmers who routinely meet for field-based sessions over an entire production cycle to learn how to make adaptive management decisions, find local solutions, and operate as a group (FAO 2016). The FFS is a financial investment in education with the goal of assisting farmers in bettering their agricultural decisions and, as a result, initiating a cycle of continuous learning and action in rural development (Pontius et al. 2002).

It is therefore expected to have a variety of long-term effects. It has proven to have social, economic, production and knowledge impact as highlighted by Karimi and Niknami (2020). Research is needed to determine whether farmer field schools can affect farmers' inner transformation, which would then probably result in agricultural sustainability.

The FFS generally positively impacted agricultural knowledge and practices such as yield increase, according to a systematic review of the published FFS results (Waddington et al. 2012). However, despite being frequently considered important, measuring the FFS's effects in the empowerment domains is still poorly understood (Braun et al. 2006), how it can be used as a transformative thinking tool, as stated by Friis-Hansen and Duveskog (2012), has not been stressed as much by most agriculturists.

2.2. Development current of the 20th century and the environmental problem

The late entry of the United States into World War II (December 21, 1941) and the rigorous preparation to participate in this event, allowed it to define the war in its favor, by

achieving 52% of the Gross World Product for its economy (David, 2019). This contributed to expand their agribusiness around the world under the cover of a development current. But, in addition, it assured him control of international markets to sell surplus production to his enemies defeated in the war, through credits that would allow them to buy those surpluses at market prices. That was the “Marshall Plan savior” for Europe (Lanigan, 2021).

With the success of the Marshall Plan, in the reconstruction of Germany and the European countries most affected by the war, the development trend of the 20th century began. From that moment on, the application of the model to the rest of the countries of the world begins, without considering the particularities of each one, nor the differences, whether cultural, geographical, geopolitical, or sociological.

This development current bet that, once economic growth was achieved, the population would begin to see the results in terms of material benefits. However, already in the 21st century it is observed that the gap between rich and poor countries has increased considerably and that the poor in each country are getting poorer (Fantini, 2023).

Within this development current, environmental problems appear as a common issue on the international agenda in recent decades. In 1972, in Stockholm, within the United Nations Organization (UNO, 1972), the first world forum was held, which concluded with the Stockholm Declaration, which had a significant impact on the international community regarding the fragility of nature and the need to conserve and restore it to ensure life on the planet.

Later, the United Nations (UN) created the World Commission for the Environment which, meeting in 1987, issues the "Brunt-land Report" also known as "Our Common Future" in which the definition of sustainable development as the ability to meet the needs of present generations, without compromising that of future generations to meet theirs (UN, 1987). Eighteen years after the appearance of the concept of sustainable development, another UN report "Millennium Ecosystem Assessment" (Millennium Ecosystem Assessment, 2005) recognizes that, in recent decades, ecosystems have been transformed by humans, faster and more extensively than at any other time in human history, in order to meet the growing demands for food, fresh water, wood, fiber and fuel (Kibria et al., 2021).

However, if the results are observed in terms of social benefits and quality of life for humanity, it is easy to deduce that this growing demand for resources has not satisfied the basic needs of humanity. According to the report of the United Nations Population Fund (UNFPA, 2001), today, despite the fact that world wealth has increased sharply and is estimated at more than 24 trillion dollars annually, there are more than 1,200 million people who cannot meet their basic needs for food, water, sanitation, health care, housing, and education.

On the other hand, the Food and Agriculture Organization of the United Nations (FAO, 2001) warns that it is a "moral obligation" to free humanity from hunger and malnutrition and that, for ethical reasons, as technologies and capacities, the stubborn persistence of hunger and poverty should diminish. The advancement of these capacities and technologies has been detached from such a "moral obligation" and, on the contrary, every day a significant percentage of humanity witnesses how these technologies are used

by industrialized society to maintain hegemony, control, and guarantee its sources of energy, its cheap raw materials and labor.

The emergence of the concept of sustainable development has been the subject of debates in which opinions have converged such as that there are few expressions as ambiguous as that of sustainable development associated with concepts such as "sustainable capitalism", "sustainable agriculture" or "sustainable use of energy" and resources (Borsari, 2022).

In view of the foregoing, it is inevitable to ask how it is that, if today it has not been possible to satisfy the needs of the world population, one can think of "planning" from now on to satisfy the needs of future generations. How is the sustainable development that the report Our Common Future talks about going to be achieved, if the prevailing globalized economic model continues to consider third world countries as its inexhaustible source of resources? How will just, free, stripped of the scourge of poverty that industrialized society has imposed if the technological false step that industrialized society has taken is not even questioned and the need to reconvert human industry into a concatenated succession of processes that achieves a complete reuse of the materials? (Fantini, 2023).

However, the expressions of concern of these UN commissions to achieve sustainable development, seem not to recognize that the origin of the growing environmental problems is based on the behavior of the industrialized society that puts economic growth before the conservation of resources. nor does it recognize that the opulence of today's industrial world is based on the economic and ecological exploitation of a third world, politically and ideologically tributary (Rocchi et al., 2020).

In order for sustainable development to exist, it is necessary to think of it, not as a set of purely economic achievements, which nonetheless cease to be important, but as a process that leads to the creation of an environment that enables the transformation of the human being into person. Human in its full dignity and in its double individual and social character and, therefore, this supposes the elimination of obstacles such as hunger, unemployment, exploitation, and discrimination that have historically prevented them from exercising this right. Within the framework of these dissertations on the concept of sustainable development, it is worth rescuing the approach presented by Charalampous, et al., (2019), according to which, given the impossibility of generating a consensus on the concept of sustainable development and due to the confluence of various interests, it is then necessary to seek common central elements in the discussion that allow the construction of development models that permanently cover the needs material and spiritual of all the inhabitants of the planet, without undermining the conditions of the natural resources that provide sustenance. As well as it is necessary to consider sustainable development as a process of directed change, in which the goals set are as important as the way to achieve them.

It could be expanded and also say that, in the last decades, economists have been interested in the ecological analysis of economic processes; after a stage of "discovery" of physical and ecological limits in the capitalist industrial development model, also a product of world criticism, given the serious problems of ecological imbalance. Conventional economists perceived the possible damage generated by economic growth itself and tried to "give a value" to these impacts and incorporate them into price systems, ultimately, within the framework of the market. Thus, Environmental Economics emerges, as a branch

of Economics (Pereira et al., 2019) providing political and economic instruments, whose objective is to act and influence economic actors, while accepting the rules imposed by the market itself. The economy, from the ecological point of view, does not have a common measure, because it is not known how to give current values to uncertainties and irreversible contingencies.

If the questions of uncertainties, time horizons, and discount rates were honestly posed, resource and environmental economics would arrive at the basic conclusion of ecological economics, namely, the absence of economic commensurability. However, this is not the case of ecological economics, which is not subject to either economics or ecology, since it could be said that it is an integrating synthesis of the two (economy and ecology). It is also defined as the discipline of sustainability management. It is within the framework of this "sustainability management" that, from ecological economics and productive ecology, there is a need for new research models that consider the interdependence of the human species with nature, as in the case of agroecology, political ecology, ecological economics (Vega et al., 2020).

2.3 Green revolution and agricultural modernization

In the 1960s, Schultz carried out research on agricultural economics and focused his attention on the study of the importance of human resources in agriculture, especially in underdeveloped countries. He criticized the weight that underdeveloped countries gave to the industrialization process, leaving agriculture in second place (Kansanga et al., 2019). Schultz's ideas were interpreted as meaning that agriculture should also undergo a modernization process, just as the industry had experienced in the past decade. It is when the Green Revolution arose which, between 1965 and 1985, promoted modern technology

that contributed to drastically increasing food production, but this practice was losing strength due to the intensive use of pesticides and fertilizers, in addition to the practice of monocultures and the high energy cost, was causing serious environmental damage (van Etten, 2022).

The Green Revolution was presented as the panacea for agriculture to produce food on a large scale and alleviate world hunger. Data on hunger in the world show the failure to apply this technology model (Harwood, 2021).

The agroecosystems managed by modern agriculture, based on these technological packages of the Green Revolution, have generally been associated with economic success. This fact has contributed to the establishment of modern agriculture as a production paradigm that meets the world's demand for food and satisfies the requirements at a global level. However, it is necessary to indicate that modern agriculture is recognized as the main responsible for the ecological imbalance, the loss of biodiversity, and the increase in malnutrition and hunger rates on the planet (Geisler, & DuPuis, 2019).

This fact has also prevented an appreciation of the negative impact on human health and the displacement of peasant men and women and the expropriation of their lands (Geisler, & DuPuis, 2019). As agricultural modernization progressed, the relationship between agriculture and ecology became more distant, since ecological principles were replaced by artificial techniques of fertilization, flowering, and chemical control of pests and diseases with products derived from fossil fuels (Bergius, & Buset, 2019).

This distancing between agriculture and ecology brought problems such as: high energy costs (Bergius, & Buset, 2019); loss of productive capacity of the soils (FAO,

2008); social impacts for peasant families -because many lost their lands, others were directly affected by contamination with agrochemicals and many others lost control of their local seeds and incorporated unnecessary technology, opening a vicious circle of debts. These changes perpetuate the gap between peasant families and corporate farmers and unleash a series of worrying processes that have repercussions in the increase in rural poverty, food insecurity and the degradation of natural resources (Bergius, & Buseth, 2019).

2.4 Sustainability and agroecology

This problem has meant that in recent years there has been a growing interest in studying the problems of the unsustainability of agro-productive systems from a new approach, different from the deterministic, mechanistic, linear, and fragmentary approach of Modernity.

Thus, agroecology emerges as a science that addresses the complexities of nature and its cultural relationships with the human species -especially those derived from scientific thought and ancestral knowledge, as well as its technological applications with socioeconomic consequences. Agroecology focuses on knowing the socioecological relationships within an agroecosystem with the purpose of understanding the form, dynamics, and functions of this relationship so that agroecological systems can be better managed and with fewer negative impacts on the environment and in society (Ebel, 2020).

From this science of agroecology, an attempt is being made to study socio-ecological systems, understood as systems in which interactions between society and nature occur, and specifically, an attempt has been made to understand the dynamic nature of nature-society interactions.

Anderson et al., (2019) understand a socioecological system as a system made up of a societal (or human) component (subsystem) in interaction with an ecological (or biophysical) component. For their part, Berkes, Colding and Folke (2003) use the term socio-ecological systems to refer to a holistic, systemic, and integrating concept of "human beings in nature." In this way, the term refers to a complex and adaptive system in which different cultural, political, social, economic, ecological, and technological components, etc., are interacting (Resilience Alliance, 2010).

This implies that the focus of the studies of ecosystems and natural resources that are carried out from the perspective of sustainability does not focus on the components of the system but on their relationships, interactions, and feedback, in contrast to the classical sciences that, with their approach fragmentary reality contribute to generating problems of unsustainability. The separation they make of the objects of the social order from those of the natural order is one of the causes. Sustainability research assumes the objects of study as systems that are coupled to social and ecological systems, called socio-ecological systems (Oteros-Rozas, et al., 2019).

Socioecological interactions are the relationships that are created between the different subsystems in various ways. In the first place, due to the set of human activities and processes that generate impacts on ecological systems, such as food production or the extraction of natural resources, fishing, etc. Secondly, due to the dynamics of the ecosystems themselves, such as floods or climatic variations, and also due to the transformations of the soil characteristics, which produce effects on social systems (Oteros-Rozas, et al., 2019).

These relationships could be of various kinds. For example, material interactions such as flows of natural and energy resources, money, raw materials, manufactured goods, food, waste, and people. Others are of a non-material nature, such as information and knowledge flows, power influences, trust, norms, values, decisions, and public actions, among others. For this reason, in the analysis of a socioecological system, issues of an ethical, political, anthropological, sociological, economic, technological, biological, environmental, and social epigenetic nature are combined (Oteros-Rozas, et al., 2019).

2.5 Production of knowledge in agro-ecology: singular and local

In recent work on agro-ecology, as in much older work on sustainable agriculture, it is above all the singular and local character of knowledge that is put forward. Some authors thus speak of “de-constructing” official agricultural science in order to “reconstruct” an “alternative” science based on local knowledge (Agumas et al., 2021).

In Anglo-Saxon literature, as in that of the French language, many authors have been interested in the transformations of what is commonly called the system of innovation and agricultural knowledge (Agumas et al., 2021). These authors have shown the limits of a vertical, top-down, and linear vision of the production and circulation of knowledge and have suggested that the latter, in order to integrate the singular and local dimensions of the situations encountered by farmers, are constructed in the action itself and in the interactions between farmers, or between farmers and advisers or researchers (Agumas et al., 2021).

2.6 Shaping and circulating local knowledge.

The particular nature of "situated" or "contextualized" knowledge raises the question for certain groups of farmers producing or mobilizing such knowledge - as well as for research and development organizations involved in this production or who would

like to benefit from this knowledge - of their circulation outside the context in which they emerged. It is a question of recognizing or having recognized the work of producing knowledge but also the agricultural models of those who produced this knowledge; to benefit other people facing similar situations. In agronomic research, we can thus see the increasing implementation of on-farm experiments, surveys, or participatory research to produce knowledge in context and benefit from farmers' knowledge. For their part, the Regional Directorates of Agriculture, Food, and Forestry and the Chambers of Agriculture, particularly in the case of the "capitalization" provided for in the agro-ecological program initiated in 2012, produce a number of documents collecting descriptions of types of systems considered agro-ecological.

