Social-Ecological Resurgence through Farmers' Traditional Knowledge and Agroecology in Pakistan

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Abstract

There is an urgent need to transform global food systems. Basic food supply chains have been disrupted due to the structural vulnerabilities within the dominant food system. Scholars, ecologists, smallholder farmers, economists and activists are increasingly advocating for agroecology as part of a path forward, emphasizing the importance of drawing on the latest agricultural research while harnessing farmers' traditional knowledge to drive social-ecological resurgence.

Farmers' traditional knowledge is essential to agroecology and social-ecological systems. The basic understanding that humans are an integral part of the natural world, interwoven with the environment, rather than separate from it, is necessary for comprehending the complex relationships that rule our existence. This study focuses on Pakistan, an agricultural country, constantly influenced and pushed towards industrial agriculture. Industrial agriculture relies on high yielding variety seeds, synthetic fertilizers, and pesticides to boost food production. However, this approach has damaged the ability of farmers to depend on their local ecosystems for food. The research explores how traditional agroecological knowledge has been embraced as a form of social-ecological resurgence in Badin, Sindh, Pakistan.

Through purposeful and convenient sampling, interviews were conducted with five farmers ranging in age from 37 to 80. The farmers' narratives provided valuable insights into local ecosystems and perspectives on the challenges and limitations of industrial agriculture. In their view preserving traditional agroecological knowledge is crucial, not only for documenting its effects on a healthy ecosystem but also for considering the challenges posed by an aging farming population and potential knowledge loss.

The data analysis revealed four major themes including the social-ecological impacts of industrial agriculture, the integration of traditional agroecological knowledge with technology as a form of resurgence, the role of women in farming, and the farmers' hopes for the future. The findings demonstrate that agroecology as an alternative to the industrial food system has the potential to bring food sovereignty while improving community systems and recognizing the role of women in the farmers' traditional knowledge systems. This research contributes to scholarly debates about the importance of local farmers' traditional knowledge in agroecology. This research emphasizes that the opinions of traditional farmers should be included and appreciated for the importance of their knowledge and their role in the communities they come from.

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Chapter 1: Introduction

1.1 Background

There is an urgent need for transformation of our global food systems (Canfield et al., 2021). According to United Nations Food and Agriculture Organization (2022), "In 2021, approximately 2.3 billion people, or nearly 30 percent of the global population, experienced moderate to severe food insecurity, which is 350 million more than in 2019, before the Coronavirus disease (COVID-19) pandemic" (para. 15). Additionally, Philip McMichael (2009a) argued that "rising food prices and a surge in food riots signaled the end of the era of cheap food" (p. 139). These challenges have prompted a critical examination of our food production and harvesting foundations, particularly their increasing reliance on fossil fuels. Moreover, studies have demonstrated that the inequitable distribution of societal wealth and resources, rather than population growth and food scarcity, is the primary driver of widespread hunger, food insecurity, malnutrition, and health disparities (Borras & Mohamed, 2020).

Gliessman (2022) writes, "Local food systems, from production to distribution, have been severely weakened and have even collapsed, especially those that have sacrificed local production systems and practices in the shift to export crops, and along with this, the loss of food security" (p. 1301). It is reported that "seventy percent of those facing the most acute forms of hunger are small-scale producers and rural workers" (UNCTAD, 2013; Canfield et al., 2021, p. 5). Many now realize that the longtime narrative of "feeding the world", reinforces the industrial food system and "proprietary technologies to feed the world" has brought more food insecurity in the communities due to the loss of biodiversity and degradation of soil (International Panel of Experts on Sustainable Food Systems, 2017; Canfield et al., 2021, p. 6).

Canfield et al. (2021) suggests that considering the structural vulnerabilities in the current neoliberal food system after the COVID-19 pandemic which disrupted the global food supply chain and the impacts of climate change on food production, there is a serious need of commitment and action to establish a sustainable and equitable food system.

This raises questions regarding the potential of local food systems as a solution and the type of agriculture that should be practiced within them. Lang and Heasman (2015) describe two parallel frameworks that point to different potential directions for global food systems, the Life Sciences Integrated paradigm and the Ecologically Integrated paradigm. Lang and Heasman (2015) argue that the Life Sciences Integrated paradigm describes food systems in a reductionist and a medicalized way, which focuses on an individualized administration of diet and health issues, therefore the implications of the Life Sciences Integrated paradigm are long-term and threaten further land degradation, erosion of traditional knowledge, and lasting social-ecological damage (pp. 31-46). The Ecologically Integrated paradigm on the other hand gives a biological approach to nature instead of industrial approach, it combines traditional knowledge with scientific knowledge and adopts an interdisciplinary lens to the natural ecosystems (Lang & Heasman, 2015, pp. 35-46). Hence, the Ecologically Integrated paradigm promotes agroecology as an approach to food production and harvesting that promotes sustainable agriculture by working with nature and people (Altieri & Farrell, 1995; as cited in Lang & Heasman, 2015, p. 36). This paradigm recognizes the need for a social-ecological resurgence, considering the challenges faced by both producers and consumers, including rising costs, expensive inputs, and increased food prices.

As debates continue regarding which paradigm will become dominant, the ongoing war on Ukraine raises concerns about dependency on countries exporting fossil fuels and those

exporting grain (Bilali, 2022). The majority of fertilizers, pesticides, and farming technology utilized in intensive agriculture, associated with the Life Sciences Integrated paradigm, rely on fossil fuels (Lang & Heasman, 2015). Since, the production of nitrogen fertilizer involves carbon emissions as the synthesis process of the fertilizers is based on fossil fuels (Menegat et al., 2022, p. 1).

Thus far, many short-term solutions have been pursued in an attempt to address food insecurity. As Gliessman (2022) explains, "food aid and embargoes are short-term solutions that do not change the structural issues caused by the loss of farmers' traditional knowledge, simplification of farming systems, growing import dependency, and price speculation and manipulation by powerful market forces" (p. 1301). Furthermore, "considering the vicious cycles of climate change, conflict, pandemics, and poverty, it becomes clear that food system transformation is needed" (Gliessman, 2022, p. 1301).

In this study, I explored opportunities and challenges as part of Ecologically Integrated paradigm to understand how farmers' traditional knowledge along with contemporary technology can contribute as a social-ecological resurgence for smallholder farmers in Pakistan. For this research I interviewed five smallholder farmers from Badin, Sindh, Pakistan to gain insights into their traditional knowledge along with the focus on their challenges and hopes related to agroecology.

1.2 Rationale

The United Nations Food and Agriculture Organization (UNFAO) (2021) reports, "The world's smallholder farmers produce around a third of the world's food" (para. 1). Globally, "there are around 500 million smallholder households counting to two billion people who cultivate less than five acres, and they make up a significant portion of the world's poor who live

on less than dollar two a day" (World Bank, 2016, para. 4). Despite producing food crops, the smallholder farmers remain among some of the poorest populations in the world (Ritchie, 2021). The smaller farms tend to achieve higher yields of food crops than larger farms because smaller farms tend to allocate a larger share of their crops towards food, rather than industrial crops (like soy and corn) for animal feed or biofuels (Ricciardi et al., 2018). Further possible explanations for smallholder farmers producing better yields are their traditional and experiential learnings through their farming practices over time and their relationship to the land and their communities.

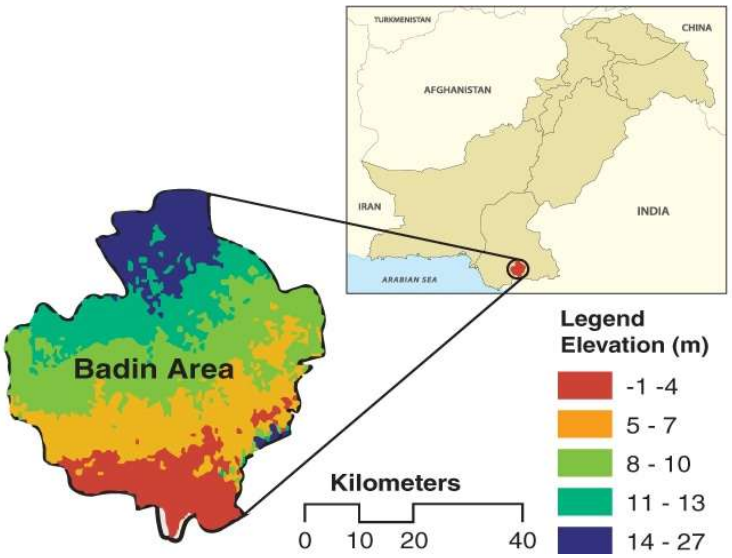

Figure 1. 1: Badin District Map

Source: Nisar et al. (2019)

In order to better understand these structural vulnerabilities and opportunities for more sustainable and equitable farming approaches, I chose to study my home village Deenar Khan Talpur in Badin district (see Figure 1.1).

Research and knowledge sharing about farmers' traditional practices has been previously done by the scholars working in the Indian Punjab region (for example, see Shiva, 2016). However, little is known about Pakistan's Sindh province which is also referred to as the Indus Delta and includes Badin district. Nearly sixty percent of the population of the Badin district faces a crisis of acute malnutrition (Integrated Food Security Phase Classification, 2019). According to Magsi and Shaikh (2017), 22 percent of the cultivated land has been degraded in Badin district. Malnutrition and land degradation in Badin is due to several reasons including the intensive agriculture practices and sea intrusion. Hence, there may also be alternatives to mitigate these issues within the same community. This is why I chose to study the local smallholder farmers who are an integral part of the agroecosystem of Deenar Khan Talpur and how they perceive the solutions to these problems. The experiences in this community can contribute to broader knowledge and the opportunity to find solutions in other places with similar agroecosystems to Deenar Khan Talpur.

1.3 Research Question, Goal and Objectives

The goal of this research was to explore farmers' traditional knowledge in agroecology and how it can contribute to social-ecological resurgence. My research had three objectives. The first objective was to explore the impacts of industrial agriculture on the farmers. The second was to explore the farmer's experiences with traditional ways of farming that can bring social-ecological resurgence (for example, the ways of making organic fertilizers and pesticides, techniques of saving native seeds, and the use of livestock instead of machinery for farm activities). The third research objective was to identify farmers' hopes for the future. A fourth research objective that emerged during my field work was to better understand the role of women in farming and their contribution in preserving traditional agroecological knowledge.

Four major themes emerged during the data analysis. First, the impacts of industrial agriculture were discussed by the farmers, including the introduction of high yielding varieties (HYV) of seeds, synthetic fertilizers, pesticides and fossil fuel based technology (e.g., tractors, water pumps, etc.) since the early 1960s. While the Green Revolution of the 1960s was ostensibly intended to end hunger, farmers discussed the negative impacts it had on natural ecosystems due to the use of poisonous chemicals. Second, farmers shared their experiences with traditional knowledge over time, including their inherited and adapted resurgent farming practices and interactions with local biodiversity. Third, farmers shared their hopes and visions for the future of agriculture, which emphasized the potential for social-ecological resurgence through the preservation and application of traditional knowledge. A fourth theme that emerged from the interviews was the role of women in preserving and transmitting traditional knowledge.

Overall, the findings from this study highlight the importance of understanding farmers' experiences and perspectives in the development of sustainable agricultural practices and policies. The themes identified suggest that the preservation and application of traditional knowledge, as well as the central contribution of women in this process of knowledge-sharing and their role in agroecology, plays a significant role in achieving social-ecological resurgence.

Chapter 2: Literature Review

In this chapter I discuss the literature relevant for this research to provide background and context. This chapter comprises three subsections. First, the global context is discussed by expanding on the chronology of the global food regimes approach. Second, I illustrate the brief agricultural history of Pakistan from the 1940s to present day. In the third subsection, I set out the terms and context of social-ecological systems, resurgence, agroecology and traditional farmers' knowledge. Additionally, I elaborate on the social-ecological systems approach to studying resurgence through traditional knowledge and agroecology, I explain traditional knowledge dynamics, and I summarize commonly studied topics in traditional knowledge and agroecological studies.

2.1 Global Context: The Chronology of Global Food Regimes

In this section I discuss the broad history and current status of the global food systems through the lens of Harriet Friedmann (1987, 1993a, 2005, 2009) and Philip McMichael (2005b, 2008a, 2009) and their joint work (1989) on food regimes. Before I present my research, to understand farmer's agroecological experiences in Badin, Sindh, Pakistan, it is important to understand the historical background of the current corporate-led, capitalist, global food system and its broader impacts on the majority of the countries across the world, and specifically the local farmer rights in these countries.

The idea of a food regime was first introduced by Harriet Friedman in 1987. Later, Friedmann's work along with Philip McMichael in 1989 unveiled the role of agriculture in the making of a capitalist economy. Harriet Friedmann (1993a) describes a food regime as a "rule-governed structure of production and consumption of food on a world scale" (p. 30). McMichael

(2009) argued, “Food regime analysis brings a structured perspective to the understanding of agriculture and food’s role in capital accumulation across time and space” (p. 140). That is why, “the food regime concept is a key to unlock not only structured moments and transitions in the history of capitalist food relations, but also the history of the capitalism itself” (p. 163). McMichael concludes that it is necessary to shift the food regime concept from the perspective of “the commodity as object to the commodity as relation, with geo-political, social, ecological, and nutritional relations at significant historical moments” (McMichael, 2009, p. 163). This concept is necessary to understand so that we can move forward to the alternative solutions for the current global food system using the Ecologically Integrated paradigm as proposed by Lang and Heasman (2015).

According to Friedmann (1993) and McMichael (2005b) there were three food regimes from the 1870s to the 1980s onwards. However, Friedmann (2005) and McMichael (2005b) have a slightly different opinions on the third food regime.

The first food regime from the 1870s to the 1930s was a mix of imports like tea and spices from the South Asia to Europe as well as imports of grains and livestock from settler colonies like the United States, Canada and Australia to Europe. These imports supported European industrialization and brought economic power to the British Empire by connecting agricultural and industrial sectors (McMichael, 2009). However, this dependence on food resources from colonies disrupted the food and ecosystems (McMichael, 2009).

The second food regime (1950s-70s), also known as the postwar food regime (Friedmann, 1993a), was more about the United States’ supply of surplus grains and food items to its postcolonial allies during the Cold War (McMichael, 2009a). Friedmann (1993a) argues that the post war food regime was governed by implicit rules which decided the power dynamics

between the countries.). This food regime shifted power between and within countries; including national and international lobbies; classes of workers, peasants and farmers and the flow of capital (Friedmann, 1993a, p. 31). Friedmann (1993a) explains that these "implicit rules" were transformed through practical experiments and negotiations between corporations, countries, ministries, farm lobbies and consumers in response to problems in production, distribution, consumption and trade which lasted for twenty-five years" (p. 31).

According to McMichael (2009), during the second food regime the food aid supplied by the U.S. subsidized wages and encouraged industrialization of the majority world[1]. McMichael explain this as an intentional strategy to secure "loyalty against communism and to imperial markets" (p. 141). The added policies of development for majority world countries, encouraged national agro-industrialization, Green Revolution technologies, initiated land reforms to divert any peasant uprisings and aimed to expand global food market participation. (McMichael, 2009). Agribusiness introduced global supply chains which created transnational commodity complexes, for example the animal protein complex which mixed the grain, soy, and lot-feeding sectors in the countries' farming industries (McMichael, 2009). Hence, this period brought a universal national economic development model that also initiated the "international division of labor in agriculture" (McMichael, 2009, p. 141; for more detail, see Raynolds et al., 1993).

In the late 1980s and beyond, a third food regime evolved. Friedmann (2009) depicts this third food regime on Burch and Lawrence's (2007) concept of financialization of food, during and after the second food regime. The power shift in the post 1990s to 2000s was from supermarkets to financial enterprises as Friedmann (2009) quote Burch and Lawrence (2007).

[1] The term "majority world" is used instead of Third World for the purpose of clarity in this thesis.

This whole shift brought the famous cost-price squeeze as "farmers became suppliers of raw materials to giant food manufacturers (supermarkets were still infants)" (Friedmann, 2009, p. 336). McMichael (2009; see also 2005b) refers this third food regime as the corporate food regime because it in many ways is the outcome of the earlier food regimes. This corporate food regime involves "the decomposition of citizenship and of national sovereignty, via the neo-liberal globalization project, reversing the political gains associated with the period of US hegemony, facilitating an unprecedented conversion of agriculture across the world to supply an affluent global consumer class" (McMichael, 2005b, p. 277). McMichael (2009) is apprehensive that the globalization project emphasizes a capitalistic approach in agriculture, which will wipe out the traditional smallholder farmers, their agroecological knowledge and the local social-ecological systems.