Two classic modes of circulation of knowledge can be distinguished: circulation between farmers and circulation mediated and organized by other actors. On the one hand, there are numerous experiences of knowledge exchange between peers, whether in the countries of the South (Vargas-Hernández, & Domené-Painenao, 2021). Knowledge then remains deeply attached or "glued" to individuals and their experience, even in its circulation, in the sense that it is only accessible and understandable to others on the basis of the experience from which it comes. This is what we observe when, in an ordinary way, farmers within their network of professional dialogues will appropriate, thanks to the testimony of other members, certain techniques or certain materials invented or adopted by these people. Beyond networks of inter-knowledge, farmers who bring new ways of doing things can also put themselves "within earshot" of other potential users who are not part of their circle of relations, through debates organized in forums, face-to-face or on the Internet. We find this type of dynamic particularly in technical fields on the fringes of

research such as organic farming and conservation agriculture, in which farmers affirm their status as peer group facilitators. In this context, knowledge, claimed as drawn from experience, becomes “commons” to be shared, not privatized and commodified resources.

On the other side, we find the many attempts aimed at registering and increasing the genericity of the knowledge produced in the situation. When knowledge is "scientized" (Agrawal, 2002), it is "taken off" from the experience from which it originates and the people who possess it in order to shape it, at the very least, to make it accessible to those who do not know these situations because they are geographically or temporally too far away from them, or, at the very best, to bring out their more general character so that, thus transformed, they can be used in a broader context. These are "the small adjustments of detail, learned by experience and impossible to state in the form of principles" which led to the success of a practice based on this knowledge (Agrawal, 2002, p. 330). The approach of increasing genericity, in particular, presupposes a work of standardization and generalization, which leads to erasing these aspects.

2.7 Encapsulated knowledge and incorporated knowledge

Encapsulation takes place through an approach that aims, for example, in the context of so-called precision or digital agriculture, or even intelligent agriculture (de facto associated with certain visions of agro-ecology), to collect the max of data, obtained as much as possible in an automated way from sensors, to order and process them in order to generate, from algorithms, a rapid and adapted decision proposal. It is therefore a question of producing intelligent tools that rely on a capacity for collecting and processing data that is constantly increasing. Encapsulation resides in the fact that the knowledge is lodged in one or more technical objects, making it difficult for an operator to access it directly while

promising him an “increase” in his capacities. A number of economic organizations, such as large grain cooperatives, are now committed to these approaches to greening agriculture based on the encapsulation of knowledge by developing their capacity to collect.

On the other hand, incorporation corresponds to an increase in farmers' individual and collective skills. This incorporation allows them to gain in capacity for observation and interpretation of the unique conditions of their natural environment and to define the relevant actions to be implemented in this environment with regard to their aims in terms of sustainability, level of production and mastery of their practices. Thus, the development of precision agriculture or decision support tools can be considered, in a debate that is found in other professional fields, as likely to only make people in the technical process than a substitute subservient to the machine or, on the contrary, to make it an “augmented human” (Compagnone, et al., 2018) with capacities for monitoring changes in his environment and for action. The "steering" of natural processes, central in a perspective of greening practices, can thus be based either on technological forms embodied, for example, in decision-making tools.

2.8 Greening process and distribution of knowledge

In this particular context of the transformation of agriculture, associating old and new and characterized by diversification of ways of greening agriculture, what do the six articles brought together in this issue give us to see? We will present them here by showing how they bring elements to the understanding of the political and social game that operates around the distribution of knowledge or, in other words, around the way in which knowledge is seen as a process (of production and learning) and as a product (resulting from this process) is concentrated or dispersed in social places and circulates in and

between these places. This notion encompasses in this sense those, discussed previously, of eco-knowledge and incorporated knowledge seen as local productions, fruits of experience and the exchange of testimonies; that of encapsulated knowledge is seen as privatized knowledge and made difficult to access for users or, on the contrary, that of knowledge experienced and put to the test in a collective of users; those of scientific knowledge, "detached" from concrete experience to circulate more widely.

3. Methodology

3.1 Introduction

One of the main learning strategies for converting agricultural systems to sustainability is the FFS (Karimi and Niknami 2020). The contribution of FFS to the transformation of agricultural systems is only partially investigated. Understanding how FFS might help transition to sustainable food systems is important, especially for emerging nations with severe food insecurity like Malawi. Information is specifically needed on how the current knowledge transfer systems in the FFS approach foster transformative thinking among smallholder farming communities and explore opportunities for leveraging transformation of smallholder agriculture towards sustainability by analyzing barriers and the strength of FFS approaches as extension approaches for agricultural development. The demand for such information is increasing as smallholder farmers in Malawi continue to face challenges as a result of decreasing soil fertility, increasing incidences of drought and floods in the context of limited access inputs and alternative livelihoods due to poverty.

FFS initiatives can help transition to sustainable food systems in Malawi in several ways:

Encouraging sustainable agriculture practices: FFS initiatives can help farmers to adopt sustainable agriculture practices such as conservation agriculture, integrated pest management, and crop diversification. These practices help to reduce environmental degradation, conserve soil fertility, and increase resilience to climate change.

Promoting gender equity: FFS initiatives often involve women as active participants and decision-makers, which can help to promote gender equity and empowerment. Women play a crucial role in agriculture in Malawi and empowering them with knowledge and skills can improve their productivity and income.

Strengthening local knowledge systems: FFS initiatives build on local knowledge systems and promote indigenous knowledge, which can help to preserve traditional farming practices and enhance the resilience of agricultural systems.

Encouraging peer learning: FFS initiatives are often organized in groups, which promote peer learning and knowledge sharing among farmers. Peer learning can help to build trust among farmers, promote a sense of community, and encourage the adoption of new technologies and practices.

Facilitating market access: FFS initiatives can help farmers to improve their market access by providing them with information on market prices, quality standards, and marketing channels. This can help to increase farmers' income and reduce post-harvest losses.

To address these issues, this study intends to fill research gaps on the extent of transformation that can be attributed to co-learning and other knowledge transfer approaches of FFS in Malawi and recommend entry points for smallholder agricultural transformation particular to opportunities and challenges FFS approaches offer as an agricultural extension approach for smallholder agricultural systems.

Table 1: Represent research design of the study.

Research Objective	Key Theory/Concepts Used	Methodology	Key reference
1. To review current technology uses by farmers currently, how FFS initiatives impacted smallholder farmers' awareness relevant for inner transformation, and its legitimacy in Malawi's food industry	Literature review: <ul style="list-style-type: none"> • Concept of FFS • Concept of legitimacy of FFS program • Farmers' attitudes towards environmental technology adoption 	Observational analysis Participation approach with participants– snowball and random sampling Focus group discussion	(Chirwa 2005) (Karimi and Niknami 2020)
2. To identify how knowledge transfer affects inner transformation on	Theory on sustainability Theory on inner transformation	Comparative analysis Semi-structured interviews (focus group) viewpoints	(Woiwode, Schöpke et al. 2021) (Duveskog 2013)

agricultural sustainability	Theory of knowledge transfer	of those who participated in interviews on their environmental awareness concepts in Malawi regarding agricultural related climate change.	Survey results (apendix)
3. To determine if there are gaps in the current extension services for inner transformation on sustainability	Literature review: Environmental awareness, participant attitudes towards environment	Secondary analysis	(Kundhlande, et al., 2014) (Akintunde 2017)
4. To review the theories related to transformation process for human beings.	Literature review: Theory of Changed Mindset. Theory of planned behavior	Secondary analysis	(Ahn et al., 2019)

This chapter provides a description of the study sites, sampling procedure, sample size, data collection techniques, ethical considerations, sources of data, study limitations and analytical techniques used in the study.

3.2. Research design

This Research opted to have a mixed research methodology. Both qualitative and quantitative information was obtained from the study participants. Also, secondary information related to topic was gathered and analyzed in this study.

This Research was carried out in following steps:

- 1) Secondary analysis of information was carried out.
- 2) Primary analysis was carried out by the study participants for a better understanding of the context.

3.3. Study area

The study was conducted in two Agricultural Extension Planning Areas (EPAs) of Mndolera and Chibvara in Dowa district under Dowa West and East District Agricultural office, both of which are under Kasungu Agricultural Development Division. The average annual temperature of the Dowa district range from 19.4°C and 21.3 degrees Celsius (Sibale, Mwenelupembe et al. 2021), which is in the humid subtropical climatic zone. These EPAs receive 868 mm and 886 mm of rainfall, respectively on average each year. Dowa district lies in central Malawi and has a population of 411,387 (Sibale, Mwenelupembe et al. 2021). The majority ethnic group is called Chewas. Farming communities make up the majority of these two groups.

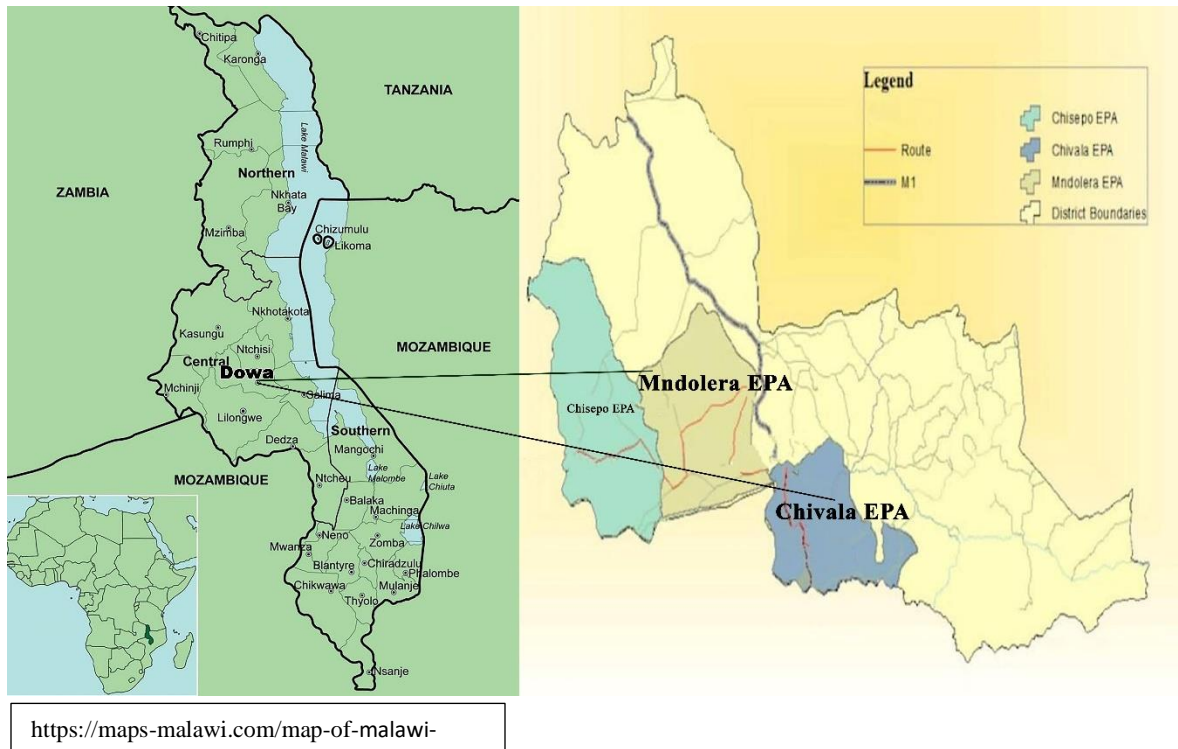


Figure 3: Map of malawi and Dowa district showing study sites.

3.4. Population and Sample

Participants of the study were the forty (40) FFS and forty (40) non FFS household in the study EPAs. Those who are part of FFS were termed as FFS and for non FFS it was assured that they do not belong to FFS. For sample selection area with both FFS and non FFs household was selected initially to carry out the process smoothly.

Snowball sampling technique (Bhardwaj, 2019) was used to select participants for the study. Researchers utilize snowball sampling, a non-probability sampling approach, to locate possible participants in studies where participants are difficult to come by.

The use of non-probability snowball sampling can have both positive and negative effects on the research endeavor, thus it's critical to be able to weigh the pros and negatives. The advantages of this sampling were applicable for this study therefore, this method was used

for sample selection. Following are the key benefits of snowball sampling: It is inexpensive, straightforward, profitable, and—most importantly—quick. It enables one to learn more about a population segment that is largely hidden and uncover novel qualities about it. Gaining primary and pertinent information is profitable. This research methodology can be used without having to do much planning.

Recruitment and training for enumerators

Three (3) research assistants were recruited to assist and help in data collection in the field after 2 days of training and pilot testing of the questionnaire. The enumerators were trained on how to administer the questionnaire to minimize the errors. The questionnaire was field pre-tested before it was administered to the respondents for the study. This was done in order to detect and correct any problem related to wording and flow of questions. FFS chairman from Mndolera EPA was selected for pre-testing questionnaire because the culture, FFS activities and the language in that area were similar to the study sites.

3.5. Methods of data collection

This study utilized mixed-method research design. Means of data collection utilized were both primary and secondary. For interviews etc. efforts were taken to select sample from Farmer Field Schools (FFS) in the Transform Project areas. The vicinity of Lilongwe, the capital city of Malawi, was another factor in the selection of the place. The choice of the study area also took finances into account. A sample was drawn from members of the FFS that have been established under the TRANSFORM project. There were 2 focus group discussions for the 2 Extension Planning Areas for the FFS groups, that is Mndolera and Chibvala. All of the respondents' households were visited for the interviews. The

information was gathered with an emphasis on the characteristics of the household, the landholding, crop yields, the amount of engagement during FFS meetings, and how knowledge of agroecological techniques was transmitted through the FFS approaches.

For roughly 60 minutes, the respondents who took part in this project interacted with the enumerator. A mobile device with a questionnaire loaded was used to record responses. To gather further information on the present FFS approaches, the study also solicited the opinions of extension workers and FFS coordinators. The information was centered on smallholder farmer's possibilities and problems FFS offer as a channel for knowledge transfer and co-learning towards smallholder agricultural transformation in Malawi. The secondary data acquired from department of agricultural extension service focused mainly on current extension service effect on smallholder farmers in rural areas where extension services are provided. Focus group discussions was also used to gather information during this Research by audio recording (Adler, Salanterä & Zumstein, 2019), note taking and participant observation organized for only 40 FFS respondents from the two Extension Planning Areas (EPAs).

For the objective related to review current technology uses by farmers currently, how FFS initiatives will impact smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry observational analysis, participation approach with participant's snowball and random sampling, individual interview and Focus group discussion were used. Focus groups are one of the methods employed in this investigation. Focus groups are a research method for gathering information through group discussion (Busetto, Wick & Gumbinger, 2020). A small group of carefully chosen individuals are included in the group to debate a certain issue. The

selection criteria may include location, age, socioeconomic status, race, etc. (Sim & Waterfield, 2019).

In addition to that, interviews were carried out with study participants. Following are the example questions included in the study: A qualitative research method known as interviews entails developing open-ended questions in order to speak with participants and gather information about a subject (Mpunga et al., 2021). The interviewer, who is typically a subject-matter expert, seeks to understand the respondents' opinions through a carefully thought-out and executed series of questions and responses.

For the second objective to identify how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability semi-structured interviews were used. Semi-structured interviews were used for this investigation. Semi-structured interviews preserve the basic interview structure while giving the researcher a great deal of freedom to elicit information from the respondents (Mbakaya et al., 2020). Although the interviewees and researchers are having a guided discourse, the researchers are given a good deal of latitude. Because this sort of investigative interview has a structure, the researcher can be confident that only one round of interviews will be required.

For the third objective related to determination of if there are gaps in the current extension services for inner transformation on sustainability secondary analysis of existing information was carried out.

3.6. Data analysis

3.7. Data analysis for a qualitative study

Constant comparative analysis (Harden, and Thomas, 2005) was carried out for the data analysis in this study. This strategy consists of taking one piece of data (an interview, for

example) and comparing it with all the others that may be similar or different, in order to develop conceptualizations of the possible relationships between the different pieces of data. So, in this study information gathered from 80 interviewees was compared with each other.

An effort is being made in the current qualitative research study to identify recurring themes and patterns in human experience. This process is carried out by comparing each new interview or record until all data has been compared.

This method of analysis is typically used to investigate human phenomena for which the researcher holds the view that some aspects of human experience and behavior can be explained by their underlying social structures. Yet, other additional approaches draw on this analytic approach to produce knowledge that is typically interpretive or descriptive. This approach of data analysis was being used for this particular investigation as a result. Given that both structured responses and those derived from open questions may be analyzed using the constant comparative approach in a questionnaire.

Gathered information from the study participants was analyzed using compared thematic analysis to address the study objectives in much better way. Comparative analysis is a research, information-gathering, and information-analysis technique that involves contrasting two or more procedures, papers, data sets, or other things. In both quantitative and qualitative research, comparative approaches have been used to examine a variety of phenomena, including language, political structure, economic ties, religion, kinship, marriage, and family (Fram, 2013).

3.8.Data analysis for quantitative study

Once the data was collected, it was found that a large amount of information that needed to be systematized and that there are, in general, three fundamental classification operations, which were undertaken: coding, tabulation, and statistical treatment of the data. Descriptive analysis was carried out. A frequency analysis was also performed to compare the responses to questions.

After coding, generating the data matrix and saving all the information in a permanent file, the researcher processed the information in a permanent file, the researcher processed the data. The data was presented in tables and graphs for later reading. In the tabulation process, the data was placed in tables to examine its characteristics in a grouped or classified way.

3.9.Ethical considerations

The following points were taken into account when conducting this study in order to address the ethic of respecting people: respect for autonomy, which mandates that those who have the mental capacity to carefully weigh the pros and cons of their decisions must be treated with due respect; and protection of people with impaired or diminished autonomy, which mandates that those who are dependent or defenseless receive protection against harm or abuse.

The search for the good, which refers to the moral duty to maximize advantages and reduce harm and mistakes (risk/benefit ratio), was another principle taken into account in this study. This principle gives rise to rules that ensure that the risks of the Research are appropriate given the anticipated benefits, that the design of the Research is sound, and that the researchers are qualified to conduct the study and protect the participants' well-being.

Consent was taken from each participant before taking part in the study. Nobody was forced to be part of the study or remain part of the study. No personal benefit was provided to any participant for participation in the study.

In addition to that confidentiality of study participants was maintained by not sharing their personal information with anyone. Data collected during this study will be solely used for this Research to understand smallholder farmer's perspectives co-learning approaches for sustainable transformation and inform the Malawi Government drive to improve crop productivity, improve smallholder farmer's livelihoods and contribute to climate change resilience in agriculture.

3.9.1. Study Limitation

Time was the main limiting resource of the study. The two months' time frame was not adequate enough to be able to tell convincingly that farmers' mindset has been changed within as they gain agricultural technologies.

4. RESULTS AND DISCUSSIONS

4.1. Introduction

The study's objectives include investigating how farmers are currently using technology, how FFS programmes have influenced smallholder farmers' perception of inner change, and how they are recognised in Malawi's food sector. To understand how information transfer affects the adoption of new values, beliefs, or worldviews on agricultural sustainability and determine if there are any gaps in present extension services for sustainable inner transformation as well as investigate the theories underlying the human transformation process.

This section presents and explains information acquired through a survey. Before describing everything in relation to the study's objectives, demographic information about the study participants is presented.

4.2 Demographic information

Table 2: Sex of respondents

Respondents	Frequency	Key information
Female	55	Findings of the analysis indicate that 55 study participants were female, and 25 study participants were reported as male. (31%)
Male	25	revealing significant availability of female in the household.

Overall, the data shows that there are roughly twice as many women as men in the survey sample, which is primarily female. But it's vital to remember that the sample size could not be representative of the entire population, generalizing about the population impossible.

Table 3: Age of study participants

Age Range	Frequency	Key information
20-30	22	Majority of respondents ranged in age from
30-40	17	20 to 50, revealing younger adults involved
40-50	20	in agriculture in the study area.
50-60	16	
60-70	02	
70-80	02	
80-90	01	

In the survey of a total of 80 people, the distribution of respondents by age is shown in the table. From 20 to 30, through 80 to 90, the age ranges are provided in 10-year increments. The table shows that the respondents' average age is between 20 and 30, which accounts for, 27.5% of the entire sample. The age group of 40 to 50, including 25% of the sample, comes next.

Seventeen individuals, or 21.3% of the sample, were between the ages of 30 and 40, while 16 people were between the ages of 50 and 60. Only two people, or 2.5% of the sample each, fall into the two oldest age groups, 60–70 and 70–80. There is just one person, or 1.3% of the sample, in the 80–90 age group.

In general, the table 3 shows that the respondents' ages are almost evenly spread between the 20 and 60 age groups, with fewer respondents in the older age groupings. It is crucial to remember that the sample size could not be representative of the entire population, generalizing to the population impossible.

Table 4: Education level of study participants

Education	Frequency	Key information
Attend sec	18	
MSCE	5	Respondents have at least a primary level of education. The study revealed no difference in illiteracy and perception rate on sustainability issues between those who attended Std 1-8 and the 7 respondents who had never attended school.
None	7	
Std 1-4	15	
Std 5-8	35	

A total of 80 respondents were questioned, and the table 4 illustrates how they were distributed according to education level. Education levels are broken down into "Attend Secondary," "MSCE," "None," "Std 1," "Std 1-4," and "Std 5-8."

According to the data, 35 respondents, or 43.8% of the total, have completed grades between Standard 5 and 8. Following this are the 22.5% (18 people) who have completed secondary education. "Std. 1-4" has the third-highest percentage of responders, with 18.6% (15 people) falling into this group. In addition, 6.3% (5 people) of the respondents have earned an MSCE, or Malawi School Certificate of Education, which is a high school graduation credential in Malawi. While 8.8% (7 respondents) have not completed any

formal education. Most respondents, as shown by the table, had at least a primary level of education, with the bulk of respondents falling into the Standard 5-8 group.

4.3 Technology Users by Farmers (RQ1 findings)

First objective of the study is to review current technology uses by farmers currently, how FFS initiatives have impact smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry.

Smallholder maize farmers in Southern Malawi are increasing production by utilising fertilisers and hybrid seeds (Chirwa 2005). Many farmers in Malawi have adopted conservation agricultural technologies (Fisher, Holden et al. 2018). In accordance with the surveys, one of the current agricultural technology used by farmers is to plant all their crops on ridges, which makes hoes quite beneficial and something farmers cannot live without. The study observed that, out of the study areas, ten (10) communities that were visited during the study, almost all the farmers were practising row planting and ridges planting for every crop they cultivated. FFS acceptability on an ecological issue is in question. In terms of whether this was acceptable, 49 participants agreed, 6 participants disagreed, 21 participants indicated they were unsure, and 4 participants were undecided.

When 40 FFS participants were asked to consider all the FFS interventions, they had taken part in, to what extent did they think FFS had integrated protecting natural resources like soils, water, and forests, nearly all of them responded that FFS had done so, which had helped most of them become more environmentally conscious. The study further discovered that FFS initiatives have positively impacted smallholder farmers' awareness relevant for perception on mankind severely abusing our agricultural production resources such as soil, trees, water, air. Regarding people exploiting agricultural production

resources. The finding indicated that, 56 participants agreed, 13 individuals disagreed, and 8 persons were neutral. Only 16% of respondents disagreed that humans are not abusing agricultural production resources such as soil, water, air, and trees. This could be due to the activeness of FFS initiative in the study area, as the study found that all FFS members try to educate other farmers on their activities from what they (FFS members) learned in their trainings.

Table 5: Impact of someone adoption of agricultural technology on smallholder farmer

Influencers	Affected adoption
Lead farmer	97.5%
Colleague member	88.75%
Family relative	78.75%
Friends	67.5%

According to the findings, 97.5% of respondents believe that the use of agricultural technology by the lead farmer has a favourable effect on the adoption of agricultural technology by other smallholder farmers. A colleague from the same farming group as FFS, demonstrating that 88.75% can be affected. Respondents stated that they learn by doing with them (both the lead farmer and the FFS approach). Findings continue to show that 78.75% of research participants may be influenced by their family members adopting agricultural technologies, which could be related to perception because they continue to practise old practises such as conserving their own seed for the following season.

From the appendix, it shows in frequency analysis that, both FFS and non-FFS research participants lack common farming tools and are still adjusting to improved seeds technology. None of the study participants reportedly own an oxcart, and only a small percentage of respondents (18) own a bicycle; this indicates that either they have not yet accepted how technology can improve their lives (the FFS programme began two years ago) or that they are unable to make use of the resources that are already available due to a lack of resources. Locals in the study region have regarded the FFS as legitimate, as seen by requests to join the FFS and men allowing their wives to attend FFS meetings as seen during the survey. Given that the FFS initiative's actions are primarily focused on safeguarding agricultural interests, this suggests that it may have had some influence. Given that the FFS and lead farmer approaches have been shown to affect the adoption of agricultural technology in the research area, it makes sense that the FFS included lead farmers approach in their activities.

4.4 Knowledge transfer and inner transformation (RQ2 findings)

Second objective of the study is to identify how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability. Sustainable agriculture is an option for food production in the present and in the future; since it protects one of the most important resources in this process: the soil, at the same time that it strengthens its health. To address the second objective of the study attempt was made to investigate how much knowledge study participants have regarding the crops they are growing. In addition to that they were asked about the productivity of the crops also to narrate reasons of decrease or increase in production in terms of climate change.

Participants were asked what type of crops were grown by them in 2021/2022 season, answers include “Hybrid maize/Composite Maize (OPV), Tobacco, soybeans, ground nuts, and tobacco.

Table 6: Hybrid/Composite Maize (OPV) grown 2021/2022 season.

Improve maize seed	Frequency	Key information
No	44	45% of the respondents grown hybrid/composite maize (OPV) crops in 2021/2022 season. When inquired, all the FFS respondents were given free improved maize seeds from the TRANSFORM project that could have affected the number.
Yes	36	

Table 7: Crops grown in 2021/2022 season/Maize Local

Local maize	Frequency	Key information
No	63	21% respondents grow local maize. This may also be related to the fact that the majority of FFS participants received free improve maize seeds, according to the study, the TRANSFORM project gave those improved maize seeds to farmers in the study area, who then distributed them to other non-FFS farmers.
Yes	17	

Table 8: Crops grown in 2021/2022 season/Beans.