In contrast, Friedmann (2005) calls this same period of time a "corporate-environmental" food regime which she argues will further increase the unequal distribution of food between rich and poor and degrade the environment. Friedmann (2005) accentuates the emergence of class diets in the retail food supply chains. She argues that countries like the US have grocery chains like Whole Foods that focus on marketing strategies based on the "social movements of consumers or environmentalists" (2005, p. 253), like having an organic produce certification on the grocery items, which she finds worrisome and calls "green capitalism" (2005, p. 257). Friedmann (2009) also mentions that grocery chains like Wal-Mart focus on "transnational classes of poor and rich consumers" (p. 252), further deepening the agriculture and food insecurity crisis for the traditional smallholder farmers and the local social-ecological systems.

The dependence on fossil fuels in industrial agriculture causes soil degradation, biodiversity loss, and the emissions of greenhouse gas, compromising the very survival of

humanity, leading to further loss of "cultural and ecological knowledge systems about working with natural cycles by wiping out smallholder diversified farmers" (McMichael, 2009, p. 153). Smallholder farmers practicing traditional agriculture, focus on producing food crops to bring food for the family whereas large scale industrial farmers focus on producing commercial crops to earn money and profit (McMichael, 2009; Weis, 2007). In response to this capitalistic approach of large scale industrial farmers, social movements are "gathering a large number of food sovereignty movements across the world" to unite against these changes and work in favor of smallholder farmers, producers and local agroecosystems (Desmarais, 2007, as cited in McMichael, 2009, p. 141)

As concerns about rising food costs and standardized mass production grow, social movements like food sovereignty, slow food, community-supported agriculture, and small-scale organic producers are gaining traction as they advocate for democracy, ecology, and equality in the food system (McMichael, 2009). These social movements are influenced by alternative social visions and recognize that the ecological challenges of a fossil fuel-dependent food system are potentially contributing to the limitations of a system of monopolies in industrial agriculture (McMichael, 2009). McMichael (2009) explains that the tension between the social movements and the monopolies of industrial agriculture in the third food regime is because, "the corporate food regime embodies a central contradiction between a world agriculture (food from nowhere) and a place-based form of agroecology (food from somewhere)" (p. 147).

In line with Friedmann and McMichael's previous analysis, it is clear that the capitalist mindest has repeatedly selected and molded each food paradigm for the sake of creating control and money. Additionally, there have been multiple social movements that have arisen to resist these hegemonic food systems.

2.1.1 Knowledge Hegemony in Food Systems

Despite ecologically sustainable agriculture being practiced in various parts of the world for thousands of years, the dominant form of agriculture today is the industrial model of agriculture which is based on the Life Sciences Integrated paradigm (Lang & Heasman, 2015). In this subsection I will discuss what knowledge hegemony is, how it works and why it is important to have knowledge paradigms that construct an epistemology based on reality.

Hegemony is defined as the dominant knowledge, ways of thinking, and narratives that are used by those in power to support their agenda (Rosamond, 2023). Throughout the past three food regimes, hegemonic knowledge systems have allowed entities like big corporations to exploit people and their agroecosystems (Friedmann, 2009; Shiva, 2016). Shiva (2016) argued that the dominant knowledge paradigm of industrial agriculture is based on "eco-apartheid" (p. 23) because the soil is considered dead instead of alive and part of a natural cycle. Additionally, the chemicals used in industrial agriculture are a by-product of petrochemicals, initially developed as an adaptation of violent tools which were used during the Second World War to kill people and their environments (Shiva, 2016). One example is that the nitrates used in synthetic fertilizers were produced in the same industries previously constructed for manufacturing explosives in the Second World War (Shiva, 2016). Hence, the dominant food system in the past and even today is a by-product of the post-war chemicals and has previously claimed to be feeding the world. However, the reality of this dominant food system is based on an exploitative agenda of control and dominance by those in power.

McMichael (2009) explained "during the moment of US hegemony, while the ideology was national development, the reality was an internationalization of agribusiness chains of inputs, technologies and foodstuffs, eroding the coherence of national farm sectors" (p. 146).

This was the reason that the second food regime, which was US-centered, shifted national farm lobbies into corporate lobbies, marginalizing the smallholder farmers through the pursuit of industrial agriculture (Friedmann, 2005; McMichael, 2009). While the hegemonic knowledge system of industrial agriculture benefitted corporations, it also led to marginalization of smallholder farmers (Friedmann, 2005) and loss of traditional knowledge (Shiva, 2016).

Outside of the US, traditional knowledge exists in many parts of the world, but has been suppressed by the hegemonic knowledge systems around industrial agriculture causing "knowledge erosion"[2] (Weis T. , 2017), particularly the loss of traditional agroecological knowledge. The outcome of this knowledge hegemony was the rise of transnational peasant movement like, La Via Campesina in 1990s to support smallholder farmer and peasant rights. In many parts of the world the competition to increase crop yields has reduced the ability of communities to be resilient in the face of climate change (Shiva, 2016). New terms like climate-smart agriculture or agribusiness used in the mainstream knowledge discourses today, reflect a reductionist approach to the natural ecosystems. La Via Campesina and Indigenous Food Sovereignty Movement allies are also particularly alert to the possibility of the term "agroecology" being equated with large-scale monoculture approaches to growing organic food (as cited in Isaac et al., 2018, p. 8).

2.1.2 Resurgent Movements

In this subsection I talk about the rising farmer-led resurgent movements that advocate for food sovereignty and farmers' rights in the majority world.

[2] Loss of traditional knowledge

Historically and recently there have been several resurgent movements across the globe to resist the hegemonic policies degrading agroecosystems as well as the farmer's rights in those ecosystems. One major movement is the food sovereignty movement, whose origins can be traced, in part, to the work of the transnational peasant movement, La Vía Campesina, and its efforts in the early 1990s to help marginalized agricultural producers across the globe resist the industrial food system by working to ensure control of food production, distribution, and consumption stays within local communities (Desmarais, 2007). Some examples of food sovereignty movements include Ubuntu in Africa (Mugumbate & Nyanguru, 2013) and Navdanya (a seed-saving movement) run by Vandana Shiva in India (Shiva, 1991).

Local farmer-led resurgent movements are in direct response to the non-existence of the smallholder farmer rights and broad negligence to protect their traditional and local knowledge in the mainstream knowledge paradigm (McMichael, 2009). Corporate-led food system consider smallholder farmers and traditional knowledge, another commodity (McMichael, 2009). That is why this food system raises questions about how farmers' traditional knowledge in agroecology can contribute to a social-ecological resurgence.

2.2 Case Study Context: Brief Agricultural History of Pakistan from 1947-2020

This section will illuminate a brief agricultural history of Pakistan from the historical perspective of food regimes, how knowledge hegemony is visible in Pakistan's case, and how it is shaping the current agricultural practices.

Pakistan is largely an agricultural country with an economy based on crops, livestock, fisheries, forestry and poultry. After gaining independence from the British-ruled Indian-

Subcontinent in 1947, Pakistan's agricultural history has been divided into three major time periods:

1. Early Drought Days (1947-1960)
2. The Green Revolution Era (1960s-1990s)
3. Post-Green Revolution (2000-2020)

2.2.1 Early Drought Days (1947-1960)

After the partition from India in 1947 and before the 1960s, the agricultural sector produced nearly half of Pakistan's gross domestic product (Spielman et al., 2016). Starting in the 1960s, the priorities in the then-newly emerged country were shifted towards industrial mode of development and agriculture leading to greater commercial crop production for export and fewer subsistence crops (Spielman et al., 2016).

In the first two decades after independence, West Pakistan (now Pakistan) was fed by the rich alluvial soils and the vast irrigation system in the northern Indus River basin in Punjab[3], which was the major producer of wheat, whereas East Pakistan (now Bangladesh) produced rice and jute (May & Jarcho, 1961). In the late 1950s the floods in West Pakistan, followed by drought in East Pakistan, caused major food shortages (May & Jarcho, 1961). Additionally, in 1958 Pakistan faced her first military coup which was ordered under the chief martial law administrator General Muhammad Ayub Khan (Oborne, 2015). Ayub Khan signed the Baghdad pact in 1955, with the Central Treaty Organization, giving him centralized power in the decision-making of the country (Bahadur, 1998). As the commander-in-chief of Pakistan's army, Ayub

[3] Much of the literature and evaluation of Sindh province was not part of the earlier research documentation in Pakistan due to the internal ethnic conflicts between the people of Sindh and Punjab province. One major reason was that Sindh was part of the Bombay presidency and much of its literature and research community from Sindh remained on the other side of the border in India.

Khan had shared his plan of military takeover and imposing martial law with the US government during his visit to New York, in October 1954, where he proposed that Pakistan should have a controlled democracy through the support of the US to suppress communism, specifically due to the Russian influence (Bahadur, 1998). Hasan et al. (1997) stated that the signing of the Mutual Defense Agreement in 1954 between the US and Pakistan brought economic assistance worth $500 million, as well as military assistance from the US to Pakistan. This partly influenced Pakistan's increased dependence on grain imports from agri-surplus from new post-war powers like the United States of America.

Part of the reason that Pakistan never developed its agriculture sector to its full capacity, according to industrial agriculture standards, was its dependence on US aid in the first decade after partition from India (Hasan et al., 1997). Furthermore, political stalemates between the military and the political parties led to "The neglect of agricultural development by policy makers, who followed much of the developing world in turning their attention to industrialization" (Spielman et al., 2016, p. 5). Table 2.1 shows various indicators of how agricultural policies were dominated by national and international entities which at first provided aid in the form of post-war surplus food from the US. Then Pakistan started importing grain, followed by signing the high-yielding variety seed agreements with International Rice Research Institute (IRRI) to increase economic development by increasing agricultural output (Spielman et al., 2016).

Table 2. 1: Major events in 20th to 21st century agriculture of Pakistan

Year	Policy
1947	Pakistan gains independence.
1953	Village Aid Program: Pakistan's first rural social protection program is established.

1955-1960	First five year national development plan which includes agricultural plan, is produced.
1958	Water and Power Development Authority is established.
1959-1960	Land reforms are pursued through various ordinances and regulations.
1960	India and Pakistan sign the Indus Waters Treaty.
1959-1970	Basic Democracies system, including district and union councils is established.
1963	Rural works program is introduced.
1964	Pakistan and the International Maize and Wheat Improvement Center (CIMMYT) begin collaboration on high-yielding wheat.
1965-1985	Pakistan Perspective Plan introduces 20 year vision to national development strategy.
1966	Pakistan and the International Rice Research Institute (IRRI) begin collaboration on high-yielding rice.
1970-1990	Green revolution is put into practice to grow wheat and rice.
1971	East Pakistan gains independence to become Bangladesh.
1972	New land reforms are undertaken: People's Work Program and Integrated Rural Development Program are introduced.
1980	National agriculture policy introduced; economic liberalization are pursued in the agriculture sector.
1981	Agriculture Prices Commission (APC) and Pakistan Agriculture and Research Council are established.
1987	National Agricultural Commission, recommending a new strategy for the agricultural development is established.
1991	National Agricultural Policy is introduced; Pakistan Water Apportionment is signed.
2004	Agricultural Perspective and Policy is drafted but not formally adopted.
2008	Prime Minister's Task Force on Food Security is established following global food price shock.

2010	18th Amendment of the national constitution gives the responsibility of agriculture and other key sectors from the federal to the provincial governments.
2010	Massive floods in the Indus River basin.
2011	New framework for economic growth is introduced.
2014	Agriculture and Food Policy is drafted.

2.2.2 The Green Revolution Era (1960s-1990s)

The Rockefeller Foundation funded a research team to survey Mexican agriculture, resulting in the development of the Mexican Agricultural Program (MAP) in 1941, for which they hired Norman Borlaug in 1944 (Patel, 2013). Borlaug developed "miracle wheat"[4] in 1954, which was distributed through the help of the Rockefeller and Ford Foundations across the world during the 1960s behind the rhetoric of ending global hunger and improving agriculture (Patel, 2013). In 1970, Borlaug won the Nobel Peace Prize for developing new rice varieties (Patel, 2013). This whole shift in agriculture was referred as the "Green Revolution" by William S. Gaud in a speech before the Society for International Development in 1968 (Parkash, 2011). While the Green Revolution's purpose was advertised as feeding the world, in practice it aimed to bring seed varieties under the control of the agrichemical, seed corporations and international agricultural research centers (Shiva, 1991). The Green Revolution also served to make the majority of the world dependent on agri-goods from the United States and a free-market trade system which benefited large corporations instead of smallholder farmers and their traditional farming practices (Shiva, 1991).

In Pakistan, Green Revolution practices were introduced in early 1960s right after the first military coup in 1958 (Bahadur, 1998). Speilman (2016) explains, "The Green Revolution began to bring major improvements in agricultural yields, in large part through the rapid

[4] High yielding hybrid wheat variety

introduction of new high-yielding, semi-dwarf wheat varieties that were highly responsive to inorganic fertilizer and irrigation" (p. 9). Pakistan engaged in research collaborations with the International Rice Research Institute (IRRI) in the Philippines for the HYV rice and with the International Maize and Wheat Improvement Center (CIMMYT) for the HYV wheat varieties (Spielman et al., 2016). Pakistan's agricultural policies shifted their focus towards "promoting modern inputs and technology, stabilizing commodity markets with procuring prices and increasing public investment in other critical inputs like irrigation, infrastructure, and agricultural science leading to growth in agricultural productivity" (Spielman et al., 2016, p. 9).

The Green Revolution era in Pakistan is a textbook example of the hegemony and implicit rules of the second food regime as described by Friedmann (1993a), who stated, "Agriculture, while marginal in policy focus, was nonetheless the most state-centered sector on a world scale" (Friedmann, 2009, p.337). Friedmann (2009) quotes McMichael (2004) here and shares that in order to create a new era of free markets to establish the international trade agreements and create World Trade Organization, the development project was shifted to a globalization project by integrating agriculture in international trade agreements.

Friedmann (2009) explained that the majority world borrowed from private banks for the purpose of importing food and oil which was costly and pushed the countries towards larger debts. Furthermore, Friedman (2009) emphasized, "Rather than let the banks take the hit for bad loans, the International Monetary Fund (IMF) negotiated longer payment schedules country by country, and imposed a set of conditionalities under the new rubric of structural adjustment" (p. 338). This made the majority world shift from national agri-food policies (including export management) towards corporate-dominated exports (Friedmann, 2009). An example of this was

increasing pressure to raise non-seasonal fish and processed fruits for export, which further increased Pakistani dependence on the import of grains (Friedmann, 2009).

Hence, the so-called "Green Revolution" provided higher yields in certain crops, but the structural vulnerabilities in the Pakistani agricultural system did not vanish; rather, the average rate of hunger increased. In 1971, Lappé (1971) noted that one in seven people on this planet was going hungry and yet we produced one and a half times the food needed to feed everybody. The Pakistani policies adopted during the Green Revolution led to competition among smallholder farmers and made them focus on growing profitable commercial crops using external inorganic inputs like synthetic fertilizers, pesticides and new varieties of seeds instead of the regular food crops for sustenance (Niazi, 2009). This competition worsened the situation of food insecurity, malnutrition and depleted the local agroecosystems in Pakistan.

2.2.3 Post-Green Revolution (2000-2020)

According to the World Bank (2020) debt report, Pakistan is the largest borrower with an external debt stock of 73 billion dollars at the end of 2018. Pakistan has produced more food crops than its population's actual consumption, yet most of the marginalized and vulnerable populations struggle to afford a sufficiently nutritious diet (United States Agency for International Development, 2020). It is very important to note here that Pakistan is the 5th largest population in the world (United States Census Beureau, 2021). At present, at least 20.5 percent of the Pakistani population are malnourished and about 44 percent of children under the age of five are stunted (World Food Programme Pakistan, 2023).

Friedmann (2009) has argued that industrial agriculture and the Green Revolution were tools developed by countries like the United States of America to control the majority world. As discussed above, one of the reasons of rising food insecurity in Pakistan was that despite of

increasing yields on farms after the Green Revolution, the farmers were indebted to large seed, pesticide and fertilizer companies. This increased debt then caused inflation and made the whole country dependent on taking loans from IMF and the World Bank. These loans from IMF and the World Bank then multiplied every year due to the interest and allowed these organizations to impose their own rules and regulations in every sector including the agriculture sector.