Beans	Frequency	Key information
No	72	Only 10% of study participants said they grew beans. According to the report, the majority of respondents do not know how to
Yes	8	include beans crops into their farms, which jeopardies soil health.

Table 9: Crops grown in 2021/2022 season/Ground Nuts

Groundnut	Frequency	Key information
No	62	22% of the respondents ground nuts. It was discovered that groundnut is not something
Yes	18	people like as food in the study area

Table 10: Crops grown in 2021/2022 season/Tobacco

Tobacco	Frequency	Key information
No	74	Only 7.6% of the respondents grow Tobacco. The research observed that the market for tobacco has decreased, and some respondents' knowledge on how
Yes	6	tobacco depletes the soil nutrients means they are forced to apply fertilizer constantly, which they cannot afford.

Table 11: Crops grown in 2021/2022 season/Soybean.

Soyabean	Frequency	Key information
No	63	Only 21% of the respondents which happen to be FFS members reported to grow soya beans based on knowledge they acquired from FFS plot.
Yes	17	

The barriers to adoption of technology.

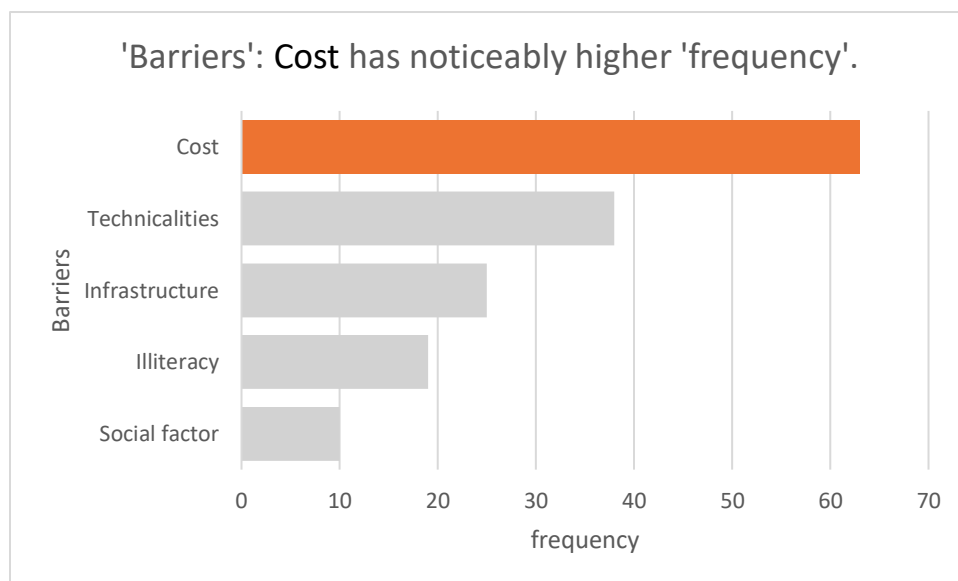


Figure 4: Shows barriers to adoption of technology.

Cost was the barrier to technology adoption for 63 study participants. Both ffs and non ffs members were willing to use improved maize varieties and apply the necessary fertiliser, but the cost involved is too high for them. For 38 study participants, technicalities could be considered a barrier as they saw most technologies, such as intercropping, require expertise in the proper spacing and types of crops that can be used. For 25 study participants infrastructure was an issue.

For the question “Indicate the state of the Hybrid /Composite Maize yield in the 5 past years” only 16 study participants reported that their harvest is increasing. Whereas only 3 reported that their harvest is constant, and all other remaining participants reported a decrease in the harvest.



Figure 5: Showing discussion between an enumerator and interviewee.

When asked for the possible reasons of increased productivity of crops study participants specified following reasons:

- 1) Participants started following improved agronomic practices.
- 2) Following good agriculture practices
- 3) Fertilizer and following new technologies.
- 4) Applied manure and fertilizer.
- 5) Used hybrid seed.

One of the participants stated that:

“I have started to follow the advice from our extension worker and lead farmer.”

He further added that:

“I used to burn after weeding but now stopped after knowing the benefits of weeded material as mulching”.

Another study participant answered the question in following way:

“Because am now using hybrid seed.”

In addition to that other reasons provided by a participant were:

“Early planting. I applied fertilizer in time”.

For the question “Indicate the major reasons for the constant in state for Maize Hybrid/Composite Maize” participants replied as:

“He's lacking farm inputs (oxcart for transportation of manure, irrigation pump, fertilizer, plough)” The study discovered that most respondents could not afford fertilisers and instead decided to use manure, but the source of manure to their various farms was too far to transport, so the Transform project provided 2 goats each to all 40 FFS members in order to supplement their small amount of manure in the future.

Other reasons specified by participants during focus group discussion (FGD) were:

- 1) fertilizer prices have affected their farming.
- 2) lack of money to buy certified seed.
- 3) lack of fertilizers
- 4) they applied fertilizer very late because they did not have money to buy.
- 5) Too much rainfall
- 6) Poor fertilizers



Figure 6: Showing discussion during FGD.



Figure 7: Showing a student researcher with one of FFS groups after FGD.

It can be stated that participants of the study know that it is important to use proper fertilizers, utilization of fertilizers in proper time is also crucial and adaptation of technology can be helpful in improvement of crops production. Moreover, they also reported use of hybrid seeds and technology, and indicated that lack of resources and improper schedule of rain is affecting their crops. Thus, their ability to understand that hybrid seeds, and other modern equipment's can help in crops growth is helpful for their transformation, that is FFS positive impact on knowledge perception.

4.5 Gaps in extension services (RQ3 findings)

Third objective of the study is to determine if there are gaps in the current extension services for inner transformation on sustainability. These were some of the technologies that has been adopted by the farmers both the FFS and non-FFS members:

Table 12: Technologies adopted by respondents.

Agricultural technology	Number (out of 80)
Conservation agriculture	30
Agroforestry	24
Climate smart agriculture	15
Intercropping	7
Crop rotation	57
Soil fertilization	51
Early planting	35
Mixed farming	38

According to survey results, 30 study participants agreed to have heard, seen, practiced, and accepted conservation agriculture. When asked the same subject during the focus group discussion, the majority of members said they used mulching technology on their farms after witnessing it work on their demonstration plots. For agroforestry 24 study participants agreed that they have adopted. The study also discovered that the majority of respondents have not implemented this technology, owing to the fact that they will be unable to grow on the same plot of land in the future. Climate-smart agriculture 15 study

participants heard, practiced, and adopted. Highest rate is reported for crop rotation and followed by soil fertilization. It could be seen that most agricultural technologies such as intercropping, climate smart agriculture, and agroforestry practices are not adopted by most of the study participants. Some participants claimed that after practicing (for example, intercropping), they noticed that it was time-consuming and difficult, but they were unsure of the benefits.

Technology facilitation is as important as or more important than technology transfer in extension. The extension is frequently viewed as nothing more than a means of transmitting technology and propagating scientific and technical advancement. That definition is too limited and inadequate. From scientists to manufacturers, knowledge diffusion is a two-way process. It is necessary to gather, examine, capitalize on, and share farmer knowledge. Producers require more than merely technical knowledge. Agricultural issues typically don't have a "one size fits all" solution because they involve technological, economic, commercial, social, and environmental factors. Farmers themselves must possess the capacity to assess restrictions, look for and test solutions, and select options from a range of options provided by the group of service providers.

Now the question arises why in this study focus is on the gap in extension services for the farmers in Malawi. Reason for that, it is one of the food-insecure nations in Sub-Saharan Africa is Malawi. Malawi does, however, have distinct factors that make it an interesting subject for research. For example, rainfall patterns are changing, and there have been notable extreme weather events in recent decades (Kumbuyo et al., 2014; Haghtalab et al., 2019). Malawi also typically has low nutrient soils because of insufficient resource inputs and ongoing cultivation of maize (Snapp et al., 1998). Socio-political determinants,

which differ across the nation, such as colonial forms of land management of resources (Mungai et al., 2020), the availability of education, and health-HIV/AIDS, together enhance food insecurity susceptibility at both the household and communal levels.

It is necessary to have a broad vision and go beyond agricultural technology. The Rural Extension, in addition to working to achieve changes in the productive systems of the most vulnerable, must contribute to opening opportunities, accessing markets, improving their food security, reducing restrictions in the financial system, contributing to mitigating their environmental vulnerabilities and increasing their representativeness in the political and social arenas.

Through the Fertilizer Input Subsidy Programme (FISP), which gave farmers access to input resources like better seeds and inorganic fertilizer, the Malawian government has made initiatives that have boosted agricultural production (Messina et al., 2017). In order to help farmers, improve farm production and livelihoods, Malawi's district-based agricultural extension services system (DAESS) participated in the promotion of the Furniture Industry Sustainability Programme and other creative interventions (Masangano et al., 2016). Since remote sensing productivity patterns are flat or declining and do not match Malawi's maize yield statistics, there has been controversy over whether and how much maize productivity and yields have increased in recent years (Peter et al., 2018).

The Malawi Ministry of Agriculture, Irrigation, and Water Development, along with collaborators from the international donor community, has been implementing smallholder-scale irrigation development since the early 2000s (Nhamo et al., 2016). The Shire River Basin Management Programme Project (SRBMP) and the Smallholder

Irrigation and Value Addition Project (SIVAP) are two irrigation projects that improve crop output in medium and small farming areas in Malawi. According to the Malawian government, there were 104,000 hectares of irrigation cropland in Malawi as of 2014. Of these, 46% were estates and 54% were held by smallholder farmers, who primarily produce maize, rice, sugarcane, and vegetables.

According to some studies (Mgbenka, Mbah et al. 2016) smallholder farmers who are granted access to inputs and take part in agricultural system measures frequently have enhanced farm productivity and are more likely to use mixed-maize systems, that involve crops like millet, root crops, pulses, and tree fruits for in-area consumption. Additionally, studies have shown that the diversity of legume crops and the use of perennial crops in smallholder systems might boost biological and ecological resilience (Kane et al., 2016). Very few investigations of smallholder agricultural growth take into account multidimensional scaling or long-term performance.

Gaps in reference to services provision in Malawi specifies that the small number of extended educators in Malawi, with an extension to farmer ratio of 1:1600 to 1:3000 per district, limits the spread of agricultural practices. In contrast, 1:750-1:850 is the extension to farmer ratio that is generally advised (Kundhlande, et al., 2014). According to certain studies, farmers with few resources, especially women farmers, have a reduced potential to participate in extension operations (Masangano, & Mthinda, 2012).

In this study it is being aimed to investigate how agricultural transformation is being adapted in terms of sustainable agriculture by smallholder famers of Malawi. Rural Extension's primary function is to transform conventional methods. Key components of extension include offering services, encouraging an integrative and transdisciplinary

approach, encouraging the adoption of new participatory methodological approaches, and utilizing local knowledge. Introduce institutional changes to decentralize and assign responsibilities to local levels in a similar manner, with extension agents refocusing on their position as facilitators and embracing new ideas and perspectives on the rural.

Another gap identified is limited access to resources and opportunities. Improving access to opportunities for women and youth, and various forms of collective action, are effective means to increase the social capital of the rural poor, reduce their risks, develop capacities, create networks of trust, reduce transaction costs and, in general, improve opportunities for insertion into markets and other spaces. The formation of human capital to promote these processes of change in people is a challenge to ensure two-way information with pedagogical approaches based on adult learning.

Evidence shows that the extension system of the Malawian administration is significantly strained. Underfunded extension workers are typically only provided with a bicycle yet are required to travel great distances and carry out a variety of government and non-government tasks with little assistance (Anders et al., 2020). In the current study an effort was made to seek out the answer to the questions related to selling and owning new things in the last few years. Outcomes indicated that every study participant owned a hoe but none of them owned a car or even an ox-cart. In addition to that many of them owned a second-hand panga or axe. One possible reason for that is increase in inflation and a decrease in resources. In addition to that extension agents earn a relatively low set monthly income, and many of the institutions that trained them have closed. Up to 1.1 billion acres of agriculture throughout the world have already lost much of their productive value, undercut the abundant biodiversity that supports them, and had their soils drained of

moisture or stripped of nutrients and blown by the wind (Fuglie, et al., 2022). According to the Food and Agriculture Organization of the United Nations, we may only have 60 harvests per year left until we run out of food to produce due to the continuous degradation of the world's primary soils (Boliko, 2019).

Rainfall has historically been Malawi's main supply of water for agriculture. The productivity of the nation has suffered significantly as a result of climate change. Despite massive irrigation initiatives like the Greenbelt Initiative (GBI), irrigation as a substitute for rainfed generation has not been used to its full potential. The goal of the Greenbelt Initiative (GBI) was to boost agricultural productivity in order to support the National Resilience Strategy.

Smallholder farmers have been urged to switch to irrigated agriculture, however obstacles like lack of access to financing, the cost of irrigation equipment, the caliber of extension services, and lack of water have discouraged farmers from doing so. This sector would grow if the appropriate policies and actions were put in place.