2.3 Setting the Terms

The existing literature on food systems through the lens of food regimes and agricultural policies in Pakistan explains that in order to achieve an equitable and a sustainable food system, it is necessary to redirect the food system towards the Ecologically Integrated paradigm described by Lang and Heasman (2015). The following sections will explore the various aspects of the Ecologically Integrated paradigm.

2.3.1 Social-Ecological Systems

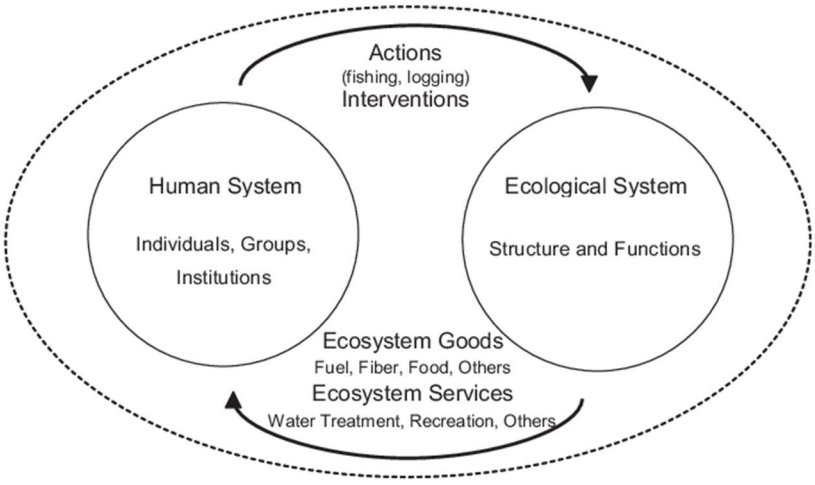

Figure 2. 1: Conceptual diagram of Social-Ecological Systems

Source: (Resilience Alliance, 2007)

Berkes et al. (2003) argues that environmental problems are embedded in the interactions between complex natural and social systems (p. 2). Berkes and Folke (1998) described social-ecological systems as a theory that examines the relationship of humans within nature, with nature being connected with social systems. A social-ecological system can be envisioned as shown in Figure 2.1.

In this research I have use the concept of social-ecological systems to further illustrate the concept of agroecology and traditional farmer's knowledge. I adopt social-ecological systems in the context of Lang and Heasman's (2015) Ecologically Integrated paradigm as the future of a sustainable food system. The Ecologically Integrated paradigm assumes that we can only understand the complex nature of human systems with ecological systems when we consider humans and their social and cultural adaptabilities as an integral part of the ecosystems they live in. This means that a local farmers' traditional knowledge should be integrated into the agricultural policies and popular knowledge discourses to counter-act the hegemonic knowledge systems imposed through capitalism (Friedmann, 2009).

2.3.2 Resurgence

In this research I used the word resurgence to emphasize traditional agroecological knowledge that is contributing to building the capacity of smallholder farmers to survive into the future. The word resurgence stands for "an increase or revival after a period of little activity, popularity or occurrence" (Oxford University Press, n.d.).

However, it is to be noted here that resilience is a step towards resurgence, I used the term resurgence, instead of resilience, since resurgence is more about a social change, whereas resilience is the capacity to face adverse changes in any system as they arise. I use the word resurgence because instead of facing the adverse issues in an ecosystem, the smallholder farmers

are facing the big agribusiness corporations who have totally ignored the necessity of integrating traditional and scientific knowledges in their popular hegemonic knowledge discourse (Friedmann, 2005; McMichael, 2009). While doing this research in Sindhi language, interviewing elders and preserving the words and names of plants in Sindhi language, I tried my best to honor my Indigenous Sindhi roots. As Corntassel (2012) states, "the daily acts of renewel through prayer, speaking your language, honoring your ancestors and etc., are the foundations of resurgence" (p. 89).

2.3.3 Agroecology

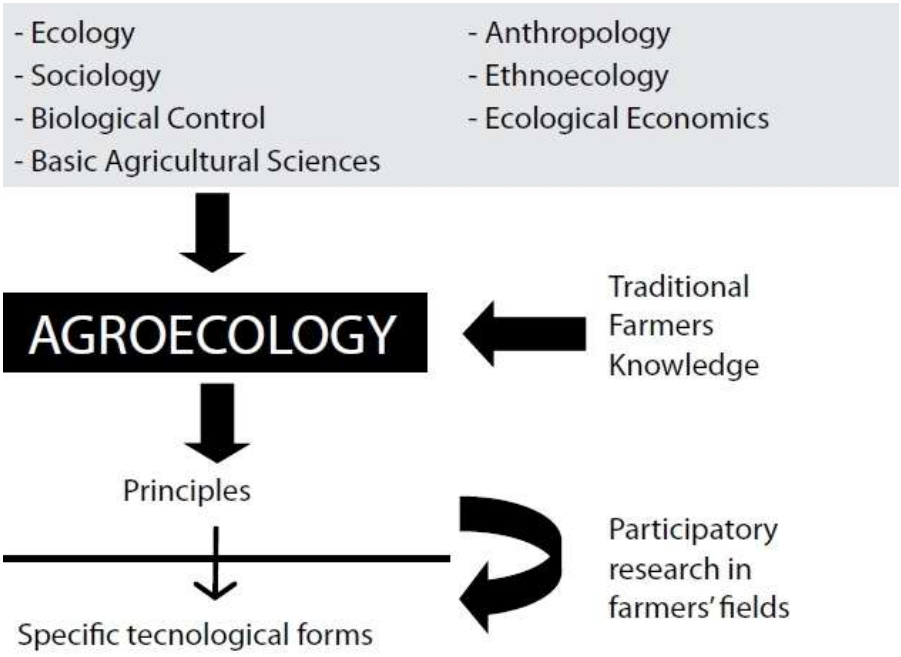

Figure 2. 2: The Principles of Agroecology

Source: (Rosset & Altieri, 2017)

The term agroecology has evolved through time depending upon who is using it; for example, the definition of agroecology for a traditional smallholder farmer may be different than that for a big corporation (Rosset & Altieri, 2017). Rosset & Altieri (2017) argue that "agroecology combines Indigenous knowledge systems about soils and plants with disciplines from modern ecological and agricultural science" (p. 9). They further elaborate that "the true roots of agroecology lie in the ecological rationale of Indigenous and peasant agriculture still prevalent in many parts of the developing world" (Rosset & Altieri, 2017, p. 8).

As illustrated in Figure 2.2, the principles of agroecology involve farmers' traditional knowledge and a mixture of scientific fields including anthropology, biology, basic agricultural sciences, ecology, ethnoecology, ecological economics and sociology. The integration diverse scientific studies as well as farmers' traditional knowledge built through participatory research and action form the field of agroecology.

In the majority world, agroecology is often misrepresented as a new version of the Green Revolution and promotes a proliferation of genetically modified technologies (Warner, 2008), similar to what Friedmann (2005) calls "green capitalism". This green capitalist version of agroecology has historically "privileged the role of scientists at the expense of poor farmers and their Indigenous knowledge" (Warner, 2008, p. 757). Researchers have argued that agroecology can only be favorable if it includes knowledge systems of both scientists and traditional farmers, as without the inclusion of traditional farmers it is an incomplete discourse (Warner, 2008).

Thus, agroecology is a combination of farmers' traditional knowledge and scientific knowledge to create resilient and sustainable agriculture. In practice, it enhances biodiversity and regenerates the ecosystem while also producing more agricultural output in a sustainable way. Agroecology as a knowledge paradigm may address the problem of food insecurity by locally

producing rich nutritious food following ecologically sustainable practices developed through centuries-old practices of local farmers and adoption of new technologies in a sustainable way.

2.3.4 Farmers' Traditional Knowledge

It is useful to understand traditional knowledge transmission in agroecological studies as it elaborates the parallel social-ecological process happening in an agroecosystem (Alzate et al., 2019, p. 347). Some scholars use the term Indigenous knowledge instead of the word traditional as traditional knowledge is derived from the 19th century word simple and steady (Berkes et al., 2000). Some authors use the terms Indigenous knowledge, local knowledge, and traditional knowledge interchangeably (Alzate et al., 2019). Berkes et al., (2000) describes that the word traditional is derived from "practice", "in short, traditional knowledge is a knowledge-practice-belief complex" (p. 1252). The purpose of this research was to explore social-ecological resurgence through the integrated approach of Indigenous and experiential knowledge built on different interactions with technology and personal experiences of the farmers. Therefore, this study uses the term traditional knowledge.

2.4 Socio-Ecological Systems Approach to Study Resurgence through Traditional Knowledge & Agroecology

Alzate et al. (2019) stated "agroecology can be viewed as a whole-systems approach to agriculture and food system development involving traditional knowledge" (p. 2). In this section I discuss the relation between social-ecological systems, traditional farmer knowledge and how these interactions contribute to creating social-ecological resurgence and form the field of agroecology.

Alzate et al. (2019) emphasizes that the combination of knowledge systems can enhance resilience of social-ecological systems (p. 340). Alzate et al. (2019) also quotes Bohensky and

Maru (2011) who highlight that social-ecological resilience is dependent on several things including adaptive learning which necessitates the need to maintain "the web of relationships of people and places" (p. 340). Berkes et al. (1995) states that "both knowledge and institutions require mechanisms for cultural internalization so that learning can be encoded and remembered by the social group" (p. 1256). Not just the fact that the traditional knowledge should be embedded in the institutions, culture and the governance of a society, but it should include the debates and decision-making of the communities that are involved in that knowledge system and the ecosystem. Therefore, "in this way traditional knowledge and shared systems of beliefs may facilitate collective responses to crises and may contribute to the long term maintenance of resilience in social-ecological systems" (Gomez-Baggethun et al., 2012; as cited by Alzate et al., 2019, p. 340)

Alzate et al. (2019) mentions that "because of its connection with environmental sustainability and social improvements, there is a tendency of analyzing, systemizing, and incorporating traditional knowledge into environmental decision making processes" (p. 340). Scholars have talked about the ways to use traditional knowledge, for example, Alzate et al. (2019) notes,

> "This usually happens in two directions: the 'top-down' approach, which includes methods based on the recognition of traditional knowledge by institutions of authority that leads to the development of rules for the use of this knowledge. The other direction is 'bottom-up' where the capacity of aboriginal people to bring traditional knowledge to influence policies, procedures of governance, and changes in regulation is recognized" (p. 340).

My focus is to explore how and where the bottom-up approach can be used.

However, resilience through traditional knowledge and local farming practices alone is not enough. In some local areas of South Asia farmers have realized that industrial agriculture is unsustainable as it destroys the local ecosystems, decreases biodiversity and causes soil erosion. That is why several non-governmental organizations and states are working towards resurgence (Lachlan et al., 2017). There is a growing sense of resurgent practices that are both traditional, and yet evolving through practice-belief-complex (Berkes, et al., 2000). This sense of resurgence is visible in countries like India where islands of success through resurgent practices could be visibly seen (Lachlan et al., 2017). Taking inspiration from neighboring countries through social media, farmers in Pakistan have also started to work on resurgence movements in agriculture. As compared to resilience the difference in a resurgence is that the farmers are not just resilient, but they are also aware of their rights. In other words resilience is a step towards resurgence. This means that their connection to their agroecosystem is organic and cannot be misused by any agribusiness corporation.

2.5 Traditional Knowledge Dynamics

Traditional knowledge is based on observations and adaptations to one's social-ecological system over centuries or more (Berkes et al., 2000). Berkes et al. (2000) explains, "Traditional knowledge, as a way of knowing, is similar to western science in that it is based on an accumulation of observations, but it is different in some fundamental ways" (p. 1251). Berkes et al. (2000) continues, "the philosopher Paul Feyerabend (1987) distinguished between two different traditions of thought: abstract traditions (to which scientific ecology belongs) and historical traditions, which include systems of knowledge possessed by people outside western science, knowledge that often becomes encoded in rituals and in the cultural practices of

everyday life" (p. 1251). According to Paul and Berkes the traditional knowledge dynamics are based on cultural and historical practices in a specific region.

2.5.1 Topics to study in Traditional Knowledge and Agroecological Studies

In this subsection, I will discuss what topics are specifically researched during a study on farmers' traditional knowledge and agroecological studies. It is important to have the context of the topics which are necessary to be studies when understanding farmers' traditional knowledge. Rosset and Altieri (2017) explain, "Traditional farming systems have emerged over centuries of cultural and biological co-evolution and represent the accumulated experiences of peasants interacting with the environment without access to external inputs, capital and so-called scientific knowledge" (p. 10). This knowledge is not just based on experiments but also experiential learning (Rosset & Altieri, 2017).

The basic question while doing research on farmers' traditional knowledge is to identify what topic to include in the study. Alzate et al. (2019) noted that their analysis of several research studies on farmers' traditional knowledge found that most scholars covered "farmer's methods of production, crop combinations and soil fertility" (p. 345). The other things the studies shed light on are "soil management, farmers' adaptive practices for cropping systems, perception of farmers about climate variability, collective water management and disease and pest management, etc." (Alzate et al., 2019, p. 345). In this section, I try to include the previous studies which touch on what topics to be included in a study focusing on farmers' traditional knowledge.

Apart from the other topics, gender has been underrepresented in male farmers' narratives and interviews. It is important to note here that Alzate et al. (2019) mentioned that gender has been reported in some studies that they analyzed, but there is no clarity why gender

aspect is not emphasized in most of the studies. For example, whenever the researchers do study on farmers' traditional knowledge they miss the aspect gender-based roles in the farmers' traditional knowledge system. In a study by Singh and Sureja (2008), male farmers specifically talked about the male farmers their roles and challenges. Yet, overall gender was not considered as a key element in their wisdom sharing. This has also been reported by Alzate et al. (2019) in his review of several research studies on farmers' traditional knowledge, this concludes that more research is needed in understanding the importance of gender, specifically the feminine perspective and roles in farmers' traditional knowledge and agroecology. Hence, it makes gender an important topic of study in farmers' traditional knowledge and agroecology.

Based on Rosset and Altieri (2017), "Agroecological systems are designed with an emphasis on the adaptation and application of the principles in accordance with local realities" (p. 23). Rosset and Altieri (2017) give an example that soil fertility can be improved based on location; in some places it can be done through worm composting, whereas in other places through planting green manure. Hence, the choice of practice depends on the local available resources in the area. Various techniques are used by farmers to manage soil in different agroecosystems. Among them, the most commonly used features in South Asia are polyculture. Polyculture refers to the planting of different species in one patch of land to balance soil nutrient cycles and livestock integration to enhance soil fertility (Rosset & Altieri, 2017). These features of soil management are also visible in the coastal region of Sindh, Pakistan where mango and other fruit trees are planted on the borders of fields to save the field from heavy winds and storms. Rosset and Altieri (2017) argue that "in polyculture systems, plant species are grown in close proximity so that beneficial interactions occur between them, thus offering a number of ecosystem services to farmers" (p. 12). Additional benefits of polyculture can include, "higher

species richness [which] improves soil organic matter, soil structure, water retention capacity and soil cover, protecting soils from erosion and suppressing weeds, all favorable conditions for crop production" (Rosset & Altieri, 2017, p. 12).

Soil erosion is a major issue and is predicted to worsen if current agricultural practices do not integrate the agroecological knowledge of farming systems. Weis (2017) states that soil degradation has repeatedly played a significant part in the history of civilizations, although unfolding too gradually to be appreciated. What is new is that this soil erosion is comprehensively understood and has sped up to an extent that some researchers place this among the most worrisome of all global environmental problems (Shiva, 2008; Weis, 2017).

2.5.2 Traditional Knowledge Sharing and Gender

I realized this important aspect during my study when I noticed the tremendous role of women in farming went untouched by the male farmers who gave interview for this research. It was a huge realization that I being woman doing this research on the preservation of traditional knowledge has a co-relation to how women and gender-specific perceptions are different. Therefore gender-specific perceptions are necessary to be part of food system study to explore the gender-specific gaps in the studies on traditional knowledge sharing and the food and agriculture work. According to Shiva (2010), in some parts of the world, traditional knowledge sharing and knowledge transfer from generation to generation is mainly a gender-based phenomenon. Women are at the heart of the efforts to preserve and transfer this knowledge. Shiva (2016) suggests, "The knowledge that governs women's food is non-mechanistic non-reductionist, and deeply rooted in the principles of agroecology" (p. 112). Some scholars argue that "modern western science has its epistemological origins in colonialism, capitalism and patriarchy and that it is intimately related to both the epistemological and physical forms of

violence that these have engendered throughout modern history" (Merchant 1981; as cited by Rosset & Altieri, 2017, p. 58). In light of this matter, Portman (2020) notes that women face gender-specific limitations in food and agriculture work.

According to Weltzien et al. (2020) there are gender-specific responsibilities which generate gendered knowledge. For example, in their study they found that women and men reported differently on what crop traits to pick and the purpose of picking the specific traits. Women mainly chose the crops through the aspect of their food use and post-harvest perks whereas men chose the higher yield and commercial traits of the crops (Weltzien et al., 2020). This specific aspect shows the importance of gender integration in traditional knowledge sharing and preservation.

Lately, scholars have observed that women farmers are usually the hidden as well as prominent heroes of the agroecological transformation (Rosset & Altieri, 2017; Morales, 2021; Shiva, 2016). One more important factor discussed by Rosset and Altieri (2017) is that despite being underrepresented as compared with male leaders, the role of women in social movements is huge and sometimes unseen. However, when one looks deep into the agroecological transformation, it is usually women who take the lead to stop a farmer household from using hazardous pesticides, and to produce healthy nutritious food for their families. One key reason is that the women suffer from hunger, malnutrition, and disease due to an inequitable distribution of power at household level (Patel, 2012; as cited in Portman, 2020). This inequitable distribution of power drives women to specifically express the marginalized aspects in their views.

Shiva (2016) argues that "industrial agriculture is rooted in a patriarchal scientific paradigm that privileges violence, fragmentation, and mechanistic thought" (p. 113). In contrast,

agroecology diversifies the responsibilities of family members on the farm, contributing diversification of income of farmers and their families (Rosset and Altieri, 2017). As compared to a regular monoculture farm, opportunities on farms that follow agroecological practices inspire the entire extended farmer family, and each family member gains important decision-making authority in specific areas (Rosset & Altieri, 2017, p. 60). This collective action reduces patriarchal power dynamics within the family (Rosset & Altieri, 2017).

Women were the world's original food producers and continue to be central to food production systems in the majority world (Shiva, 2010). Therefore, involving feminine perspectives in traditional knowledge sharing is important for preserving an agroecosystem. It is also essential to incorporate the field of Ecofeminism into agroecology to highlight the role of gender in preserving traditional knowledge and balancing social-ecological systems (Portman, 2020).

2.6 Conclusion

Farmers' traditional knowledge is essential to agroecology and social-ecological systems. These frameworks and discourses reveal issues in the food system and point towards alternative solutions. The basic understanding that humans are an integral part of the natural world, interwoven with the environment, rather than separate from it, is necessary for comprehending the complex relationships that rule our existence.

Additionally, since humans are an integral part of the ecosystems they belong to, they should be adapted to their ecosystems. Therefore, farmers' traditional knowledge can be called as the "pivot of harmony" and the alternative solution in the face of capitalism which is the "pivot of hegemony" and "implicit rules" as argued by Friedmann (1993a, 2009). I choose the phrase "pivot of harmony" because when we include local farmers' traditional knowledge, it

balances the social-ecological system. This gives a reason why farmers' traditional knowledge, which is a "practice-belief-complex" (Berkes et al., 2000), also the foundation of agroecological wisdom, often passed on from generations, serves a pivotal role in the balance between the local communities and their local agroecosystems, around the world. This knowledge system develops the family as a single unit that contributes to equality and equity, where the role of women as participants and knowledge keepers is not overshadowed by patriarchy and strengthens the unity among communities. For example, agroecology involves local communities that depend on each other for the production and harvesting of crops by helping each other for on-farm activities. This approach to food systems provides a way to work towards food security and food sovereignty in local agroecosystems, through less resource intensive and sustainable agricultural practices. The synergy between traditional knowledge and agroecological principles bolsters the resilience of social-ecological systems, contributing to the resilience from the disturbances in the global food supply chains, such as the COVID-19 pandemic and the war on Ukraine. Perhaps, this necessitates the urge to work towards the preservation and integration of traditional knowledge in the face of the capitalist food system today, and brings me back to my research question of how farmers' traditional knowledge in agroecology can contribute to social-ecological resurgence in Pakistan?

Chapter 3: Research Methodology

There are seven subsections in this chapter. In the first subsection, I share my positionality, including my role as a researcher and my position as an insider within the communities I studied. The second section digs into the theoretical and methodological approach of my research. In section three, the methods used for data collection and the sampling techniques utilized are discussed. The fourth section explains the geographical area under study. In the fifth section, I describe the process of conducting interviews with farmers, including the interview settings. The sixth section presents the backgrounds of the farmers. The final section addresses the ethical considerations that informed my research process.

3.1 Positionality

Figure 3. 1: Batool (center) with Khudabakhsh's granddaughters.

Picture Courtesy: Munaza Saeed

My acknowledgment of my positionality as a researcher and as a Sindhi woman is necessary. Since I was both an insider and an outsider within the communities I interviewed. My insider perspective provided me with unique insights and connections to the participants of my study because I knew the cultural context and the farming backgrounds of the participants before conducting this research. This understanding of the cultural context being an insider in the community was valuable in interpreting the findings. On the other hand, not being a farmer helped me to articulate the findings through the perspective of an outsider. This unique positionality brings the outcomes of the study through two diverse lenses.

It is important to mention here that, since I studied in Canada and belong to the same community, the farmers felt a sense of pride to share their knowledge with me. They also treated me as a child they had seen growing up and studying abroad allowed them to trust me more. One significant advantage of the study abroad aspect was the perception that a person educated abroad is more intelligent and devoted to their farming values, and less likely to misuse their knowledge for other reasons. Additionally, the farmers do not trust individuals who are non-Sindhi or those associated with public universities in Pakistan. The lack of trust on Pakistani universities and non-Sindhis stems from years of marginalization of the Sindhi community within their own province. In conclusion, trust-building through various factors converging, including my belonging to the community, studying abroad, and acknowledging the farmers (which is quite rare).

Besides straddling the roles of an insider and an outsider within the community, I also had to uphold research integrity by navigating between two distinct worldviews: Western Academia and Sindhi Wisdom. Therefore, it is crucial to recognize and address any potential biases or preconceptions that may arise from this unique positionality to maintain research

integrity. I did not have the opportunity to fully verify the translations of the interviews with another native Sindhi speaker, who is also professional English translator. It is important to note this, as my research integrity relied solely on my translation skills. Despite being a professional translator myself, obtaining another perspective in translating the interviews would have been valuable. This was impossible in a two year master's program with limited time and monetary resources. Another potential bias could stem from my familiarity with unique cultural elements that may not have been adequately explained in the research as they are so deeply embedded in me. Since, the study was based in Pakistan, my supervisor and committee members had to rely on my sources for their evaluation, given their limited exposure to the community, culture and language in which I conducted my research.

My gender also plays a key role in my understanding and interest towards preserving traditional knowledge. Meanwhile my gender and age allowed me this great position to get the liberty to interview the subjects of my study from my own community. Since, I am young girl who the subjects of my study, from my village saw growing through the time, their trust towards me helped to conduct this research more freely and clearly as compared to an outsider. If an outsider person would have approached the farmers from my village they would have rejected the person because of lack of trust. My background of coming from the same village and my being an educated woman allowed me to interview the farmers, however, any outsider educated woman would also not have the liberty to request the farmers for an interview. One key reason, the outsider woman researcher might not have that much access to the farmers of my village is because the farmers are shy and reluctant to give interview specifically to a woman due to the cultural and religious barriers. This was also a reason, I could not interview more female farmers or the wives of the farmers I interviewed. Since, it is usually frowned upon to allow a woman to

give an interview that would be shared elsewhere. I assume much of this perception comes from the cultural and religious barriers of the communities and their lack of education and exposure to the outer world.

Overall, I position myself as a middle-class, brown, Sindhi speaking Pakistani. I come from the same village of Deenar Khan Talpur in Badin district, where I conducted this research. I am both an insider and an outsider in this research because I belong to the same community. It was an opportunity to do research in my own community as I understood the participants' worldviews, which would have been more challenging to understand for an outsider.

3.2 Theoretical and Methodological Approach

Qualitative research begins with naming assumptions and the use of the interpretive, or theoretical, frameworks that inform the study of research (Creswell & Poth, 2018). I used a qualitative approach looking into human behavior, perspectives and historic changes. The reason to choose the qualitative approach to answer my research question was because I wanted to explore the narratives of the subjects of my study. The central question that navigated me through my research goal was, how can farmers' traditional knowledge in agroecology contribute to social-ecological resurgence? In this research, the participants' stories and views on agricultural practices were the primary data used for the research analysis.

My research followed a narrative approach (Creswell and Poth, 2018) as the focus of this research was to explore personal experiences and stories and "narrative stories tell of individual experiences, and they may shed light on the identities of individuals and how they see themselves." (Creswell & Poth, 2018, p. 148). Furthermore, "the focus of narrative inquiry is not only valorizing individuals' experience but is also an exploration of the social, cultural, familial, linguistic, and institutional narratives within which individual's experiences were, and are,

constituted, shaped, expressed and enacted" (Clandinin, 2013, p. 18; as cited by Creswell & Poth, 2018, p. 148). In this research a second-order narrative approach was used as it is a biographical depiction of a participant. Creswell and Poth (2018) describe the second order narrative as a narrative describing life experiences about other people or a particular experience of an individual and the story about that experience.

For this research, a social constructivist interpretive framework was used. Creswell and Poth (2018) describe social constructivism:

> In social constructivism, researchers seek understanding of the world in which they live and work. It is helpful to develop subjective meanings of participant experiences—meanings directed toward certain objects or things. These meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrow the meanings into a few categories or ideas. In other words, they are not simply imprinted on individuals but are formed through interaction with others (hence social construction) and through historical and cultural norms that operate in individuals' lives (p. 77).

Given the importance of relationships and historical context in social constructivism, I chose this interpretive framework because I was exploring and preserving the participants' views about agriculture and the traditional practices that they apply in the region, which were shared with them by their ancestors and the practices that they learned through their personal experiences. In collecting this data, I also drew upon articles on the history of agriculture in Pakistan and the global context of food regimes.

This study focused on farmers' traditional knowledge in agroecology and this was the topic that participants reflected on while describing their life stories.

3.3 Data Collection and Sampling

In this research, I employed a purposeful convenient sampling method to collect data. Purposeful sampling in qualitative research involves three key considerations, including the selection of participants (or sites), the specific sampling strategy, and the sample size (Creswell & Poth, 2018). Participation-based research can provide additional possibilities for agroecology where it can assume a cultural and political dimension. Specifically, it allows the co-production of new cross-cultural knowledge, and this is a basic aspect of the agroecological approach due to its interdisciplinary nature (Ceuller-Pedilla & Calle-Collado, 2011).

I conducted in-depth interviews with five smallholder farmers. The decision to focus on smallholder farmers was informed by the fact that the majority of land in the Badin district, where my research was conducted, is owned by smallholder farmers (Magsi and Shaikh, 2017). The choice of interviewing five farmers stemmed from practical considerations. The Deenar Khan Talpur village's population consists of a few hundred individuals. From this population, only a limited number of farmers were willing to participate in the interviews across the three distinct communities; Khaskhelis, Talpurs and Jats. Therefore, at the start, I opted to select one farmer from each of these communities. The use of in-depth interviews as a data collection technique was deliberate to allow for rich conversations to take place over longer periods of time.

Among the selected participants, three participants were active residents of Deenar Khan Talpur village, located within the Bhugra Memon union council in the Badin district of Sindh province, Pakistan. However two interviewees from the Jat tribe, Akhtar Jat and Abdullah Jat,

shifted to other part of the district but previously their families used to live in the same village. Part of the reason the Jat tribe moves is their community is a nomadic community and in past they used to move from one place to another for grazing their camels.

During the interviews, I employed semi-structured questions, which can be found in Appendix A. To increase diversity in age and gender, I made the decision to conduct two additional interviews. One of these interviews involved a young male farmer, Akhtar Jat, who resided outside of my village, while the other interviewee was a female farmer named Mariam Zubair who belongs to the Khaskheli community of Deenar Khan Talpur. The interviews were recorded using a mobile phone. The interviews were conducted at the participants' homes or in the village community hall, with each participant interviewed separately. The interview of Mariam Zubair was conducted virtually. During the interviews, I inquired about the farmers' life journeys in agriculture, encompassing traditional farming practices such as oxen-based soil plowing, organic manure for soil fertility management, pest control techniques, and seed preservation methods that continue to be practiced in the region (Rosset & Altieri, 2017).

The sample selected for this study represents a purposeful convenient sample. This approach was chosen due to the value of collecting data from a community with which I have a personal connection (Creswell & Poth, 2018). It facilitated the selection of participants who were suitable for this research and willing to share their experiences (Sandelowski, 1995). I previously knew all the participants I selected for the interviews. Having grown up in the same ecosystem and community, I shared a common background with them. This shared perspective allowed me to better navigate their knowledge background and build rapport, as I had witnessed these participants practicing traditional agriculture throughout my life.

Furthermore, the choice of my native village, Deenar Khan Talpur, was driven by practical considerations. It allowed for cost-effective data collection, as I could stay at my grandmother's house without incurring accommodation expenses. Additionally, my deep-rooted connection to the community facilitated a more profound understanding of my research question compared to an outsider researcher or a community outside my familiar circle (Hennink et al., 2011).

Although the research is being written in the English language, the interviews were conducted in Sindhi language and notes were recorded in both languages. All interviewes were transcribed in Sindhi, then translated into English by myself withou the use of any translation software. I tried my level best to keep the language style intact in my translations. The coding and analysis was performed in English, using NVivo, however, later on, I chose to select the relevant themes and analysed the data according to the themes that I found relevant to my subjects of study.

3.4 Research Area

In this section I talk about the geographical context of the research, specifically focusing on the coastal zone of Badin district in Sindh province, Pakistan.

3.4.1 Badin District Profile

The coastal zone of Sindh province, spanning Badin, Sujawal, and Thatta districts, stretches approximately 350 km, encompassing the vital Indus Delta, a dominant ecological feature that blankets eighty five percent of Sindh's coastline (Majeed et al., 2010). Situated in southern Pakistan (see figure 1.1), the district boasts two distinct economic zones: a solely agricultural northern section and a mixed area with both fishing and agrarian communities in the

south (Government of Sindh, 2014). This research took place in the southeastern part of Badin district.

The district of Badin has previously been prone to natural disasters which drive its communities to practice adaptation and resilience in their daily lives. From rebuilding homes after a cyclone, to relocating during floods and surviving during droughts, the communities of Badin are famous for their resilience. Furthermore, the region of Badin was historically famous for its Indigenous rice varieties which produced the largest yields while practicing purely traditional agriculture.

The inception of substantial foreign aid occurred in the aftermath of the major cyclone that struck Badin district in 1967. This external assistance, referred to locally as *imdad* (signifying immediate aid), marked a turning point. Previously, the populace had been largely self-reliant, drawing sustenance solely from the region's unique ecological traits and adaptive practices. However, the post-cyclone era ushered in a new generation reliant on external assistance.

The 1970s also witnessed changes in the irrigation methods on farms as more irrigation canals were developed as part of the newly emerged country's development programs. This expansion reduced the dependence on local wells for water resources. Additionally, the reliance on wild herbs and staple wild grains was also slowly converted towards newly introduced agricultural packages where farmers were provided large monetary subsidies which made them affluent for a short time.

In Badin region most of the people were already smallholder farmers before the 1970s, therefore, not much of the land reforms impacted this region. Five distinct tribes including

Talpurs, Khaskhelis, Mallahs, Koris and Lohars reside in the village of Deenar Khan Talpur. I come from the Lohar tribe, who were originally blacksmiths and gradually moved to different occupations. The Jat tribe which once used to live in the village, have moved to another place in the district of Badin. Three tribes consisting of some clans of Talpurs, Khaskhelis and Jats are still practising smallholder farmers.