The best ways to persuade farmers to switch to irrigated farming are highlighted in a study by Malawi Priorities, a collaborative research-based project run by the National Planning Commission (NPC) with technical assistance to the African Institute for Development Policy (AFIDEP) and the Copenhagen Consensus Centre (CCC). The research investigation focuses on two interventions as a way to expand the irrigation area.

Due to a lack of extension workers to reach farmers and the requirement for suitable training and mobility for outreach activities, extension services have experienced difficulties. Training is required for extension agents, which would enhance the services

provided to farmers. The first intervention focuses on reorienting extension services to encourage smallholder farmers to employ gravity irrigation. In order to offer smallholder farmers with adequate and current knowledge on agricultural output and irrigation, the study evaluated the necessity to reorient extension officers and increase the provision of Agricultural Extension Development Officers (AEDOs) and Lead Farmers (LFs).

The estimated advantages are those of the first intervention, which included reduced variability and greater productivity linked to irrigation during the wet season. In general, research continues to show that the choice of irrigation technology and crops is a crucial factor in determining return on investment, making strategic crop diversification an essential part of any irrigation intervention.

Relying on the above-mentioned information it can be stated that service providers must be mindful of the different requirements of every category of farmers (men, women, young, old, labourers, and pastoralists), as improving livelihoods is crucial rather than only increasing agronomic knowledge. These needs could be met by offering supplementary information (e.g., on nutrition), concentrating on the agricultural activities most frequently performed by different types of farmers (e.g., poultry raising or vegetable cultivation with women), or conducting various events that are especially interesting or accessible for that kind of farmer (e.g., women-only events).

Findings specified that one reason for study participants having limited knowledge of technology and limited resources is poor management by administration. According to Huan, Li, Chi, and Zhan, (2022) influences and determinants of sustainable agricultural technologies have been studied in an expanding body of literature in recent years. However, little is known about the connection between adoption of environmentally friendly

agricultural innovations on farms and agricultural socialised services that have transformed the smallholder agricultural system and boosted scale operation in rural China. The adoption of sustainable agricultural practises (SAPs) is examined in our study because of agricultural socialised services. In contrast to most other research that analyse the binary choice of adopting agricultural technology, we record the number of SAPs adopted in this study. Authors employ a national representative farm-level survey data set of 1357 farm households from 132 villages in China to analyse using an endogenous-treatment Poisson regression model. The findings demonstrate that the usage of socialised services considerably increases the adoption of SAPs. Findings of the study imply that agricultural socialised services can encourage smallholders to use sustainable agricultural technologies, assisting in the conversion of traditional agriculture to sustainable agriculture. Around the world, dispersed urbanization has spread into rural areas. The study by Cecchini et al., (2019) concentrated on the metropolitan area of Athens, the nation's capital, and discussed the possible contribution of a typical rural Mediterranean environment, one dominated by olive groves, to the containment of urban sprawl and the preservation of peri-urban biodiversity and regional customs. Olive groves, which are of significant cultural, culinary, and aesthetic significance, are a characteristic feature of Mediterranean peri-urban settings. This study identifies territorial transformation processes towards urban sprawl in the study area, as well as changes to the "olive landscape," and offers fresh suggestions for sustainable land management in metropolitan contexts affected by socioeconomic disturbances like the current economic crisis.

The study's second objective focused on how farmers adopted new technology. Participants in the study are aware of how vital it is to apply the right fertilisers, how

important it is to use them at the right time, and how technology adaption can help increase crop yield. Additionally, they mentioned the usage of hybrid seeds and technology and said that their crops are being negatively impacted by a lack of resources and an inconvenient rain schedule. Their capacity to comprehend how contemporary tools can aid in crop growth, like as hybrid seeds, is crucial to their metamorphosis. In Malawi the DAES is the main extension service provider for agriculture and nutrition. However, the cultivation of maize continues to get many extension efforts, with little attention paid to other areas. According to the 2013 IHS, 56% of rural areas said that extension services for maize production were either better or the same as they were five years prior. In contrast, more farmers claimed that over the past five years, extension services connected to tobacco, credit, and livestock have been worse. This contrasts with farmers who believed that extension services linked to maize had gotten better. Just over a third of the farmers also claimed that extension personnel helped them recognise extension messages.

Using the Care Group model, NGOs frequently offer services that integrate several areas into community-based rural livelihoods programmes. NGOs execute their rural livelihood programmes using the Care Group model, focusing on households with young children and pregnant or lactating women. The Care Group model places lead farmers in charge of groups of 10 to 15 households that the NGOs organise (Care Groups Info, 2010). These initiatives aim to address issues like women's empowerment, agribusiness and marketing, nutrition, food security, and water, sanitation, and hygiene. The NGO programme staff frequently supports these organisations and pays them visits.

Empirical evidence shows that it is important to use technology properly to get more appropriate results. Before they do, they frequently discover that applying ever-

increasing volumes of fertilizers and pesticides is costing them more of their hard-earned money, which accelerates the march towards depletion. And when the land reaches the end of its life, some people abandon it while others continue to transform more grasslands, forests, and other crucial natural ecosystems into farming and pastures until those areas, too, are unable to sustain life (Rosa et al., 2020). In the current study it was discovered that study farmers had less access to production procedures than those in charge of the demonstration plots. However, the extent to which they are credit constrained determines what they study, and most field-day participants concentrate on mastering labour-intensive skills like mulching and plant spacing. This does not need to be the case. It is entirely possible to enhance global food production without turning more natural habitats to agriculture, according to science, economics, and practical experience. Regenerative farming methods may restore soil on existing farmland and grasslands around the world, preserve water, protect the area's abundant biodiversity, and shift the agricultural industry from a greenhouse gas emitter to one that combats climate change (Fenster et al., 2021).

However, despite of the fact that farmers are facing number of challenges government extension agents continue to be a key resource for farmers for information despite these difficulties. Nearly 70% of Malawian households that sought advice from outside sources—as reported by Ragasa and Niu (2017)—did so through government extension agents.

To conclude it would be ideal to conduct more research that includes in-depth discourse analyses of various social subgroups as well as additional qualitative data, artefacts, and triangulation. Furthermore, discourses are a dynamic, ongoing process that are constantly changing. Investigation into these processes in particular reveals several

power and interest groupings. We contend that the socially responsible design of a sustainability-focused digitalization of agriculture will be greatly influenced by how the subjects, arguments, and narratives attributed to digitalization change over time, as well as how problematizations and responsibilities are assigned and accepted. This would necessitate an ongoing examination of the social meaning-making processes and, consequently, of discourses across a longer time frame.

4.6 Theoretical framework of FFS

Fourth objective of the study is to review the theories related to transformation process for human beings.

The FFS's lack of lectures and emphasis on experiential (learning-by-doing), participatory, and hands-on learning are important contributors to its success. This advances the theory and practice of adult learning. There is a process for action, observation, analysis, and decision-making for each activity. The importance of "why" as well as "how" is stressed. Expertise has shown that after the FFS itself is complete, planned, useful activities provide a strong foundation for ongoing innovation and local adaptation (Braun & Duveskog 2011). It is one of the main reasons farmer facilitators find it simple to lead FFS because, once they learn how to facilitate an activity, the results are clear from the exercise itself. According to Karimi and Niknami (2020), the FFS program has proven to impact the knowledge, social, economic, and production of participant in Iran. As to whether farmer field school can impact inner transformation are yet to be found.

4.5.1. The Theory of Planned Behavior

The theory of planned behavior was proposed by Isaac Eisen (1985) in his article "From Intentions to Actions: The Theory of Planned Behavior". The theory was developed

from the Intelligent Action Theory, proposed by Isek Aizen (1980). Reasonable action theory was in turn based on various relational theories such as learning theories, expected value theories, consistency theories (such as balance theory, Osgood and Tannenbaum's correspondence theory, and Festinger's dissonance theory), and attribution theory. The high correlation between attitudes and subjective norms to behavioral intention, and subsequently to behavior, has been confirmed in many studies (Ajzen, 2020).

A counter-argument has also been offered against the high relationship between behavioral intention and actual behavior, as some studies show that, due to circumstantial limitations, behavioral intention does not always lead to actual behavior. Namely, since behavioral intention cannot be the sole determinant of behavior when individual control over behavior is incomplete, Aizen (2020) introduced the theory of planned behavior by adding a new component, "perceived behavioral control". With this, he extended the theory of reasoned action to involuntary behavior to predict behavioral intentions and actual behavior.

4.5.2 Theory of Changed Mindset.

Kurt Lewin, a pioneer in change theorizing and considered the father of modern psychology, was born in Poland. In 1933 he flees from Nazi Germany to the United States where he works as a teacher at various American universities. In 1942 he was appointed President of the Society for the Psychological Study of Social Issues (Bernecker, & Job, 2019).

- Lewin's model has the advantage of being easy to understand and reflecting a straightforward approach.

- However, it is very linear and does not really explain the experience of those involved. It is a good model of understanding, but its weakness lies in the possibilities of intervention.
- Some also criticize the notion of re-freezing as it is difficult to achieve in periods of constant change.
- Other dynamic models have enriched the psychological and social dimensions of change.
- However, the Lewin model continues to be a dynamic reading of the change process that has served as the driving model for many subsequent developments.

4.5.3. Theory of Knowledge Transfer (KT)

Transferring knowledge has thus become a strategic action that intervenes particularly to succeed in an alliance between several firms, to transmit scientific knowledge to Small and medium-sized enterprises (SMEs) which do not have research and development capacities, to ensure the sharing of experience between subsidiaries of a multinational firm or more generally to facilitate the dissemination of know-how between several organizations.

The social and organizational dimensions of knowledge are posed as determining factors and questions are asked about the best means of facilitating the integration of knowledge within an organization. For this, two main paths are taken: that of organizational design by questioning the formal integration capacities of the organization, and then that of networks and social capital which consider that the links between people are more important. than the formal structures of an organization (Ahn et al., 2019).

The extension of the KT theory (Barney 1986 and 1991) to the field of knowledge gave rise to the emergence of a new field of research: the KT approach with a founding article by Ahn et al., (2019), which puts highlight the importance of knowledge resources for business competitiveness. According to the KT theory, which is very close in its principles to the Resource Based View theory, a company is successful if it obtains a competitive advantage due to the optimal management of knowledge considered strategic.

During this research work, we choose to focus our attention on the transfer of knowledge. Since the publication of two special issues (Strategic Management Journal, 1996; Organization Science, 2002), the transfer of knowledge has, until now, been the subject of particular attention because it constitutes an important process in knowledge management.

4.5.4. Proposed analysis grid

The importance of knowledge transfers in the post-merger phase, highlighted by the pioneering work of Haspeslagh and Jemison (1991; cited by Lamont et al., 2019), is now the subject of a broad consensus both within the scientific community and among practitioners. However, the approaches dealing with this theme are part of very varied approaches. We have classified the literature into three main families of work: the “macro” perspective, the “micro” perspective, and the “soft” perspective.

Thus, the works which are part of the “macro” perspective, seek to identify the explanatory factors of the transfer of knowledge situated at the level of the context and the organizational conditions of integration. The transfer is assimilated into a process of deliberate exchange of knowledge between the acquiring company and the target company. The second perspective, which attempts to determine the “micro” factors, is

generally associated with the individuals involved in the post-merger integration process. Finally, supporters of the “soft” perspective are interested in factors related to social interactions between individuals. The “soft” level of analysis is thus centered on the social actor as the unit of analysis. The transfer is analyzed there as a social process emerging from the interaction of the actors.

Despite the progress of this research to explain the success of knowledge transfer, it seems to us that their results are not always convergent and moreover remain elusive on understanding the role of an integrative approach. The analytical framework developed for our study is as follows: the acquirer and the target each possess, before the merger, knowledge of their own. The operation gives rise to a certain degree of integration (Lamont et al., 2019), which affects the transfer and sharing of partner knowledge. The quality of transfers will thus be linked to the management of post-merger integration. Indeed, according to Haspeslagh and Jemison (1991; cited by Lamont et al., 2019), the success of a mergers and acquisitions operation depends on the ability of managers to reconcile two needs: the need for strategic interdependence between the two merged companies, which consists in transferring strategic knowledge; and the need for organizational autonomy aimed at preserving strategic knowledge. The “balance” between these two needs determines the most appropriate integration strategy for mergers and acquisitions objectives. Thus, the authors distinguish between modes of integration: preservation, which involves safeguarding the identity of the target company, absorption, which consists of the merger of two companies into one,

At the same time, previous research emphasizes the need to focus on the factors that promote the success of knowledge transfer in the integration process. Our presentation

of the factors identified in the literature is organized into three parts which correspond to the three main levels of analysis. First, the macro-factors, then the micro-factors, and finally the soft-factors. The literature also teaches us that the transfer can only be understood from an identification of the nature of the knowledge to be transferred.

4.5.5. Theory of Inner Transformation

Achieving a change in the way of life through the development of consciousness is not in the repetition of concepts or theories read or learned. Knowing the different lines of knowledge, doctrines, philosophies, sacred scriptures, books, and finally, the various tendencies to achieve personal development, does not give any guarantee to live the experience of evolving and awakening from the dream of unconsciousness.

Erudition nourishes the mind, activates the intellect, helps us to think, discern to find the path that leads us to the interior of oneself. This is useful and very interesting, but without the application of what has been understood, it will only be an adornment for the spiritual ego. This strengthens the delusion that the mind makes into believing that knowing is enough. The transformation is lived inside and manifests itself in the coherence of thoughts, feelings, emotions, and actions. It is what has expressed in our way of life and our relationship with everything that surrounds us.