Badin's population is also largely dependent on hunting migratory-birds such as ducks, cranes, flamingoes, and pelicans for food. Two communities Gajani clan and the Mohana clan of the Mallah tribe were totally dependent on birds and fishing through out the year. Up until the 1990s, the Gajani's bartered the hunted birds for getting rice grains and the Mohanas sold fish for survival. Both of these communities today are stranded in sub-urban settlements and terribly food insecure, living far below the poverty line; Gajanis because of over-hunting and Mohanas because of overfishing. In addition, natural disasters pushed some of the families from these communities to do inland migration and work as laborers in factories in large urban settlements.

Prior to the 1970s, there was a strong sense of community in Badin district and there was an inter-dependence among communities. Despite the significant population displacement that occurred during the partition of Pakistan, a considerable number of communities in this area remained Indigenous and unaffected by external immigration. However, external aid and agricultural subsidies gradually transformed the landscape. Badin, once recognized as the leading rice-producing district, now has a marginalized farming population and widespread land degradation.

While various factors have contributed to this land degradation, including sea intrusion and reduced water flow from the Indus River from dam construction, the consensus among most

farmers is that the shift away from traditional practices catalyzed many changes within the land and the community.

3.4.2 Sindhi Worldviews

Sindhi worldviews are unique compared to Western worldviews. In a Sindhi household, a tree, a cow, and the mud thatch house itself are all considered as family members. The cow dung is valued equally to cow's milk. Agricultural waste, such as threshed rice grass, remaing crops and food leftovers, becomes fodder for livestock. Therefore, from cow's milk to dung, agriculture waste, and crop output, nothing is considered foreign or separate. This balanced circle of social-ecological system propels the communities towards the collective goal of living in harmoney with the ecosystem. While Sindhi communities are connected to their folklore and language, the connection with the land has been interrupted and disintegrated after years of British colonisation, industrialization and the indepedence of Pakistan in 1947. All these factors contribute to farmers' perceptions regarding their choice of farming, their willingness to participate in an interview from within the community and their reluctance to share farming knowledge with someone outside of their local communties.

3.5 Interview Setting

Normally, an informal narrative interview lasts between an hour and 90 minutes. In this research, I prioritized the convenience of the participants over the time limits. A majority of the participants engaged in the interview for 1-2 hours. This way, I got more time to learn about the farm activities and the farmers' perspectives. I tried to revise my notes and seek in-depth answers in the same day however for some answers I followed up on the farmers on a second visit. Some of the answers were further elaborated by the farmers on a follow-up phone call.

An interview guide consisting of semi-structured, open-ended questions about farm knowledge was used (see Appendix A). The questions included inquiry about their experience of soil management, pest management and seed saving for the next season that builds on research by Rosset and Alteiri (2017). Questions regarding changes in their perspectives and experiences of farming, along with the opportunities for and perspectives about a social resurgence, were also asked.

3.6 Farmer Profiles

It is essential to share the backgrounds, approaches to farming and underlying perspectives of each farmer before writing the key findings from the narratives shared by the farmers.

Figure 3. 2: Batool interviewing Khudabakhsh in his house.

Picture Courtesy: Munaza Saeed

Khudabakhsh Khaskheli is an 80 year-old farmer who has been engaged in farming since 1956 (see Figure 3.2). He belongs to the Khaskheli community of Deenar Khan Talpur

village. He reflected on a time when life was simpler and characterized by hardship, but also by abundance, respect, inner peace, and healing. He talks about traditional farming practices that were in harmony with nature and relied on the strength of bulls for plowing. He recalls the days when there were no pests or crop diseases, and the cycle of farming followed the positions of the stars.

Khudabakhsh emphasizes the importance of self-sufficiency and living off the land. He highlights the use of natural resources such as handmade *ghee* (clarified butter) from milk, boiled rice, and water-cooked food. His family's livelihood depends on the produce from their own fields, and they rarely need to purchase flour or rice from shops even today. He reflects on the changes brought by the introduction of tractors, pesticides, and synthetic fertilizers. He believes that these developments have disrupted the balance of nature, increased expenses for farmers, and resulted in indebtedness. Khudabakhsh remains committed to traditional farming methods and abstains from taking loans while relying on the blessings of nature to fulfill their needs.

Despite the challenges faced by the farming community, Khudabakhsh maintains a deep faith in God and expresses gratitude for the sustenance provided. He shares his concerns about the lack of water due to sea intrusion and its negative impact on both India and Pakistan. He advocates for a return to a simpler way of life, free from greed and focused on sustainable agriculture that respects the environment.

Khudabakhsh's story provided an important reminder of the changes that have occurred in farming practices and the importance of preserving traditional knowledge.

Figure 3. 3: Manzoor Talpur (Left) with my uncle in village community hall.

Source: Batool Fatima

Manzoor Talpur is 57 years old and comes from a family of farmers from Talpur community (see Figure 3.3). He was inspired by his parents and ancestors who believed that farming brings inner peace and mindfulness. Manzoor continues this tradition and finds fulfillment in cultivating the land and producing crops.

Manzoor's farming serves both commercial and domestic purposes. He allocates half of his farm output for household food consumption and sells the remaining produce in the market to repay the loans taken for purchasing fertilizers, pesticides, and seeds. The profitability of his farming endeavors varies, as he sometimes experiences profits, sometimes he breaks even, and

other times he faces loss due to unpredictable factors including weather conditions like heavy rainfalls or extreme droughts.

One of the significant challenges faced by Manzoor is the rising costs of resources involved in farming, particularly due to the use of tractors that require fuel (diesel or petrol). The increasing costs of fuel affect all aspects of farming, from plowing the land to running irrigation systems. Additionally, water scarcity is a persistent issue, as irrigation canals are often empty, making water availability unpredictable.

Although Manzoor acknowledges the financial burden of using tractors compared to traditional methods involving bulls, he prefers tractors due to the time and labor savings they offer. Tractors allow him to prepare the land quickly, enabling him to grow two or three crops in a year, compared to the slower pace of using bulls. However, the adoption of tractors has also increased dependence on external inputs and the associated costs. He still prefers tractors and intensive agricultural methods for commercial crops. He uses traditional farming methods for the food crops that he solely produces for his family. For example, he mentioned that he used camel dung to retain soil fertility and used native rice seeds for the family's consumption.

Manzoor has adopted new seed varieties that offer faster growth and higher yields. These new seeds, such as Guard rice seeds, have replaced older varieties like Ratriyun, Motiya, and Jeera Shahi. While the new seeds provide better average yields, they also require the purchase of seeds each year as they do not produce viable seeds for saving and replanting. But due to the market demand he plants these seed varieties.

To achieve better crop yields, Manzoor uses both artificial fertilizers and natural alternatives. He acknowledges the effectiveness of organic fertilizers like camel dung but also

highlights the higher cost and reduced availability of organic manure due to the depletion of trees like Salvadora Persica (locally known as *Khabbar* or *Jarr*). Since, Salvadora Persica is one of the major fodders for the camel and the camel dung used for soil fertility as manure is also the dung produced after eating the Salvadora Persica plant. Manzoor emphasizes the importance of managing debts related to fertilizer purchases and strives to buy fertilizers by immediate payments to minimize losses.

Manzoor cultivates two main crops including Rabi[5] (winter) and Kharif[6] (summer). Rice and cotton are his primary crops, with rice being grown for both household consumption and sale to middlemen. Water availability is crucial for his farming, and the absence of water can lead to significant challenges in repaying loans and meeting the needs of livestock. The changing market dynamics and preferences of middlemen have influenced Manzoor's farming practices. He mentions that the demand for specific crops, like Pishori tomatoes, has led to a shift in his cultivation choices based on market trends. However, the fluctuating prices and dependency on middlemen sometimes result in lower profits and financial difficulties.

Manzoor utilizes a limited amount of pesticide. He applies it only when necessary, usually for surface-level pest infestations such as Millibugs, which can cause significant damage to crops. The introduction of non-native cotton seeds has led to the emergence of new pests, necessitating the use of pesticides to mitigate their impact. Manzoor observes changes in the local ecosystem, such as the disappearance of certain bird and fish species. However, despite all these changes, he chooses a mid-way to earn from his crops as a farmer and as a head of the house to feed the best quality food to his family.

[5] Rabi stands for the crops grown in winters.
[6] Kharif stands for the crops grown in summers.

Figure 3. 4: Abdullah (Left) with his nephew.

Source: Batool Fatima

Abdullah Jat is a 52-year-old farmer who practices a combination of traditional and modern farming methods (see Figure 3.4). He owns a three-acre farm where he primarily grows tomatoes and chili peppers. While he uses hybrid[7] seeds (originally not from the same region) for tomatoes, he prefers to plant local varieties of chili peppers. Abdullah started farming when he was in grade five, initially learning from his primary school teacher who was also a landlord. He pursued education for only four months each year while tending to his family's camel grazing as his major activity.

The motivation to start farming came from the changing circumstances in Abdullah's life. As a member of the Othari Jat community, which traditionally grazes camels, Abdullah and his

[7] A variety of plant created by cross-pollinating two different varieties of the same plant.

family used to roam in search of grasslands. However, due to factors like water shortages and the disappearance of mangroves, they had to sell their camels and settle in one place. That's when Abdullah got involved in agriculture and has been striving to bring innovation to his farming practices.

He has learned about modern farming techniques from videos and has experimented with Cocoon[8] technology, inspired by the practices of countries like Israel, United Arab Emirates, and Saudi Arabia. Abdullah planted tomato and papaya using this method and observed successful results with minimal water usage. He also relies on cow manure for fertilizer, a practice he has followed since his primary school days. Abdullah believes that these innovative methods can enhance crop growth and yield.

Abdullah's income primarily comes from agriculture, and although he occasionally takes loans to purchase fertilizers and pesticides, he still manages to make a profit. However, he acknowledges that the farming community in his area often repeats the cycle of taking loans and using HYV seeds without embracing innovative practices.

Abdullah has faced criticism from his community for his experimental farming methods, but he believes that once he achieves success, people will acknowledge his efforts. He saves chili seeds for future planting but does not create a formal seed bank. He hopes that knowledge and awareness about suitable crops and weather conditions will lead to improvements in farming practices.

[8] Cocoon is a water-saving technique, used by keeping certain amount of water in an earthen pitcher or any water container and then connecting that water container by a cotton or jute thread to plant a seedling. It is a technique used in arid zones to successfully grow crops.

Abdullah does not foresee any significant changes in agriculture through government initiatives and believes that farmers must find their own ways to adapt to challenges such as water scarcity. He admires the work of Subhash Palekar[9] in neighboring India and seeks inspiration from their agricultural practices.

Akhtar Jat is a 37 year-old farmer and he has eight acres of land. Akhtar belongs to the Shaadi Jat family, which is part of the larger Seendhlani clan of the Jat tribe. He grows rice, chili, canola and tomatoes on his land. His community is known for its farming practices and traditional seed saving techniques. In Akhtar's community, women play a pivotal role in saving seeds and weaving sacks for saving grains and seeds. Although Akhtar's community was originally involved in camel rearing and living a nomadic lifestyle, these days his family no longer keeps camels. Akhtar decided to pursue farming after his father's death and his experience with farming is relatively new.

Akhtar faces the challenge of waterlogging on his land for most of the year, which restricts the type of crops he can grow. However, he has found a way to adapt to this situation by planting rice, as it tolerates waterlogging. This choice allows him to explore additional crop possibilities. For his family's consumption, he prefers using native varieties of Basmati rice seeds, which were gifted to him by a community member. For commercial purposes, he opts for IRRI 282 and IRRI 06 rice seeds.

Akhtar mentions that he utilizes Di-Ammonium Phosphate (DAP) fertilizer to dry the rice crop before harvest. He acknowledges the effects this fertilizer has on the ecosystem, as it leads to the death of fish, snakes, frogs, and other organisms present in the soil. He shared that the use

[9] Indian agriculturist famous for his zero budget natural farming techniques. He is popular in both India and Pakistan for his traditional farming techniques.

of pesticides and the establishment of artificial hatcheries have caused a significant decline in fish populations in the region.

In terms of gender roles within his community, women primarily focus on household chores, embroidery work, and taking care of children. However, there is a growing emphasis on education for girls, and efforts are being made to establish a kindergarten school specifically for young girls within the community.

Mariam Zubair is a 62 year-old woman farmer. She belongs to the Khaskheli community of Deenar Khan Talpur village in Badin. She has been involved in farming for the past 20 years. The major crops that she cultivates are tomatoes and rice. She used to produce Motiyo rice in her earlier days of farming but now she produces Sindhi Ganjo rice variety. She is involved in all kinds of farming activities including preparing the land, sowing the seeds and applying fertilizers and pesticides.

Previously, Mariam and her husband used to plant the seeds they saved from previous harvests, but nowadays government regulations have affected their choices of which seeds to use and which crops to plant. While this has brought some benefits in improved crop yields from the crops such as the HYV seed varieties, it has also brought many challenges including the need to rely on external seeds. Since, the native seeds are not popular in the market, these seeds are only used for growing foods for family consumption.

Mariam particularly shared about her past days when the community system was strong, characterized by sharing agricultural resources and supporting one another. She explained that the sense of unity within the communities in the old days allowed them to overcome big challenges. However, with the passage of time, government policies and rising inflation

contributed to increasing expenses and promoted resource-intensive agriculture which made it challenging for Mariam and others in her community to sustain themselves and their families solely through farming. Although farming provides some subsistence to her family, the costs of inputs for farming have made it increasingly challenging for Mariam and her family to guarantee a good crop output. When there is a good harvest, the surplus crops sustain her family for several months; however during unfavorable seasons, she and her family are pushed to seek additional income as a daily wage laborers, or to take loans from seed-fertilizer-pesticide companies and middlemen to survive and meet their basic needs.

3.7 Ethical Considerations

I received my Tri-Council Policy Statement (TCPS-2) certificate and adhered to the ethical guidelines set out by the Tri-Council and the Lakehead University Research Ethics Board (REB) protocol I developed. I also checked for existing ethical guidelines in Pakistan to ensure I met local ethics standards. The Higher Education Commission (HEC) of Pakistan have ethical guidelines for publication in Pakistani research journals (Ethical Guidelines for Journals, n.d.) but there are no specific guidelines for any individual research projects to be approved from any committee in Pakistan. I submitted an REB application to Lakehead University and received approval before beginning this research.

All the interviewees were fully informed about the nature of the research and asked to provide their consent before beginning the interviews. First, the information letter (see Appendix B) was translated and read verbatim to the farmers in Sindhi Language. After the information letter, a consent (see Appendix C) form in Sindhi language was read and the interviewees were orally requested to give their consent and sign the consent form.

Only I as a researcher and my supervisor had access to the raw interview data and the consent form. All documents (interview notes, audio recordings, and interview transcripts) were stored in password-protected computer files and deleted from the mobile phone after being backed-up to the computer. The only information shared publicly is the information related to the research topic, and it is quoted in English after translating from Sindhi. This information was shared back with the farmers, and they were given the choice to remain confidential in the final research findings. All the farmers preferred to share their names and backgrounds in the final thesis research publication.

Chapter 4: Findings

4.1 Introduction

In this chapter I present the findings of my research. There are four sections in this chapter. The first section delves into the farmer's experiences of industrial agriculture. The second section explores the implications of traditional knowledge in farming practices. The third section illuminates the importance of the role of women in farming practices, transfer of knowledge and their perspective towards traditional knowledge. The final section explores the future hopes and opportunities.

4.2 Impacts of Industrial Agriculture

Narratives of the older farmers suggested that the time period before the 1970s was less influenced by technology, hybridization and competition among the farmers. The main purpose of agriculture at this time was to generate food for families, and much of the agriculture was subsistence farming. The farmers explained that at the time, the agriculture they employed was primarily based on traditional practices which they felt made the crops and the farmers resilient in adverse climatic conditions: such as droughts, cyclones, floods and other such natural disasters. While sharing this, Khudabakhsh said:

> …I started farming in 1956...or 58, I guess, since then I have never bought a single kilogram of flour or rice from any shop…There was no greed or desire that could affect us, that is why even if we used to eat *naaro*, *kalh* [names of edible grass roots] *lorihiyun* [lotus roots] and lotus flowers, we were happy. *Delha, pusiyun, gurar, goloon*[10]. We never had a proper cushion to cover ourselves as fabric was expensive. We used to cover ourselves with whatever hand woven pieces we had. In those pains was ease, abundance, respect, inner

[10] On my follow-up call, the farmer told that three of these plants have vanished from the land while only *Gurar* is present. Botanical name of *Gurar* is *Pentatropis capensis*.

> peace, healing. We had no idea how things were fulfilling back then. We were stronger despite hunger and scarcity.

From Khudabakhsh's response it is clear that there was acute food-insecurity in the region. The farmers remained resilient and connected with their ecosystems for survival. They were self-sufficient for food without any external interventions by government or international organizations like IMF or World Bank, to feed them. They had the knowledge to live in seasons of droughts or famines. Also, the crops were grown primarily for subsistence not for commercial purposes of big corporations or with the intention of making a large profit. Instead of greed for making money and depending on others, for deciding the value of their crops, the farmers used to work with passion and devotion to fulfill their duties of living good life.

According to Khudabakhsh, in past, pests and insects were not considered to be harmful. With a very basic education and negligible exposure to the modern world, what he explained in his native Sindhi language meant in the conventional agriculture there was a great importance to the biodiversity and agroecosystem. He claimed, back then, the variety and intensity of pests and diseases in the crops was very low as compared to nowadays. He explained:

> When we would start plowing, mynas, cattle egrets and black drongos used to come to eat larvae of harmful insects and throughout the cropping period bee-eaters, sparrows, bulbuls, Indian rollers, swallows and nightingales would prey upon baby locusts [hoppers] and beetles. Owls and long-tailed shrikes would eat even lizards and rodents. On the other hand snakes, jackals and foxes would be a great control of the rodents and porcupines. That was the natural pest management. How would there be any disease when there was no such thing as pest?

Prior to the Green Revolution there was no concept of mechanization of agriculture. No tractors or modern tools. Instead, oxen manually plowed the soil which required hard labor. Cattle dung was used as a natural fertilizer. Farmers indicated that tractors and other fossil fuel

dependent machinery like power generators to run motor water pumps were expensive and inefficient, and the increased use of machinery (dependent on fossil fuels) was another reason for the increased costs of farming due to the ever-rising fuel prices. Since in the case of oxen the grass was a surplus on farm and there was no extra cost of petrol and renting a tractor. Also, the cows would provide milk and butter. In Khudabakhsh's view, key causes of so many pest attacks and diseases were the use of tractors and excessive use of chemical pesticides:

> Now these tractors mesh the soil and breed locust larvae so well, now brother come let's spray...Let's spray pesticides...We did not pay for fuel with our oxen, our soil got dung of oxen as compost and pests were dead [due to the deep plowing of oxen compared to shallow plowing of tractors]. With tractor we have to feed the driver food. With oxen we never had to take anyone's favor of giving us or lending us tractor and a driver. With oxen we did not buy a cigarette packet for the driver or give money for fuel. We were not under anyone's influence with our oxen. We had our own lassi [yoghurt] to feed on from our cows or we can borrow lassi to feed our tummies. No big favors from anyone.

The inefficiency of tractors and dependency on fossil fuels was also lamented by Manzoor:

> Back in the old days we used to have oxen for plowing the land… Nowadays the tractors have added more cost due to diesel…and petrol. Everything, every cost rises because of oil. We need petrol to even turn on a generator, to run the water motor [pump] for crops. Irrigation canals are mostly empty due to water scarcity.

The farmer responses suggest that the intensive usage of tractors, have increased the time needed by the soil to gain fertility. The usage of tractors has also increased dependency of the farmers on external inputs as compared to the locally available more eco-friendly resources. For example, with the oxen, there was no need to go all the way to the city to buy diesel or petrol or to borrow a tractor from a wealthy landlord who has a large farm that practices industrial

agriculture. This dependency has taken away the smallholder farmer's right to choose the kind of seeds, fertilizers, and pesticides they use on their farm and increased their debt. In order to pay off their debts the farmers are given more seeds, fertilizers, and pesticides by the agribusiness companies in a promise that they will make more yields through those packages and pay off their compounding debts making large landowners richer and the smallholder farmers poorer. Large landowners monopolize the industry and also control farming in the region as they own the shops that sell fertilizers, pesticides and seeds in small villages, they own the tractors which smallholder farmers rent and they even own the petrol pumps from which the farmers must buy fuels.

Participants also mentioned that they usually used to plant one crop in the whole year to allow the soil to strengthen and regenerate its vitality in the no-crop season.[11] Khudabakhsh said that previously, there was only one staple crop harvested in one year and the grains were stored in seed banks and used for the whole year. He mentions:

> We used to plow with a pair of oxen from November. This plowing went on till December, January, February, March, April and then in May. [Counting on fingers] For seven months, we used to plow. During this time winds, cold weather, sunlight and all the thick stones used to get leveled and soil would get ready for a new crop. The soil got energy. Got stronger for a new crop. Now this, [he pointed towards the soil] is weak. It is energy less.

Fallowing of soils (leaving fields unplanted for a time to let the soil regain its fertility) increased soil fertility by allowing time for the soil to regain strength after one crop. This forced the farmers to keep grains for their sustenance in seed banks and allowed them to not depend

[11] Each farmer decided their crops and left one season in the year where the soil would have time to regenerate its vitality. Since crops can grow year round in Badin, Sindh, Pakistan, the farmers decided which season they wanted to give the soil a break.

upon external sources for food aid. The farmers got the opportunity to do other cultural and occupational things during the no-crop seasons. Three out of five participants talked about hunting, knowledge sharing and other social activities as part of their culture and society, which has faded now. Khudabakhsh reflected:

> So, this November to May period was hunting, playing and plowing period. This was also the period when we produced poetry, did discussions [knowledge sharing], learned other skills. This was the period of repairing houses and catching fish…In the rainy seasons some would play with dogs, some would take sticks to go and wander and aged people like us would go and play cards or mollusk-shells [traditional board game].

The mixing of soil with organic manure and oxen plowing was good for soil health, compared to extensive tillage with tractors and usage of synthetic fertilizers. These resource intensive practices have caused the soil to require more water and nutrients. Much of community-based engagements of the farmers were compromised in industrial style agriculture where each farmers' thinking shifted from "food for sustenance" to "food for profit". The competition inherent in making more money disintegrated the unity of the communities and negatively impacted their folklore and cultural activities.

Among the older farmers, Khudabakhsh and Mariam reflected on the governments of their times to share the policies which brought changes in the agricultural system. Khudabakhsh talked more about the first military coup of Pakistan in 1958, when he was a young boy and started farming. While discussing the policies taken by the military leader and president General Ayub Khan, Khudabakhsh said:

> Motiya and Ratariyun[12] disappeared. What happened was that a larvae ate away [diseased] these Motiya and Ratariya rice seed when they were still not

[12] Native rice varieties

> ready for harvest…Then he [President Muhammad Ayub Khan] brought two rivers to Pakistan [talking about Indus water treaty] from Indira[13]…then President[14] [Ayub] went, I don't know to which country and brought IRRI-08 rice [International Rice Research Institute] and IRRI-06 rice. This IRRI was such that it even got upright in garbage. People and our elders would say that this IRRI is a fodder for horses not humans.

Mariam shared the changes in agricultural policies in the time of a democratic rule of Zulfiqar Ali Bhutto, the first elected leader of Pakistan. According to Mariam, Bhutto took care of the poor people, and specifically farmers. Bhutto divided the land of large-scale landowners into small-scale subsistence farms, to decrease poverty and encourage agriculture. Bhutto brought the law that the landlord will pay for the seed and fertilizers and all the labor cost instead of the peasants (farmers who worked as wage laborers at the large-scale agriculture farms). Mariam described Bhutto's farmer-friendly policies:

> When Bhutto's reign came, he announced that no peasant should be charged for fertilizers or seeds by the landlords. Everything would be provided by landlord and the farmers will get half of the harvest. We were happy for this decision as now we can also charge the landlord if we were using our own seed and fertilizer. We prayed for Bhutto as he got us free from the loans and debts of the landlords.

When asked about which time period was better in terms of profit, overall income and food security through farming, Khudabakhsh, Mariam, Abdullah, and Manzoor replied that the traditional agriculture was more profitable and had lesser cost compared to today. Only Akhtar was unaware of the previous time since he started farming when modern industrial style agriculture had become an integral part of the agroecosystems of Badin. Mariam shared:

> The previous time was good. By the time of next harvest for example, we were able to buy kids slippers or clothes after harvest, by the 12th month, each

[13] Former Indian Prime Minister
[14] Former President of Pakistan

> year…Today, even for plowing we need to pay 2000-3000 rupees per hour for tractor…Then you have to buy seeds from city, in the old days there was no seed cost. Our seeds of rice were so good. They were tastier and smelled good. You can smell those rice from far. Even their yield was greater and sufficient. Now we buy small seed pouches. These seeds mostly don't sprout. This is the reason for the whole inflation. That is why the output of harvest is less and people are going backwards each day.

She went on to compare how recent time period is influenced by industrial agriculture is different. She said:

> These days, profit is there on one side. Fertilizers are expensive, seeds are expensive but whatever the output that comes out, has a reasonable price to get profit. Nowadays everything has its rate [money]. Back in those days we did not calculate rate[15] [value in money], we used to think about output for food only. This year the water shortage ruined everything and now these floods. I am afraid about food this year. Rice grains are so expensive these days, a poor person cannot even buy one kg. 120 rupees per kg is the rice flour.

When asked about the purpose of farming, most of the farmers responded that they were involved in farming for food and to support their own subsistence. For example, Khudabakhsh said, "We do farming for food, not to make money. We don't do this to get rich."

Manzoor also explained the reason for farming was not money but the generational practice of doing farming for sustenance. He said, "My family inspired me to do farming. This was a trend in rural areas back then. They used to say [my parents], *Kheti sir sehti* meaning farming brings mindfulness. It continued on in our generation through me."

[15] "Rate" is a word used for value counted in money in Sindhi it is an English influence after the British invasion. In earlier days, the value of things was not calculated in terms of money. Therefore, the local Sindhi word was Naanrun which means "unique value."

Participants also talked about the introduction and use of hybrid seeds and its impacts. Abdullah suggested that the problem with hybrid seeds was the introduction to so many diseases that the farmers had no knowledge to cure. He said:

> When we used to plant heritage seeds, they would never get any disease. But ever since the bombardment of this "hybrid", the diseases have affected our heritage seeds also. Because of these hybrid seeds much of our seed is lost. Now the fact that this poison is being transmitted in our body is another story which we are not aware about. But we have heard that brother these chemical sprays and these fertilizers are killing the fertility of the soil and they are creating an environment which cradles invasive insects and diseases. Plus, what you are eating is poison.

Manzoor shared how the local food system was impacted and controlled with the middleman system. He said, "For the last 7-8 years, the native seed was not being purchased by middle man that is why we left planting it. Back in the old days the men used to purchase Pishori tomatoes. The middle man advised us to buy a new variety… Most of the people stopped planting and saving the Ganja (local rice variety) variety just because the middle man stopped buying these. When they stopped buying, people stopped planting or saving even for their family.

All five participants complained about the middleman system. The middleman system is when a man from city comes as a buyer of harvested crops to the village and he decides rates on his choice which can be very low. Farmers become trapped in debt to the shops or dealers from taking seed-fertilizer-pesticides on loan. Seed and grain saving knowledge helped farmers to not depend on the middleman for buying the seed-fertilizer-pesticide package. Khudabakhsh expressed his agony on how the culture of seed saving was erased from the village. He shared,

Figure 4. 1: (Left to Right) A typical *khori* (rice granary) and *gundi* (wheat granary) in Khudabakhsh's house.

Source: Batool Fatima

"My child, in these 300 to 400 houses you will not see a single *khori* [rice granary] except in my home." Talking about this current Industrial Agriculture inspired farming methods, Khudabakhsh said:

> The problem is tractors, pesticides and fertilizers. This whole package has destroyed everything. IRRI-08 was not a problem. Now this loan of all these things has indebted everyone; now they pay from their pockets to return their loan. They are selling assets like livestock animals in order to pay off the loan to these companies; even after this all, there is no profit in farming.

In summary, the farmers felt that Green Revolution was a disaster for the local food systems. Three respondents agreed that the introduction of hybrid seed varieties brought large yields and prevented hunger during the famine years of 1970s. However, the introduction of pesticides, fertilizers and dependence on fossil fuels for running the tractors caused disconnection with nature. These agricultural practices also brought competition and changes in

the farming ideologies of farmers. For example, more farmers started to buy new seeds, fertilizers and pesticides in hopes of increasing their profit. This drive impacted the whole agroecosystem. As this approach to farming was based on producing crops for money instead of for food, it caused unequal distribution of food and increased hunger and competition among farmers.

4.3 Using Technology to Build Farming Practices and Adapting Traditional Knowledge

The participants shared that they check weather forecast on their phones, and they call and inform other farmers of weather conditions. They share information and protect crops by sending Whatsapp voice notes. They also use social media to learn about new, affordable and environmentally friendly techniques of farming. The use of the HYV seeds is also done in a measurable precautious way. For example, one of the farmers mentioned that he buys hybrid seeds of tomatoes from a shop and then grows them on his farm. He keeps the seed for the next year from the output of that crop. Those seeds, he mentioned, produce more yield than the first generation of the crop. The farmers have also learned to minimize the use of harmful, inorganic fertilizers and pesticides by learning from their own experience and from those of other farmers.

The interviewees shared that their current approaches to farming involves their own traditional knowledge as well as innovative techniques that they came to learn through the internet. For example, Abdullah shared his use of Cocoon technology. Ever since the Green Revolution, the farmers have become used to irrigated water sources which was not available throughout the year and the farmers started to depend upon water from electricity-based tube wells or ground water hand pumps. Recently, these resources have been exploited and exhausted

and contribute to pushing the region towards drought. Using technology, the farmers are building on their traditional knowledge and learning through social media and internet to use other techniques like utilizing water efficiently. The Cocoon technology is one such technique being adopted in the community in Pakistan. Abdullah said:

> We have seen the videos of the people who use this Cocoon technology. We don't have those companies who can send us those readymade tools to be used. We definitely need to use some shortcut inspired from these methods…we really are flooded by these experiments [saying sarcastically for the outcomes of dams on downstream delta]. Now what I did was, I planted some tomato and some papaya plants through this technology. They survive beautifully well… trees like Neem…Chickoo or Moringa or all other such kind of trees, only need 25 litres of water for 365 days of the year.

The farmers have also realized the importance of using native seed varieties. Many women farmers have started to save the native seed varieties of mainly chili and other vegetable crops. Usually, these varieties are then sold to the fellow farmers in the next season. These varieties are not just resilient to pests and weather but also produce more yield per acre. This attempt to save native seed varieties is considered a positive resurgence in the region. As Abdullah shared:

> …Recently some poor women from our neighbors, they saved some chili seeds from previous [Indigenous] chili crop…they do not have enough field or land to transplant those, so these women will now sell those seeds to other farmers in a good price for the next season. They will sell it for around 3000-4000 Pakistani Rupees…We only save 8-10 kgs [of chili seeds] in small cloth bag for the next season's plantation.

The farmers shared that these native chili varieties gave higher yields even in the adverse weather conditions. Abdullah said:

> …if [there is a] cloud burst with about 100mm to 200 mm rainfall in an hour, the sea is nearby… even if rainfalls for 400mm even then the water would flow

> away towards sea...there in that part we plant chilies around 1.5 acre. The first picking of these chilies goes about nine hundred thousand Pakistani rupees in output. You can now imagine the margin of profit. All these seeds were not hybrid, these were our heritage seeds.

The traditional practice of saving chili seeds still continues because of the larger profits and demand of this chili variety in the region. There is no alternative chili which is in demand. Older age women save this seed also because they are experienced in seed-saving practices.

Young farmers have done innovative experiments with the new seed varieties. In the case of the tomato crop, some farmers use second generations of hybrid seeds. The farmers buy hybrid tomato seeds from market and then after harvest they save seeds to use for the second season. These second generation seeds produce greater yields than first generation seeds. Akhtar, shared, "The tomato's hybrid seed which we plant that year, we save that seed and plant it again the following year. That second generation seed gives rather more yield than the first hybrid seed."