The level of inner peace that is enjoyed is the level of consciousness achieved, which reduces internal conflict and gradually diminishes the problems of the individual. This translates into well-being, mental and emotional health, harmony, enjoyment, and a high level of acceptance. This is not just anything, there is a lot of will and internal work, self-observation, honesty, and responsibility for personal life.

2.5.6. The protection motivation theory

The protection motivation theory was proposed in 1975 by RW Rogers and reformulated in 1987 by Rippetoe and Rogers.

Protecting motivation is the intention to take preventive action. It depends on three factors:

- (1) the subjective likelihood of a potentially hazardous event occurring (vulnerability).
- (2) evaluation of the event (severity of the problem).
- (3) the perceived effectiveness of the proposed preventive action in terms of addressing the threat (response effectiveness).

According to the model, the degree of protection motivation is determined by a combination of all three factors. This premise is based on the obvious fact that the motivation to defend will not arise if the value of at least one of them is equal to zero. Who will think about preventive action if he does not believe in the possibility of infection, considers the threat to health insignificant, or protective measures ineffective? However, despite the validity of this provision, in a number of studies, it was practically not confirmed.

As a result, the theory of defense motivation was transformed into a general theory of behavior in the face of a potential threat. Motivation to protect arises when individuals face a health threat. For example, a young and sexually healthy bachelor might read that people who have casual sex with many different partners are at particular risk of getting AIDS (vulnerability); that no cure has yet been found for the disease (severity of the problem); and that the use of condoms is strongly recommended. According to the new version of the theory, the encounter with a health threat triggers two evaluation processes

(known from stress theory): both the threat itself and the recommended behavior. When assessing a threat, individuals consider the degree of its danger and the measure of their own vulnerability (risk of disease), and the cost of the consequences of maladaptive behavior (neglecting condoms). In assessing coping behaviors, the costs associated with implementing recommended preventive actions are related to their expected benefits (response effectiveness). The perceived ability to implement recommendations (self-efficacy) is also assessed.

The outcome of the assessment process will depend on the degree of protection motivation, i.e., on the nature of the individual's intention to carry out the recommended actions. Although this theory includes many of the variables considered in the theory of planned behavior, they have very different theoretical sources. The theory of defense motivation is based on the theory of stress, and the theory of planned behavior is based on the theory of attitudes. In addition, while threat assessment and action assessment are directly related to defense motivation, they are usually difficult to quantify directly when testing a model.

In the revised version of the model, Rogers (1987) abandoned the idea of “multiplying” vulnerability, threat level, and response effectiveness. In his opinion, the factors that make up the evaluation process are simply summed up. For example, the vulnerability, the severity of the problem, and the benefits of maladaptive behavior under algebraic summation give the final threat score (vulnerability + severity - benefits of inaction). Similarly, the score for coping behavior is the sum of the scores for response effectiveness, self-efficacy, and the "costs" associated with following the recommendations (response effectiveness + self-efficacy - costs). After that, the final assessment of the

situation is already obtained as the product of both assessments. The last assumption was made in order to independently evaluate each of the performance scores.

According to the theory, an increase in the threat level increases the motivation to protect, but only if the individual believes in the possibility of protective behavior for himself, as well as in the adequacy of the measures taken to reduce or completely eliminate the danger (when self-efficacy and response efficiency are high enough). If individuals believe that they are incapable of performing a defensive action, or that it is ineffective on its own, an increase in the level of threat will not increase the motivation to defend.

Given the difficulties that arise, it is not surprising that it is difficult to verify the validity of the mathematical side of the Rogers model. Although there is some evidence that it is possible to multiply the numerical values only of those variables that belong to different classes, data from other studies do not support this hypothesis. Thus, the nature of the relationship of variables considered by the defense motivation theory is still far from obvious. As well as a model of health concepts, the theory of protection motivation is explored in the context of a wide range of different activities related to health care: physical exercise; independent search for seals in the mammary glands; behavior caused by the threat of Acquired Immune Deficiency Syndrome (AIDS) and smoking.

However, in contrast to the model of ideas about health (as well as the theory of planned behavior), the theory of motivation for protection is being worked out experimentally. Experimental data confirm the main provisions of this theory. Behavioral intentions are often found to be positively associated with model components such as self-efficacy, response efficiency, vulnerability, and perceived danger. As a rule, self-efficacy

is the most reliable predictor of behavioral intentions, while the role of the level of perceived danger can be difficult to assess.

5 Findings Summary, Recommendations and Conclusion

5.1 Findings summary

Over time, peasants have accumulated a diversity of knowledge about managing the environment and natural resources depending on where they live, allowing them to survive and adapt to where they live. In this sense, traditional ecological knowledge results from experience acquired over hundreds of years of direct contact between a man and his environment. The development of agricultural activity requires a sum of knowledge and practices, which are transmitted from generation to generation.

The first objective of this dissertation was to review the current technology used by farmers, assess the impact of Farmer Field Schools (FFS) initiatives on smallholder farmers' awareness relevant to inner transformation, and its legitimacy in Malawi's food industry. The results of the study indicate that the participants are still in the process of adopting technology in their farming practices.

The study's findings suggest that farmers in Malawi use maize hybrid seeds and practice conservation agriculture; however, none of the participants own a vehicle or an ox cart., which may be because of a lack of money or a reluctance to adopt new technologies. A bicycle might impede a participant's capacity to move crops and agricultural supplies because just 23% of the participants reported having one.

The hoe, on the other hand, was a tool that was possessed by each research participant, suggesting that it is the one that is used for farming the most frequently.

Overall, the results point to the participants' partial adoption of technological change, which may be caused by a lack of resources or ignorance. The FFS programs might

have a big impact on increasing smallholder farmers' production, encouraging the adoption of new technology, and boosting awareness among them. Further research is necessary, nevertheless, to determine the viability and validity of these projects in Malawi's food sector.

This research emphasizes the need to give smallholder farmers access to technology and increasing public knowledge of the advantages of implementing new agricultural techniques. The results may be used as a foundation for policymakers, extension specialists, and other stakeholders to create efficient plans for fostering technological change in Malawi's food sector.

This implies a vision of both the environment and agriculture; to this situation, we must add the elements of culture related to the organization of family units for agricultural work, as well as the worldview that people have of the elements of nature (Perez et al., 2014).

The second objective of the study was to identify how knowledge transfer affects inner transformation (value, belief, or worldviews) on agricultural sustainability. The research participants have varied levels of knowledge about the crops they farm, according to the results that have been presented. In the 2021–2022 season, only 45% of participants said they cultivate maize hybrid/composite (OPV), while 21% said they would be growing native maize. The number of persons who reported growing beans, pigeon peas, soyabean, etc. was equally low. Only 1% of the individuals said they grew tomatoes, compared to 22% who said they grew ground nuts and 7.6% who said they grew tobacco.

The results indicated that, for the lead farmer, 97.5% reported being affected by the use of agricultural technology. 88.8% reported how influence co-members are when it comes to adoption of technology. In terms of family members, 78.8% said they may be influenced by their family members.

According to the research's findings, cost was a barrier to technology adoption for 63 study participants on high price of fertilizers while technical difficulties with intercropping were a barrier for 38 people. The problem for 25 players was the infrastructure.

Traditional knowledge is basically practical in nature, especially in the fields of agriculture, fisheries, horticulture, and forestry. The farmer's work, like any productive process, however simple it may be, is supported by a set of ideas, knowledge, values, definitions, and beliefs that interact with a specific productive structure. Safeguarding a worldview or belief system is even more difficult than preserving a natural environment. Protecting the natural environment is linked to safeguarding the cosmology of a community and the elements of its intangible cultural heritage.

Peasant knowledge is at risk of being lost, so its preservation means ensuring its intergenerational transmission within communities and protecting knowledge from socioeconomic and cultural changes, particularly in terms of maintaining its functionality and connection. dynamic with the practices of individuals and groups, in their daily interaction with the environment. The free transmission of knowledge, based on the experiences of every farmer, has marked human relations with Mother Earth, the provider and giver of food and life, and has contributed to the dissemination of the bases of current agricultural biodiversity (Vergara et al., 2020).

The strength of farmers' traditional knowledge derives not only from keen observations but also from experiential learning. Tropical farmers are based on ethno science, on the wisdom of the people accumulated through historical processes. It also indicates that this knowledge and agronomic practices keep an agricultural potential accumulated for millennia. Its technological dispositions have helped maintain the peoples' diverse productive and cultural options. Such provisions constitute the cognitive bases to be incorporated into the new and advanced knowledge of agricultural and ecological science to overcome and prevent the technological-ecological problems inherited from the green revolution (Barreto, 2017).

The third objective of the study is to determine if there are gaps in the current extension services for inner transformation on sustainability. The findings presented in the text draw attention to the shortcomings of Malawi's current extension services for inner change and sustainability. There is a need for more focused and efficient extension services to promote these practices because the survey participants reported diverse levels of adoption of various sustainable agricultural methods.

The text also implies that Malawi is the subject of attention because of its severe food insecurity and distinct sociopolitical factors that aggravate vulnerability at the family and communal levels. To address challenges like food security, financial system constraints, and environmental vulnerabilities, rural extension services must have a comprehensive vision that extends beyond agricultural technology.

The text emphasizes the significance of both technology transfer and technology facilitation in extension services. It highlights the necessity for a two-way process of

knowledge dissemination that includes obtaining and utilizing farmer information as well as encouraging adult learning techniques to support the development of human capital.

The findings discussed in the text support the goal of locating gaps in the current extension services for sustainable inner change in Malawi. To advance rural development and food security, they provide light on the varied rates of adoption of sustainable farming methods and emphasize the significance of tackling concerns that go beyond agricultural technology.

The fourth objective was to review the theories related to transformation process for human beings. Results suggested that studying the ideas relating to the human transformation process has given us important new understanding of the variables that affect knowledge transmission and behavior modification. In predicting and influencing conduct, the theory of planned behavior emphasizes the significance of attitudes, subjective standards, and perceived behavioral control. Kurt Lewin's theory of transformed mentality, on the other hand, places a strong emphasis on the need to unfreeze old behaviors, switch to new ones, and then refreeze the new behaviors to ensure that they remain. The idea of knowledge transfer also provides light on the organizational and social aspects that influence how information is shared and integrated within an organization such as farming.

Overall, being aware of these ideas may aid people and organizations in better managing change and achieving goals. People are better able to foresee and regulate their own behavior when they are aware of the significance of attitudes, subjective standards, and perceived behavioral control. To encourage the adoption of new behaviors and the transmission of information, farmers might apply the notions of a transformed mindset and

knowledge transfer. In the end, these theories offer helpful frameworks for comprehending and controlling the challenging human transformation process.

5.2 Recommendations for future studies

After analysing the literature, several ideas for future study directions come to light that will help illuminate various aspect of the connections between transformation and sustainability in agriculture sector. A field of investigation envisages conducting inquiry during the growing season phase, distributing cultivated land, bringing together intensive agriculture with high environmentally friendly standards. In addition to that focusing on integrated and organic farming, precision agriculture, conservative and agro-ecological farming systems to produce sustainable food products and ensure global self-sufficiency.

Further research into innovative agricultural methods that responsibly handle water, pesticides, and fertilisers/nutrients must be done in this regard. It would be interesting to examine the social responsibility of the organisations that operate throughout the agri-food supply chain and to establish a generally agreed framework for evaluating sustainability performance. Another suggested research direction looks at technological solutions to be used alongside the Forest Stewardship Council (FSC), novel forms of FSC sustainability governance, and novel approaches of multi-stakeholder collaboration in an effort to lessen the intricate nature of the food distribution system and its externalities. In this regard, comparing the performance of local and global logistics networks regarding food loss and waste as well as figuring out how packaging affects the reduction of food waste and greenhouse gas (GHG) emissions could help agri-food markets achieve goals of food security, sustainability of the environment, and economic growth.

Examining the economic and social ties between the local and international agri-food markets is another subject of great interest. To understand consumers' propensity to change their eating habits and diet models towards functioning properly, sustainable dietary patterns and their readiness to pay for agri-food products acquired in a sustainable way, a final research avenue is to study, on the one hand, the food needs and relative satisfaction of buyers in nations that are developing and, on the other hand, consumer's behaviour in developed countries. As always, science paves the way, but ultimately, each human is ultimately responsible for bringing about change.

5.3 Conclusions

In conclusion, the goal of this study was to examine how smallholder farmers in Malawi adopted technology and how Farmer Field Schools (FFS) programs affected their knowledge of and internal change toward agricultural sustainability. The results showed that the participants are still implementing technology into their agricultural methods, with many of them encountering obstacles including a lack of money or illiteracy. The hoe, however, was a tool that each research subject had, indicating that it is the one that is employed in farming the most frequently. The FFS programs may also have significant effects on increasing smallholder farmers' productivity, promoting their use of new technology, and raising their level of sustainability awareness, FFS must be supported in order to close the extension-farmer ratio gap. To ascertain the legitimacy and viability of these programs in Malawi's food industry, more study is required.