Some of the farmers have started to follow popular traditional farmer leaders from the neighboring country of India. The farmers came to know these leaders through social media. Abdullah recalled:

> ...Whatever work Subhash Palekar is doing is exceptional. He is basically an ecologist. He withdrew from all these current farming methods. He says you should leave this all and follow what our forefathers taught us or what nature does, and what *Bhagwan* [God] teaches you, follow that. He says empower the mother earth, make it poison-free…

The farmers complained about the inefficiency of the synthetic fertilizers. Their responses suggested that rather than increasing the yield and improving the crop output, fertilizers destroyed the crop and its output. For example, Abdullah said:

> Just for experiment, I planted tomatoes and papaya in two different ways. One with poison [inorganic fertilizer] and one with livestock manure [organic fertilizer]. What do these companies make? Fertilizers? After giving fertilizer that poor tomato did not survive, since I was not aware about proper amount scientifically approved for this purpose. Even though I threw the fertilizer away from roots, still the tomato wilted. But the papaya survived. Among the tomatoes, whatever the tomato I haven't given this synthetic fertilizer that is better. Livestock manure is better than synthetic fertilizer. Fertilizer which certified and brought from big cities for "good crops".

This experiential learning of the farmers has given them courage to continue to use traditional practices on their fields, albeit with adaptation of new ideas and technologies when appropriate and when they choose to use them. This experience brings in them the confidence to choose between what is good for them, their fields and its output.

Akhtar shared that the pesticides that he used on his farm, killed even the frogs in his field. He said, he did not even remember his father's style of agriculture as he was too young when his father died, and he did not learn about agriculture at a young age. This was because he was raised not to be a farmer, but to go to school and get education. In Pakistan, education means the westernized schools which do not share the traditional farming knowledge in the syllabus but the colonized model of education. Akhtar stated:

> ...There must be for sure a reason my father used to keep fish in rice paddies but I am unable to recall that. We are even killing the baby fish we don't breed fish at all. This poison [pesticide] has just killed all frogs and even venomous snakes.

From the farmer responses, it is clear that there are several contemporary issues that have been realized by the farmers. For example, the positive and negative aspects of using technology specifically technology that is dependent on fossil fuels; the use of synthetic fertilizer and pesticides and their impacts on the agroecosystems; the use of hybrid seeds and the vanishing

native seeds and the overall failure of industrial style agriculture which was hyped during the Green Revolution time period in Pakistan. In addition, the farmers have built in themselves a resurgence to face those challenges and look for viable solutions.

It is clear from the interviews that the farmers have realized the negative impacts of synthetic pesticides and fertilizers that were brought with the Green Revolution. Knowing the drawback of poisoning the land for monetary profit is another reason that the farmers strive to bring back and build on their traditional knowledge to cope with problems like land degradation. All the respondents agreed that the industrial agricultural practices influenced by the Green Revolution are very resource intensive. These approaches to farming require many more input and produce less output for the farmers. Despite this, the farmers have learned to mix their traditional knowledge and experience with modern techniques to practice farming that is both socially and ecologically more sustainable.

4.4 Role of Women

Another theme that emerged during my research was the role of women in agroecology and their contribution in passing traditional knowledge to the younger generation through story telling. I realized this while speaking with the male farmers who rarely spoke about aspects of care for the household. During the research, I had many questions like, who took care of the bulls once they had ploughed the soil. This is when I realized the important role of the women in preserving the agroecosystem as well as the knowledge systems. To address this, I decided to interview one women farmer from one of the communities. Although women in most of the communities in the village of Deenar Khan Talpur do not engage directly in farming, it is crucial to know their perspectives of the farm as well as the household. I realized that a lot of the

discourse of knowledge would have gone untapped had I not included at least one women farmer in my study. This also gave me an insight into the workings of our patriarchal society. Much of the male dominated knowledge sharing does not involve other sides of the story.

When I was interviewing Akhtar Jat, who described himself as a male farmer, the conversation did not specifically address the role of women in farming, but it provided some insights into their involvement in other activities. Akhtar mentioned that women in his community primarily engage in activities like embroidery and weaving. These activities are separate from the farming work and indicate traditional gender roles where women are involved in domestic and handicraft-related tasks. He then mentioned the caretaking of the livestock was also done by women. Upon my repeated questions on the role of women, Akhtar acknowledged the role of women in drying and saving seeds of chili crops and several other crops. This task involves preserving seeds for the next planting season, and women are actively involved in this process. Based on the conversation, it is clear that women in Akhtar's community do not participate directly in on-farm activities, however women indulge in all the off-farm activities like drying and saving seeds. The focus of their involvement appeared to be primarily in domestic tasks and seed-saving. However, their roles in the household chores also provides the backbone of the work done on the farm, freeing time for men to engage in direct farming activities.

When I focused on the role of women by asking more questions about their contribution and involvement, Akhtar mentioned that they are requesting a kindergarten school for young girls to provide education opportunities. This suggests that education for girls is gaining

importance in the community, indicating a changing perspective on women's roles and the desire for their empowerment through education.

To further understand the role of women, I decided to interview a female farmer from my village. I shared my intent to several community members through the help of my grandmother. Many of the women were reluctant to give an interview that would be published or to even share their point of views. The exception was Mariam Zubair. Mariam belongs to the Khaskheli community and women from her community work on the farm as well as do household chores. Mariam actively engages in farming alongside her husband.

Mariam and her husband chose farming as their profession because they inherited their land and had limited resources. They saw farming as a means to earn a livelihood and feed their family. They recognized the importance of land in providing sustenance and felt a connection to the earth.

In their community, women farmers do many types of work and their contributions normally go unrecognized. Mariam shared:

> Every morning I used to wake up the earliest. My husband first took out milk from our cow and I would make tea. Then he will go to farm with oxen to plow the land. I used to take his lunch to the farm at noon time. There was big walk to reach there. After lunch I had to clean all the big stones and other unwanted stuff in the farm and then come back home. You know it was difficult for women because it was two-way. My husband just worked on farm. I had to clean the farm, clean the house, take care of kids, feed the livestock and give them water and clean the livestock area of the house every day. We also cook the food. We also repair our house with mud thatch. All grinding of rice and making flour was done by women. Winnowing and crop cutting was done by women. All fishing for food was done by women. Men used to hunt for fun. We would catch fish for the household food. You know all the bigger responsibilities of feeding, keeping house intact and livestock care was done

> by us. We women work in both places my child. Still men will get angry and fight with us after coming from farm.

Mariam shared insights into traditional farming practices, such as using oxen for plowing and threshing rice, manually winnowing grains, and grinding rice in stone grinders. These practices were prevalent in her community before the introduction of modern machines. She said:

> We would bring lots of rice grains and make a huge mount in the front yard of our house, and I would cover that rice with dried rice stalks and mud. That mud would dry and our rice remained safe from rain and insects for a whole span of a year or so (see figure 4.1). Every house had those big mounds of rice grains in their houses. We call them *khori*…We then winnow rice to clean it. After this we used to make a rice huller on a base of dried clay with a wheel made of mud. That wheel separated the husk from the rice. We called it *jandi*. They all disappeared after machines came. This process was called, *darahn* in our language…After hulling, we used to grind rice in a stone grinder, which we call, *chakki*. This all was done by us, women, after finishing work at the farm.

Such knowledge about traditional tools was impossible to have learned from the male farmers who had never used traditional machines as it was the job of women in the house to save the grains and convert the crop into food.

Mariam also shared that she values preserving ancestral crops like barley and jute. The reason was that she had seen her father planting those crops which nowadays no one plants in her area. She uses the same traditional seeds that she got from her father. She recalled:

> My father used to plant barley and jute seeds, I tried planting that same variety [of seeds] to keep them alive [save them from getting erased] even if it means only one plant [in a year], I try to plant it every year to keep those [seeds] alive.

This saving of native seeds was also done by women, a point also shared by Akhtar and Abdullah. This is evidence of the women's contribution in an agroecosystem.

Mariam pointed out that women often suffer from poor health and malnutrition due to a lack of proper diet. Women prioritize feeding their children and families, often neglecting their own well-being. Limited access to affordable food and reduced income contribute to this issue. She further expressed her concern over how the young women in today's time are losing traditional knowledge and are lacking the contemporary knowledge. She said:

> …Still I will say, the previous time was better than today as women are useless, today. Most of our skills are dying and most of the girls these days are becoming aware of their rights, but they are also loosing those skills, which we used to have.

By this she meant that the young girls were neither learning the traditional practices for example, the technology has replaced the roles of grinding rice to make flour, nor the newer practices as these new technologically intensive practice like driving a tractor, etc are mostly carried out by men. Therefore, women's roles in their households have been limited.

Mariam mentions the changing dynamics of farming, such as the shift from traditional practices to modern methods involving machinery and market-driven decisions. This transition has led to a decline in self-sufficiency, increased dependency on external inputs, and reduced control over the farming process.

Overall, Mariam and other farmers' interviews shed light on the role of women as active participants in farming, their resilience in the face of challenges, and the impact of external factors on their livelihoods. This highlights the need for support and resources to empower

women farmers, improve their access to nutritious food, and address the systemic issues affecting agricultural communities.

4.5 Hope for the Future

Generally, farmers were quite hopeful for positive change in the future. The major hindrance in achieving resurgence is debt, the middleman system and the loss of seeds. A lot of the traditional knowledge sharing processes were destroyed after western colonized ways of knowledge-sharing overtook them and technology created barriers among the communities to sit together to sort their issues in unity. Nevertheless, farmers still found ways to use positive adaptations of technology that built on their traditional knowledge. These opportunities demonstrate that current technology can be used in parallel to the traditional farmer knowledge.

Among the older farmers, Khudabakhsh expressed less hope that change would occur. He pointed towards the many problems in the village, such as water shortages. Land degradation and biodiversity loss is another irreversible damage that the he does not see changing. He also discussed the loss native seeds, which are no longer available in the region. Khudabakhsh noted, "My child, I am telling you that our settlements are displaced as there is no sweet water, land is incapable of growing crops due to bad soil."

Mariam was certain that some of the traditional practices can never come back, yet she still believed that change is inevitable. She explained that a lot of the farmers want to practice traditional agriculture, but they feel they are trapped in the debts and the middleman system, which is killing their hopes:

> …Some people who were taking seed and fertilizer loans understood this problem and are now backing out of this. They have found alternative ways to

> cope with this. Only poor people like us or the farmers who really are hand to mouth are in difficult situations today. To get out of this vicious circle… [her] Boys don't want to take loans. They are trying in their own ways by selling livestock to get rid of everything that is imposed by these middle-men. Loan is a disease, it is a cancer. We all want to fight against it but in whatever way we can. We are poor and have limited resources to bring that big change.

Manzoor did not really talk about any hope or any future opportunities. His comments reflected that resurgence is based on each individual's background in farming and their interest to work on it.

Abdullah however was optimistic for change in the agricultural system. He said that it would come from individuals instead of governments, and it would be visible soon. He felt that more people will turn towards traditional practices in the future:

> …In my opinion the farming model which is given by Subhash Palekar, suppose if we follow that, maybe then God will save us from this inferno…Only, if we initiated this chain. Now suppose if I started and they [neighboring farmers] saw my success, they will definitely start to follow me…Not 100 percent, I am 200 percent hopeful, that he [Subhash Palekar] is right... Change in a Sindhi society will be a big thing.

Three farmers, including Khudabakhsh, Akhtar and Manzoor, seemed less optimistic for any reasonable changes in the near future which would be both socially and ecologically focused. Akhtar was the youngest interviewee, but he was not very optimistic about any change. Abdullah and Mariam talked about future hopes, and they looked forward for an inevitable change in their communities.

It seems that the farmers have realized the grave situation that is based on the current agricultural practices, yet they are not sure about the future of farming. Technology is helping them find hope, but is also displacing their traditional practices and exhausting their lands. There

is a lack of unity in the community to bridge the gaps in the farmers' perspectives of their farming techniques. The general feeling was that there are opportunities for evolving agricultural practices at the local scale, but also a feeling that there are very little chances for larger scale change in industrial agricultural practices more broadly.

Chapter 5: Discussion and Conclusion

5.1 Discussions

The overall purpose of this research was to explore how traditional farmers' knowledge in agroecology contributes to social-ecological resurgence in the agroecosystem of the village of Deenar Khan Talpur in Badin district, Sindh, Pakistan. The insights shared by the farmers is an important contribution to the understanding of the local ecosystems and how traditional farmers perceive the current industrial agriculture based on their experiences and ancestral knowledge. This information is valuable because most of the farmer demographics in the village suggest an aging population in the occupation of farming. If not shared or preserved, the new generation will not have access to this knowledge in the future. In this chapter, I synthesize the findings from this research with the literature and share my reflections. I discuss the social-ecological impacts of Industrial Agriculture and Green Revolution, the erosion of traditional knowledge and how to preserve that knowledge, the potential options for the farmers and policymakers which can improve the agroecology and the importance of feminist perspectives in knowledge-sharing.

The first section of the findings shared farmers' views about the impacts of industrial and traditional agriculture. Older farmers reminisced about their self-sufficient, ecologically connected farming practices before the Green Revolution. They shared that the introduction of tractors, hybrid seeds, and chemical inputs disrupted their traditional methods, increased costs, and led to ecological imbalances. The focus shifted from subsistence to profit, leading to inequality and food insecurity among farmers.

The second findings section expanded on farmers' views about their resurgence through modern technology and internet resources to enhance their farming practices. They shared how

they exchanged information about weather forecasts, crop protection, and eco-friendly techniques through social media and WhatsApp. Some farmers are reverting to traditional practices, saving native seed varieties, and minimizing the use of harmful fertilizers and pesticides. Innovative techniques like Cocoon technology are being explored and despite challenges, the farmers are striving for socially and ecologically sustainable farming practices.

The third section was specifically based on the woman farmer Mariam Zubair. In this section Mariam shared her role as a woman in agroecology and her preservation of traditional knowledge by sharing her narrative in a unique Sindhi storytelling style which was not prominent among the rest of the interviews. Her story-telling style impacted me in how a women never misses a detail and why it is important to have female narratives in studies on farmers' traditional knowledge. The interviews with the men overlooked women's contribution to the farm and the household. Mariam shared her involvement in all farming aspects, from plowing to selling produce. She shared that women handle various tasks, including seed-saving livestock care, cooking and cleaning of both the farm and the house. She also said that women faced challenges, such as poor personal health and limited access to food. Hence, her interview revealed that preserving ancestral crops and empowering women farmers can enhance agricultural communities' resilience and help in bringing social-ecological resurgence.

The farmers expressed hope for positive change despite facing hindrances such as loans, the middleman system, and declining native seed varieties. Technology is used positively, like checking weather forecasts on phones and learning from farmer leaders outside the community. Some older farmers were less hopeful due to water shortages, land degradation, and loss of native seeds. Although other farmers saw a potential for change, some felt uncertain about the future of farming. The lack of unity in communities hinders bridging the gap between traditional

and modern farming practices. Overall, there are opportunities for agricultural change but major changes in industrial agriculture practices are challenging.

It is clear from the participants' views that the impacts of the Green Revolution and Industrial Agriculture brought on competition within the communities. Smallholder subsistence farmers, who once used to farm to produce food, now farm primarily for money to make profit so that they can pay off their debts. It also indicates the change in approaches to farming generally, which have turned to a reductionist ways of thinking. As Shiva (2016) mentioned, the reduction in availability of fertile land and genetic diversity of crops as a result of the Green Revolution practices indicates that at the ecological level, the Green Revolution produced scarcity, not abundance. At the social level the Green Revolution reduced livelihoods into wage labor, and turned human skill into a commodity (Shiva, 2016). From the farmers' accounts, the context of the pivot of hegemony, as discussed by Harriet Friedmann (1993, 2009) is clear. It can also be witnessed the way that dams, irrigation canals as well as hybrid seeds, fertilizers and pesticides were all part of a bigger scheme offered by the World Bank for the then newly emerged, independent country of Pakistan in 1960.

The tractors that are plowing the lands so intensively have led to soil degradation and left most of the land less fit for farming. In addition, as shared by Manzoor, Mariam and Abdullah, the prices of produce are decided by the middlemen, who keep their profit margin high. Often the farmers do not even receive the amount of monetary input that they invested in their crops. This can be related to what Weis (2017) has stated: "As with all commodities, food is shrouded in mystery, in that consumers have limited knowledge about the array of social and ecological relations that went into making the things (and their prices) that they encounter in markets, and

the many costs that are unvalued or undervalued in this process" (p. 118). The ecological cost of the Green Revolution cannot be calibrated with large yields or extensive production. A lot of the socio-ecological costs that farmers are paying go uncalculated in this. For example, the farmers' perspectives towards food have gone from food for household purposes like feeding their families to crops for making profits.