The study also showed that traditional ecological knowledge has developed through time, enabling peasants to manage and adapt to their local environments and natural resources. Traditional knowledge is mostly of a practical nature, particularly in the areas of gardening, forestry, fisheries, agriculture, and health. This information must be protected from socioeconomic and cultural changes in order to be effective and connected in the future. It must also be passed down from one generation to the next within communities. This will aid in spreading the fundamentals of modern agricultural biodiversity. In order to favor the reproduction of sustainable agriculture systems, it would be convenient for urban consumers of the middle socioeconomic class to diversify their food supply, carrying out efforts to exercise participatory consumption, beginning by locating intermediary initiatives that ensure a physical space for exchange. of products, where it is

possible to carry out activities that facilitate the interaction between consumers and farmers. However, the impoverished image of the farmer vis-a-vis the urban population identified in the focus groups could represent a difficulty regarding the possibility of this interaction and the intention to develop a broader understanding of agriculture. The image of sadness, backwardness and desolation was expressed by the majority of urban consumers with respect to farmers. The opinions of consumers about agriculture are associated more with a social problem of inequality and poverty that falls on farmers and less with information about what an agricultural system implies, the technologies that are applied in it -natural or industrial-, among other aspects.

Overall, this study highlights the need of giving smallholder farmers access to technology and raising public awareness of the benefits of using cutting-edge farming methods. These findings can serve as the basis for effective programs developed by policymakers, extension professionals, and other stakeholders to promote technical transformation in Malawi's food industry. The research also emphasizes the value of traditional ecological knowledge and the function it serves in managing the environment and natural resources.

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APPENDIX

SMALLHOLDER FARMERS' MINDSET OF TRANSFORMATIVE THINKING RELEVANT FOR SUSTAINABLE AGRICULTURE IN RURAL MALAWI

Consent Form

Participation is voluntary

Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences to your beneficiary status in the TRANSFORM project for you if you chose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data.

We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).

The information collected will be primarily accessible to NMBU through Professor Bishal Sitaula and his PhD student, Austin Tibu. All the names and contact details will be replaced with codes before further analysis to prevent leakage of your personal data. No personal names and contacts will be published from the data in this study.

The study intends not to archive the data. The data will only be analysed for the purpose of the PhD study which will be wind up in 2025. The data will not be stored beyond the 2025 study period.

What will happen to your personal data at the end of the research project?

The project is scheduled to end in August 2025. Almost all the data will be destroyed by the end of the study because it is solely collected to achieve the doctoral purpose. TRANSFORM project collects its own data where possible. As indicated early on, names and all personal contacts will be coded before further data analysis in this study. The codes will attach to each response as soon as the fieldwork is complete in May 2023.

Your rights

So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you.
- request that your personal data is deleted.
- request that incorrect personal data about you is corrected/rectified, and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?

We will process your personal data based on your consent.

Where can I find out more?

If you have questions about the project, or want to exercise your rights, contact:

- NMBU via *Professor Bishal Sitaula at the Faculty for Life Sciences, email: bishal.sitaula@nmbu.no* or by telephone +4767231372
- NMBU Data Protection Officer: [*Jan Olav Aarflot, by email: jan.olav.aarflot@nmbu.no*] or by telephone +4790636301
- Data Protection Services, by email: (personverntjenester@sikt.no) or by telephone: +47 53 21 15 00.

I have received and understood information about the project entitled ***SMALLHOLDER FARMERS' MINDSET OF TRANSFORMATIVE THINKING RELEVANT FOR SUSTAINABLE AGRICULTURE IN RURAL MALAWI***

and have been given the opportunity to ask questions. I give consent:

- to participate in *(the collection and sharing of the information I provide, with the partner organizations listed in the list I have been shown/provided. I understand that such collection and sharing is strictly limited on a need to know basis, to information that is necessary in order for NMBU and partner organizations to better understand and meet my household's needs (livelihood, resilience and crop productivity). I understand that at any time, I may request and obtain an up-to-date list of partner organizations with whom the information I have provided has been, is being or will be shared with. I have understood that the interview will not result in direct support to me or the community)*
- to participate in *(the questionnaire interviews and focus group discussions) – if applicable*
- for my personal data to be stored until the end of the study in 2025*

I give consent for my personal data to be processed until the end date of the project in August 2023

(Signed by participant, date)

Household Characteristics

HOUSEHOLD IDENTIFICATION	NAME	CODE
Household head		
Name of village		
Traditional Authority		
District		
Region		
Name of interviewee		Sex 1= Male 2=Female
Level of education		
Enumeration area		
Residence area	Husband's village (1)	
	Wife's village (2)	
	Neutral Village (3)	
Name of Enumerator		
Name of data entry		
Date of interview	Date:...../...../2022	Checked by:

	Start time:.....:..... Finish time:.....:..... Approved:
Reasons for not conducting interview:		Household location GPS Coordinates: N..... E.....

A. Provide the details of household head and members

Member ID	Name of household member	Sex	Relationship with HH head	Marital status	Age yrs	Education			
						A6			
		A2	A3	A4	A5	<i>Number of years of schooling</i> <i>(a6.1)</i>	<i>Highest class attended</i> <i>(a6.2)</i>	<i>Highest level of class complete</i> <i>d (a6.3)</i>	<i>Highest level of education completed</i> <i>(a6.4)</i>
01	A1								

02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									

Code: A2 1=female 2=male

**A3 1= husband 2= wife 3= son 4= daughter 5= Grandchild 6=Brother 7=sister 8=neice
9= nephew 10=Father 11=Mother 12=other relatives (specify)**

A4 1=Married 2=Widowed 3=Divorced 4= separated 5=Never married

**A6.4 0=none 1=std 1-4 2= std 5-8 3= Attend sec 4=MSCE 5=Techn. Colle
6=University**

**A7.1 0=none 1= Farming 2=bussiness 3=ganyu (labour) 4=Salaried work 5= full time
schooling, 6= Unemployed, 7= schooling (part time attendance) and farming, 8=other
(specify)**

A7.2 0=Has to take care of siblings, 1=Has to help out on farm, 2=Has to help out with family business, 3=No point in attending school, 4=Fees, 5=Others (specify)

A10 0=none 1=once 2=twice 3=three times 4=whole season

B. Assets owned by the household

Items	Does your household own the following items B1 1=yes 0=no (go to B6)	How many items do you have? B2	How much did you pay for it? (MK) B2.1	When did you acquire them? (year) B3	When acquired, was item new? B3.1 1=yes 0=no	If you were to sell them today what will be the price? (MK) B4
Car						
Ox cart						
Bicycle						
Wheelbarrow						
Hoe						
Panga						
Axe						
Sickle						
Handsprayer						
Treadlepump						
Engine pump						

Bed										
Table chairs										
Chair sofa										
Ridger										
Table										
Sewing machine										
Radio										
Plough										
Pressing iron										
Television										
Cellphones										
Others (specify)										

B. Assets owned by the household Cont'

Items	Did you lose	Did you own	If yes what happened?	When did this happen?	If sold why?	If sold what was	Who received	Do you plan
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	or sell any item last year? 1=yes 0=no B5	any in the last five years? B6 1=yes 0=no If no go to B10	B7	(year) B7.1	B8	the price? (Mkw) B9.1	the money? B9.2	to buy any of these this year? 1=yes, 0=no B10
Car								
Ox cart								
Bicycle								
Wheelbarrow								
Hoe								
Panga								
Axe								
Sickle								
Handsprayer								
Treadlepump								
Engine pump								
Bed								
Table chairs								
Chair sofa								
Ridger								
Table								
Sewing machine								
Radio								

Plough								
Pressing iron								
Television								
Cellphones								
Others (specify)								
			1 =lose 2 =sell 3 =stolen 4 =damaged/won out 5=gave out 6=other(specify)					

B9.2: 1= husband 2= wife 3= son 4= daughter, 5=other, specify

B11. If you need more land for cultivation do you have any available for you?

1-Yes How?

2-No why?

B12 If you were to buy land how much will you be willing to pay for one acre?

(MK).....

Definition of parcel: A unit of land with permanently defined borders based on ownership and spatial characteristics.

Definition of a plot: A unit of land that has been planted with the same crop or combination of crops during last growing season (2014/15) and has received similar management and input use. For maize plots we separate plots also by maize variety, such that an area of maize where part of the plot was planted with hybrid maize and another part with local

maize, should be divided in two plots, one for the hybrid and one for the local maize. Similarly, if only part of a maize field has received fertilizer, the field should be split in two plots, one with fertilized maize and one with unfertilized maize. And similarly, if part of the maize field is intercropped with e.g. pigeon pea, the field should be split in one mono-cropped and one intercropped maize plot. We then also need to have the areas and inputs and outputs for each of these maize plots as exactly as the farmer is able to estimate it

Cs. -Security of the plots

Plot ID	Who decides on plot? <i>Cs0a</i>	Who works on plot? <i>Cs0b</i>	Who will inherit this plot from you <i>Cs1</i>	Under what circumstances can you stop cultivating this plot <i>Cs2</i>	Who can grab the land away from you? <i>Cs3</i>	What are you doing to ensure that you don't lose the plot? <i>Cs4</i>

Cs0a (makes production and investment decisions) 1=Husband/male head, 2=Wife/female head, 3=Joint husband/wife, 4=Sons, 5=daughters, 6=Others, specify

Cs0b 1=Husband, 2=Wife, 3=Joint husband/wife, 4=Sons, 5=daughters, 6=both (children), 7=Others, specify

Cs1 1=Sons, 2=daughters, 3=both (children) , 4=brothers, 5=sisters, 6=others,

Cs2 1=Divorce, 2=Death of spouse, 3=Emigration, 4= end of contract, 5= none 6=others

Cs3 1=Village Chief, 2=Brother, 3=Brother in law, 4=Sister in law, 5=none, 6= owner,

7=government, 8= uncle, 9= others

Cs4 1=Plant trees, 2=Plant vertiva and 3=Rhodes (Nsenjere) grass, 4= registered, 5=none,

6=others

Cc: Crops grown on each plot Household ID (number):

Plot ID	What crops were grown on this plot last season (2022/23)?				Identify type of Cropping System	What factors are taken into account in making decision on what crops to grow on each plot or leaving the plot fallow? (in order of priority starting with the most important)	What major reasons did the household have for mono-cropping or mixed cropping? (in order of priority starting with the most important)												
	1 st <i>Cc1</i>	2 nd <i>Cc2</i>	3 rd <i>Cc3</i>	4 th <i>Dc4</i>							<i>Cc5</i>	<i>Cc7</i>				<i>Cc8</i>			
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
	Crop codes 0 fallow 1 Maize Hybrid 2 Composite Maize (OPV) 3 Maize Local 4 Beans Dry 5 Beans Green (Zitheba) 6 Peas 7 Ground nuts 14 Tomatoes 15 Onions 16 Lettuce 17 Rape 18 Mpiru 19 Pumpkins 20 Garlic 21 Cucumber 22 rice 23 Millet 24 sorghum 25 sugarcane				1= Mixed cropping 2= Mono-cropping 3= Intercropping	1= Land availability 2= Labour availability 3= Prevailing market prices 4= Seeds, fertilizer, availability 5= Meeting household basic consumption needs Credit 6= Past crop performance (in previous seasons) 7= Expected rainfall patterns. 8= Crop rotation 9= Other (specify)	1= Maximize revenue from land 2= Allow positive complementarity effects among crops (e.g. N-fixing,) 3= Save time and labour in crop management 4= To produce quality standards for exclusive for marketing 5= other												

	8 Tobacco 9 Cassava 10 Pigeon peas 11 Irish potato 12 Sweet Potato 13 Cabbage	26 soybeans 27 others (specify)			
--	--	--	--	--	--

D. Harvest

How much did you harvest last season (2021/22)

Plot ID	Crop code	Harvest 2021/2022							Indicate the state of the yield in the 5 past years.	Indicate the major reasons for the change
		1 st		2 nd		3 rd		4 th Others		
		Quantity	Unit Code	Quantity	Unit code	Quantity	Unit code	Estimated value		
	<i>D1</i>	<i>D2</i>	<i>D3</i>	<i>D4</i>	<i>D5</i>	<i>D6</i>	<i>D7</i>	<i>D8</i>	<i>D10</i>	<i>D11</i>
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
	Use Crop codes									

Code D3, D5, D7: 1= basket 2=oxcart 3=pail 4=wheelbarrow 5=bags (50kg) 6=bags

(90kg) 7= bales 8=Nkhokwe 9= lichelo (basin) 10=others

D10: 1=increasing 2=decreasing 3=constant

E: Membership to Farmer Groups

Group ID	Organization	Membership Characteristics				
		Project Financing the Group?	Role in the Group	How many years of membership	Trainings Received in each group	Was problem identification conducted by participants at the beginning of the Group
	<i>E15</i>	<i>E16</i>	<i>E17</i>	<i>E18</i>	<i>E19</i>	<i>E20</i>
1						
2						
3						
4						
5						
6						
7						
8						

9						
10						
11						
12						
13						
14						
15						
	1= Farmer Field School 2=Farmer Cooperative 3=Farmer club 4=Association 5= Others (specify)	1=Government 2=Non Governmental Organization 3=United Nations Organization 4=Research/Academic organization 5= Civil Society Organization 6=Farmers Organization 7=Others	1= Lead Farmer 2= Community Facilitator 3=Committee member 4=Ordinary Member 5=Non member 6=Others	Number of seasons	1= More than 1X per season 2= 1X per season 3=less than 1X per season	<i>I=yes 0=no</i> If yes, please take a picture or copy of the problem tree analysis

F. Recent shocks to household welfare

Negative shocks are defined as sudden adverse events (NOT ANTICIPATED) that lead to a loss of household income, a reduction in consumption, a loss of productive assets, and/or serious concern about household welfare. Anticipated shocks such as death after a long illness, crop failure following a long dry spell or drought, etc will not be considered as shock in this study.

Has this household experienced ANY major shock since 2021

GO THROUGH THE ENTIRE LIST (F2)	Did you experience a shock this year? 1-yes 0-no F1.1	The year shock occurred. F1.2	Note down the three most significant shocks you experienced for each year. F2	Degree of coverage F3	Duration of shocks in weeks F4	Effect of the shock F5	Estimated total value of loss. (Not for 11-14) F6	What did you do in response to this shock to try to regain your former welfare level? F7			
1- Lower yields due to drought or flood 2-Crop disease or crop pests 3-Livestock dies or were stolen 4-Large fall in sale prices for crops 5-Household buisness failure 6-Loss of salaried employment 7-Non-payment of salary 8-End of regular assistance, aid, or remittances		2020	1								
			2								
			3								
		2021	1								
			2								
			3								
		2022	1								
			2								
			3								
		2023	1								
			2								
			3								

from outside HH										
9-Large rise in price of food										
11-Death of HH head										
12-Death of working members of the HH										
13-Illness or accident of household member										
14-Death of other family member										
16-Dwelling damaged, destroyed										
17-Theft										
18-Other (specify)										

F3: 1=Own HH only 2=Some other HHs too 3=All HHs in community

F5: 1=Reduction in income 2=Reduction in assets 3=Both 4=Nothing

F7: 0=Nothing

8=Removed children from school to work

1=Spent cash savings

9=Sent children to live with relatives

2=Sold assests (tools etc)

10=Went elsewhere to find work for more than one month

3=Sold farmland

11=Borrowed money (relatives, bank, local money lender)

4=Sold animals

12=Received help (government, NGO, etc)

5=Sold more crops *13=Reduced food consumption (smaller proportions,
fewer meals per day)* *6=Worked more (incl. other HH members, ganyu)*
14=Diversify food consumption (Wild foods, meal sharing, no meat or fish)
7=Started a new buisness

G. Weather Shocks and Coping and Adaptation Strategies

Weather shock	Did you experience weather shock this [...] year? 1. Yes 0. No	Year shock occurred	Rank in order of importance	Duration of shock (weeks)	How many times did [shock] occur in past ten years before this [...] year? (if zero put 0)	Important risk management strategies before [shock] occurrence CODE 1; Rank 3			Important coping strategies after [shock] occurrence CODE 2; Rank 3			How did [shock] affect production of <u>main food crop</u> of the household (% reduction)	As a result of [shock] how much of your income did you lose? (% reduction)	Do you think [shock] will become more important in future?(0=No 1=Yes>P11 -77=Don't know)	If Yes , how often do you think [shock] will occur in the next ten years?	
						1 st	2 nd	3 rd	1 st	2 nd	3 rd					
	G1	G2	G3	G4	G5	G6a	G6b	G6c	G7a	G7b	G7c	G8	G9	G10	G11	
1. Drought/dry spell 2. Too much rain or floods 3. Hail storm	2022	1														
		2														
		3														
	2023	1														
		2														
		3														

CODE 1			CODE 2			
1. Plant drought tolerant crops	9. Change from crop to livestock	15. Saving in cash	1. Plant drought tolerant varieties	7. Change from crop to livestock	13. Stop sending children to school	
2. Plant crops adapted to water-logging	10. Minimum tillage	16. Saving in kind (e.g. Jewellery)	2. Replanting	8. Change from livestock to crop	14. More on-farm casual work	
3. Plant drought tolerant varieties	11. Soil and stone bunds	17. Food preservation	3. Selling livestock	9. Eat less meals	15. More off-farm casual work	
4. Early planting	12. Increase seed rate	18. None	4. Selling land	10. Reduce meals	16. None	
5. Crop diversification	13. More on-farm casual work	19. Other (specify).....	5. Rent out land	11. Out-migration	17. Other (specify).....	
6. Intercropping	14. More off-farm casual work		6. Selling other assets (specify).....	12. Borrowing		
7. Rotation						
8. Tree planting						

H: To identify how knowledge transfer affects inner transformation on agricultural sustainability.

Consider all the FFS interventions that you have been involved in, to what extent do you consider that FFS integrated the following.

No	Leverage Points for Inner Transformation (refer to Woiwode et. al., (2021))	Rank					
		1	2	3	4	5	6
1	Nurturing mindfulness and self reflection during trainings and practical sessions during the season						
2	Embracing diversity, building trust and clarifying common vision for establishing FFS						

3	Contributing to social intergration and cohension and enriching life during meetings, trainings and discussions						
4	Practcing conflict facilitation and developing peace building skills between memebtrs of the FFS						
5	Reconnecting to nature during problem identification and selection of enterprises and their potential benefits to smallholder agriculture						
6	Creating opportunities for other members of the farming community to learn for FFS establishments						
7	Developig agricultural based economies including savings group, storage facilities, entrepreneuership sessions during the FFS season						
8	Promoting a balanced social structure including local leadership and gender						
9	Preserving natural rsources including soils, water and forests						
15	If things continue on their present course, we will soon experience a major						

Codes
1. Fully integrated
2. Well integrated
3. Somewhat integrated
4. Poorly integrated
5. Not at all integrated

I. Reviewing the current agricultural technology. (Expecting possible multiple answers)

No	Different types of agricultural technologies	Codes				
		1	2	3	4	5
1	Conservation agriculture					
2	Agroforestry					
3	Climate smart agriculture					
4	Intercropping					
5	Utilisation of improve varieties					
6	Crop rotation					
7	Soil fertilisation					
8	Mixed farming					
9	Mixed farming					
10	Early planting					

Codes
<ol style="list-style-type: none"> 1. Heard 2. Seen 3. Practiced 4. Adopted 5. Don't know

J. Technology Adoption

No	Can adoption of agricultural technology by someone affecting other	Rank				
		1	2	3	4	5
1	Lead farmer					
2	Family relatives					
3	Friends					
4	Opinion leaders					
5	Colleague group member					

Codes
<ol style="list-style-type: none"> 1. Highly affected 2. Well affected 3. Somewhat affected 4. Poorly affected 5. Not at all affected

K. Do you know any technologies that can be used for better growth of crops on sustainable basis? (Yes) (No) If yes kindly give examples

How do you received information from your leaders at highest level and how do they welcome your ideas

- a) Top down approach
- b) Bottom up approach.
- c) Others specify.

L: To review current technology uses by farmers currently, how FFS initiatives will impact smallholder farmers' awareness relevant for inner transformation, and its legitimacy in Malawi's food industry.

L1. Consider all the FFS interventions that you have been involved in, to what extent do you consider that FFS consider the following.

No	New Ecological Paradigm (NEP) Scale Description	Rank					
		1	2	3	4	5	6
1	We are approaching the limit of the number of people our agricultural fields can support						
2	We have the right to modify our homes, fields and our environment to suit our needs						
3	When humans interfere with nature it often produces disastrous consequences for our food production systems						

4	Human ingenuity will ensure that we do not make our environment unproductive for the current production systems						
5	We are severely abusing our agricultural production resources (soil, trees, water, air)						
6	Our environment has plenty of natural resources if we just learn how to develop them for increased production						
7	Plants and animals in our agricultural systems have as much right as humans to exist						
8	The balance of nature is strong enough to cope up with the land degradation, floods and drought						
9	Despite our special abilities to practice agriculture, humans are still subject to the laws of nature						
10	The so called ecological crisis facing our agricultural systems has been greatly exaggerated						
11	Our agricultural environment is like Noah's ark with very limited room and space						
12	Humans were meant to rule over the rest of nature for agricultural production						
13	The balance of nature is very delicate and easily upset						
14	Humans will eventually learn enough about how nature works to be able to control it						

15	If things continue on their present course, we will soon experience a major crisis in agricultural production						
16	Postive impact on the current agriculture technologies						

Code 3
<ol style="list-style-type: none"> 1. Stronly diasgree 2. Diasgree 3. Neutral 4. Agree 5. Strongly agree 6. Don't know

L2. What components of agriculture technology you tried worked well and what failed? Expecting multiple answers

L3. Have you benefited from joining FFS/group on your awareness of agriculture sustainability? Yes /No If yes how?

MI. Obstacles of Transformation

No	Barriers that prevent transformation among smallholder farmers	Rank				
		1	2	3	4	5
10	Cost					
2	Technicality					

3	Social factors					
4	Infrastructural conditions					
5	Illiteracy					

Code
1. Strongly disagree
2. Disagree
3. Agree
4. Strongly agree
5. Don't know

M2. Do you believe FFS is an enabling factor that can encourage transformation among smallholder farmers? If yes how

N. To determine if there are gaps in the current extension services for inner transformation on sustainability.

N 1a. Did you have visits from extension staff last season (2021/22)? 1-Yes 0-No

.....

N 2b. If yes how many times?

.....

N 2c. What advice did you receive from the extension staff?

N 3. Would you explore new farming technology? (Yes) (No). If yes, why

N 4. How long would it take you to adopt a new technology (Adoption rate) in terms of days, months, or years, and why?

- a. Within one year
- b. Two years
- c. Three years
- d. Others

N 5. Does requirement of adopting new technologies leads to sustainability Yes/No If yes how_____

XX: Livestock ownership, livestock sales and technology adopted in the past 2 years

Livestock code	How many do you have now? xx2		What is the estimated price if you were to sell today? xx2.1		How many were sold? xx3	At what price were they sold? (MWK) Xx4	Why were they sold? Xx5	How many were slaughtered and consumed in HH? Xx6	How many were stolen? Xx7	How many have died? Xx8	What technology have been adopted for livestock Xx9
	Young / old/ sick ones	Adult/ healthy ones	Young / old/ sick ones	Adult/ healthy ones							
1.Cattle											
2.Goats											
3.Sheep											
4.Pigs											
5.Chickens											
6.Doves											
7.Guinea fowl											

8.Rabbit											
9.Duck											
10.Turkey											
11.Bees											
12.Donkey											
13.Others											

C. Result tables

How many household members are there in your house.

Household number	Frequency	Percentage
2	3	3.8
3	11	13.8
4	17	21.3
5	17	21.3
6	19	23.8
7	5	6.3
8	3	3.8
9	2	2.5
12	1	1.3
14	1	1.3
15	1	1.3
Total	80	100.0

Results show that respondents varied from 2 to 15 members of house. With highest number for 6 household members (n=19) followed by 5 (n=17) and 4 (n=17) household members.

Marital status of the respondent

Marital status	Frequency	Percentage
Divorced	6	7.5
Married	63	78.8
Separated	3	3.8
Widowed	8	10.0
Total	80	100.0

Findings of the question related to marital status showed that 63 respondents of the study were married, 8 were widows, 6 were divorced and 3 were separated.

Relationship of the respondent to household head

Household head relationship	Frequency	Percentage
Mother	1	1.3
Self	40	50.0
Spouse	39	48.8
Total	80	100.0

For the question “**Relationship of the respondent to household head**” it was reported that all 40 participants were self-reporting the required information, 39 were the spouse providing the information and 1 were the mother of the household.

Residence area of respondents

Residential area	Frequency	Percentage
Husband's village	57	71.3
Neutral Village	4	5.0
Wife's village	19	23.8
Total	80	100.0

For the question related to residence area 57 study participants reported to be living in husband's village and 19 were living in wife's village. Remaining 4 study participants were reported to be living in neutral village.

Whether the respondent is FFS member

FFS member	Frequency	Percentage
No	40	50.0
Yes	40	50
Total	80	100.0

For the question related to respondent being FFS member 40 study participants reported not being FFS member and 40 reported as a member of FFS. Though 40 participants were not members of FFS, but they belong to different farmer groups only 2 participants were not belonging to any farmer group (but rather follow farmers)

Village name of respondents

Village names	Frequency	Percentage
Bwemba	6	6.4
Chipafi dausi	4	5.0
Dzoole	8	10
Kafela	1	1.3
Kangulu	3	3.8
Kansulila	7	9.0
Kapondo	5	6.3
Kapondo.zakaria	1	1.3
Kawole	6	7.6
Kayesela mgunda	1	1.3
Kayeselan'gunda	1	1.3
Kayesera Village	1	1.3
Masinja	1	1.3
Mbalame	4	5.0
Mchemela	8	10
Mtipulula	1	1.3
Ndalama	7	8.8
Ngalazuka	1	1.3
Pioni	1	1.3
Sauzande	2	2.5
Tambala	11	14
Total	80	100.0

For the question related to which village study participants belonged to different villages including Tambala, Sauzande, Pioni and Mtipulula etc.

Traditional Authority (TA) of the study area.

Traditional authority	Frequency	Percent
Dzoole	40	50
MKUKULA	40	50
Total	80	100.0

For the question related to traditional authority study participants reported that they belong to Dzoole (n=40) and Mkukula (n=40).



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