One major realization during the research was the aging farmer demographics. The withdrawal of the younger generation from farming to working as daily wage laborers in factories is a critical issue for future generations. Young people are not only losing their local food systems and self-sufficient farms by becoming daily wage laborers in the nearby cities, but also contributing to the erosion of the traditional knowledge. Because they do not spend time on farms with their elders who are doing farming. After the current generation of farmers, there are not enough young people interested in continuing to be farmers. Many young people are selling their rural lands and moving to large cities in the quest for a "better future". This is also a problem in countries like Canada and the US. As Mariam mentioned, her son does not like farming, as it is not thought to be a respectable job. This whole scenario is contributing to the continued erosion of traditional knowledge as well as contemporary farming knowledge. The concern is that if the knowledge is not shared or encouraged, in the very near future there will be a population incapable of producing food for itself. Knowledge erosion can be one reason for a ripple effect contributing to soil erosion, biodiversity loss, and the rural-urban population influx, as well as limiting resources for the displaced population in urban areas. This brings me back to Alzate et al., (2019) who mentions that "degradation of traditional knowledge is not only a critical concern for scientific knowledge, which could be enriched by it, but is especially a problem as it is a foundation for local management strategies" (p. 338). Knowledge erosion will

create dependency on hegemonic knowledge shared by big corporations in order to sell their products, while also destroying local social-ecological systems. Khudabakhsh mentioned that the culture of community-level wisdom sharing is declining and the lack of community systems will increase confusion among the individuals in a small population. More competition and profit will not provide benefits in the long run.

This leads to the question, what could be the potential options for the farmers and policymakers that can improve the local agroecology? The participants shared several innovative practices combining technology and traditional knowledge to achieve their farming goals. For example, the use of Cocoon technology to plant tomatoes as shared by Abdullah. Another example is the use of second generation of the hybrid tomato seeds that the farmers buy from the local market. Further, the usage of mobile phones for the weather forecasts and outreach through social media were inspiring. Where Khudabakhsh was concerned for the youth about losing traditional knowledge, Abdullah shared about the farmer leader, Subhash Palekar from India as a ray of hope for teaching traditional eco-friendly farming methods on YouTube. This relates to the literature that explains ways that agroecology combines Indigenous knowledge systems about soils and plants with modern ecological and agricultural science and also is the struggle for the social and environmental justice (Rosset and Altieri, 2017). Agroecology teaches food sovereignty and self-determination, while the organizations like the World Bank and IMF teach dependency on extensive loans. Therefore, agroecology can be used to solve the problem of food production as well as hunger.

The transitions in agricultural policies while reviewing the literature on Pakistan using the lens of food regimes, clearly indicate hegemony. For example, the implicit rules mentioned

by Friedmann (1993, 2009) during the second food regime, impacted the smallholder farmers and their livelihoods. Using the frameworks of social-ecological systems, agroecology and farmers' traditional knowledge, I analyzed the farmers' reflections on agroecological practices and the ways in which they integrated traditional sustainable farming practices with technology such as social media. I learned that despite challenges, the farmers were adapting to new ways and bringing a silent resurgence within their farms. For example, Manzoor, Khudabakhsh, Akhtar and Mariam mentioned that they plant native grain seeds for their personal consumption, which enhanced their food security and Abdullah's usage of technology and social media are all a testament to the resurgence.

5.2 Conclusion

This study helped to answer my central question: How can traditional farmers' knowledge and agroecology contribute to social-ecological resurgence? My research shows that the integration of traditional knowledge and scientific knowledge is an important way forward. The traditional and experiential knowledge of the farmers helps promote resilience in social-ecological systems. When social-ecological systems are strong, they create a community which is self-sufficient. And these social-ecological systems can only be possible when Ecologically Integrated paradigm is considered to be used. Also, agroecology in the local and national policies to create an equitable and sustainable food system.

In addition, my findings concluded that considering the role of women in agroecology is essential for social-ecological resurgence. Since, women not only advocate for sustainable and eco-friendly practices at household levels, they also share traditional knowledge through generations by telling stories to kids (Rosset & Altieri, 2017). The women are also key players in

converting the crop from grains to food and developing culture, recipes and taste of food around the locally available food crops. In my conclusion, women are the ones standing against the industries. As they resist industries by providing food from home instead of food from factories. Social-ecological resurgence can be possible by empowering and encouraging women farmers in the fields and using feminist narratives in the research approaches. It is also necessary to transition back to the joint family divided work system which has been reduced by the industrial agriculture as tractors, flour mills and pesticides are usually used by male farmers. This highlights that patriarchy is also connected with industrial agriculture. The women are the pivotal link between the agriculture output and the food for the family. Their social contribution in a local agroecosystem is an ideal example of a balanced social-ecological system. Some scholars have recently highlighted this matter in their research (Zaremba et al., 2021; Morales, 2021; Trevilla Espinal et al., 2021). However, more research is needed in understanding the role of gender in creating a balanced Social-Ecological System. As Portman (2020) suggested, "eco-feminist theory articulates material and conceptual connections between the subordination and the degradation of the nonhuman nature" (p. 57).

Another key factor which needs an urgent attention is encouraging and increasing awareness in the youth about farming. Since, the farmer population is aging, it is crucial to encourage the youth to respect the profession of farming instead of loathing the name of a farmer as mentioned by Mariam and Khudabakhsh. There is a need to address the youth's poor attitude towards farmers, and lack of knowledge of the importance of farmers in an agroecological system. Future scholars can also do further study on the dissociation of youth in the agroecosystems. Encouraging respect for farmers mean a social-ecological system that is food secure and is based on agroecology.

Lastly, involving farmers in the decision-making of agricultural practice in the local agroecosystems and preserving and sharing the farmers' traditional knowledge is essential. Farmers' traditional knowledge can play a valuable role in improving the sustainable use of technology for example, the usage of smart phones, social media, Cocoon technology and the sustainable usage of hybrid seeds as mentioned by farmers. This again creates a social-ecological balance, between the new technology and its sustainable use.

Knowledge hegemony can be reduced by recording and emphasizing local farmer narratives and taking their opinions in the political decision-making of agricultural policies. Also increasing awareness by promoting local knowledge-sharing and using research approaches which are grounded in the local agroecosystems and epistemologies.

There may not be a systematic change through the governmental policies but by highlighting and preserving farmers' traditional knowledge and agroecology, more resurgent movements across the globe could be amplified in the common narrative about the agriculture and the resilience in the overall food system. This way bigger challenges like pandemics and conflicts will not directly impact the majority world's population, specifically the food security of traditional smallholder farmers.

5.3 Limitations and future research

While conducting this research there were several limitations. Among those limitations one of the major issues was to find authentic content on Pakistan and the translation from Sindhi language to English. I felt the immense responsibility of translating the unique worldviews of the Sindhi farmers.

Literature on Pakistan is limited and is usually written by organizations like IMF and World Bank. Hasan et al., (1997) talks in a way which focuses on scarcity to show the room for the World Bank to intervene. Or there might be a research gap in the agriculture and food sector of Pakistan. I struggled a lot to share the facts presented by authors who represented the organizations like World Bank. Since, much of the articles shared the story which on the ground could be considered the other way round. It took a lot of my time to find the original roots of the problems in the agriculture and food security sector of Pakistan.

I tried my best to translate the worldviews of the farmers with the language style they used, however there were several occasions I felt that studying in the western educational system, limited me by keeping me focused on the research question. This intensive and focused research approach restricted in grasping the styles of traditional conversations and wisdom-sharing. I also felt the responsibility to accurately translate the sentences while translating the farmers' responses from Sindhi to English. In the Sindhi language, sentences are like paragraphs with complex sentence structures. I tried my best to translate the farmers' views while keeping Sindhi language style of conversation as well as the context of my study, as relevant as possible.

This research contributes to scholarly debates about the importance of local farmers' traditional knowledge in agroecology. My research also highlights that the smallholder farmers realize the value of their efforts and practices to the agroecosystem and their approach for a resurgence. This research emphasized that traditional farmers should feel included and appreciated for the importance of their knowledge and role in the communities. This research model can be expanded in other agroecosystems globally, to include farmers' perspectives in the decision making of the governmental policies, the big corporations and global institutions like

IMF and World Bank that impact the life of the farmers and the livelihoods of the local populations.

If I had unlimited time and resources, I would have interviewed more old age farmers in different regions of Pakistan to preserve that traditional knowledge. Since this older generation might be the last generation to have a significant agroecological understanding of their local social-ecological systems. I would have also interviewed more women farmers to know their perceptions about farming and their future aspirations. The perspectives of the women farmers would have enriched the study. However, limited and resources as well as the time to convince woman farmers to participate in interviews would have been beyond a master's thesis research timeline.

Some of Pakistan's agricultural policies are relatively new. While other historical policies need a thorough reading and analysis from the available secondary resources. Some of these resources are in Urdu (national language of Pakistan) or in Sindhi language (provincial language of Sindh province) which require translation. There are several policies which are yet to be made where the room for research can improve the quality of the policies made around the agriculture.

Future scholars can study the role of gender in agroecosystems; the reasons for the lack of interest of youth in farming; curating the inspiring stories of the farmers in larger Indigenous food sovereignty movements like La Via Campesina to increase the diversity of the local ecosystems that are documented and included in these movements and to preserve the traditional knowledge. Future studies on agroecology in Pakistan can be also improved by more translation of the content into English for future researchers across the globe.

Resurgence can be encouraged through the utilization of social media platforms such as YouTube, TikTok and Facebook videos in Sindhi language. This could involve celebrating local farmers and their knowledge in literary festivals held in Sindhi, Urdu, and English, both in Pakistan and globally. Farmer activists can be highlighted and supported through social and moral encouragement, connecting them with larger food sovereignty movements like La Via Campesina. Additionally, creating farmer heroes in children's cartoon films, in local languages, can serve to inspire interest in the farming profession. Conducting academic research on farmers' traditional knowledge and disseminating the findings in local Sindhi newspapers can increase outreach to grassroots populations. Beyond these suggested actions, resurgence is gradually taking shape, with youth, such as myself from the Sindhi community, realizing these aspects and actively working towards them. I am confident that there are numerous individuals in other indigenous communities, including young Sindhis, who are also dedicated to inspiring their communities and safeguarding their food systems and traditional knowledge.

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Appendix A: Interview Guide

Name:

Place:

Time of Interview:

Date:

Checklist:

□ Describe project in Sindhi Language

□ Ask if participant has questions or concerns

□ Read and sign consent form in Sindhi

□ Ask if participant would like to be identified or remain confidential

A. Introductory and contextual questions

What we hope to elicit here: These first questions of the interview will also be used to build trust, start the conversation, and build rapport between interviewer and interviewee.

- How would you describe yourself as a farmer?
- How long have you been farming for?
- Why did you chose farming as your profession?
- What motivates you to work on farm?

B. The impacts of Green Revolution on the agricultural perspectives of farmers

What we hope to elicit here: A deeper understanding of the impacts of Green Revolution on the farmers' perspectives.

- Do you plant staple food grain and vegetables on your farm to feed your family?
- Do you earn from your farm?
- How much is your average annual farm income?
- Do you spend more amount of money on your farm input than what you receive when you sell your crop output?
- Has your farm profit increased through time?
- What are the reasons of increase or decrease?

- Do you take any loans for buying any fertilizers, pesticides or seeds?
- How have your practices changed over time?

C. General understandings and experiences of traditionalfarming practices

What we hope to elicit here: A general understanding of what Traditionalknowledge of agroecological practices the participants have that they have learned from generations to generations.

- What farming practices have you learned from your community and/or ancestors?

For example:

  - The ways of making organic fertilizer. (Regenerating soil)
  - Polyculture (inter-cropping)
  - Techniques of saving native seeds
  - Taking care of crops from pests.
  - Use of livestock instead of machinery for farm activities

- What are the social and ecological challenges that you face with the current farming practices?

D. Opportunities for social-ecological resurgence

What we hope to elicit here: An overview for potential way forward in the perspective of farmers for a social-ecological resurgence through their Traditionalknowledge and practices.

- Are your practices similar or different to other farmers in the village?
- What motivated you to continue farming in this way?
- What changes in the farming practices have occurred through the time and why?
- Would you like to share any personal experience or stories?
- What could be the solutions for these challenges?
- In your perception, how you see resurgence happening?
- Can you share any examples or stories?

E. Demographics

To tell the participant: Before signing off, I have a few short demographic questions. We are asking these questions to get a sense of the people and voices that we are hearing from and those that we are not hearing from, as we would like to gather a diversity of experiences. You can decline to answer any of these questions.

- What is your age?
- What is your gender?
- What is your ethnicity?

Appendix B: Information Letter

Dear Potential Participant,

Mohtaram Aarzi Hisedaar,

Social-ecological Resurgence through TraditionalFarmer's Knowledge in Agroecology in Pakistan

Rivayati haari je tajarbey saan Pakistan ji zaraey maahol main samaji ain maaholi bahaali

Thank you for your interest in this research project. Your time and help are truly appreciated. This sheet gives some basic information on the research, what you can expect, how the data will be handled and used in the future. If anything is unclear or you want more information, please feel free to ask any question you wish, our contact details are at the end of this document.

Tawhan ji mehrbani hin kam main pehnjo shoq dekharan lae. Tawhan jo waqt ain madad wakhanr jogi aahe. He panun mukhtasar tareef bayan kare tho hin research project je kam je hawaley saan. Jeko tawhan khe samjh main na ache tawhan puchhi sagho tha. Wadheeq tafseel heth disanda.

What is this research about?

He kam chha je baarey main ahe?

This research project will explore **traditionalfarmer's knowledge in the local agroecology and how that can act as a form of social-ecological resurgence. A narrative inquiry approach will be used to interview the three farmers from the region of Badin district Sindh, Pakistan.**

Hin kam main **aseen Rivayati haari je tajarbey saan Pakistan ji zaraey maahol main samaji ain maaholi bahaali khe disandasi. Asaanji bunyadi tawajoh Badin, Sindh, Pakistan tey aahe.**

What is being requested of me?

Muhinji chha madad shamil hundi?

You are being invited to participate in this research because of you are a smallholder farmer from Badin district, Sindh, Pakistan. I am asking you to participate in an interview to share your knowledge and perspectives about **your activities on your farm which are related to the agroecology of the region, how and why you do these activities and what perspectives of yours have changed through the time. Which perspectives ad activities can be a form of social-ecological resurgence?** Your participation is completely voluntary; you may refuse to answer any questions, or withdraw from the study at any time.

Tawhan khe in karey shamil kayo wayo aahe jo tawhan Badin ziley je hiq nadhey erazey ja haari aahyo. **Muhinje interview main tawhan khe mathey dinal tafseel je bare main pehnjo moaquf diyanro pawando. Rivayati hari ji kehri maalomat sa samaj ain mahol main tabdeela aanrey saghjey thi.**

Twahan jo hiso wathanr muqamal azad aahe ain tawhan ji marzi tey jurial aahe. Tawhan kenh bh I waqt hin ma wapis thi sagho tha

Are there any benefits or risks I should be aware of?

Chha hin main ke risk ya faida aahin?

Conducting this interview will help me understand **more about the farming techniques/knowledge in the Badin region and will help me in understanding more about the agroecology of the region**. It will also help me to understanding of the global implications of such farming techniques. While there are very few perceived risks from participating in this research, I recognize that some questions may be perceived as sensitive. Your participation is voluntary and you are only being asked to offer information you feel comfortable sharing with us.

Hin interview karan sa mukhe Badin ji hariyap baabat khabar pawandi. Hun khabar pawanr sa aon wadheek shayun janry saghandas. Hin sa aalmi tor te jeke asar achi saghantha un babat bhi mukhe maaloomat hasil theendi.

Due to the COVID-19 pandemic, in-person research carries greater or additional risk. To ensure safety, we will aim to conduct the interview outside. If we meet inside, I will wear a medical mask and we will maintain physical distancing.

How should I expect to be treated?

Moun sa kehro rawayo rakhyo wendo?

This research aims to maintain the highest standards of ethical conduct and integrity. Centrally, this means that in participating in this research you should feel that you, and your contribution to this research, have been treated with respect. Participation is entirely voluntary and all information offered will be treated in good faith. You are welcome to refuse to participate, withdraw from the research at any time and refuse to answer any of the questions asked without any negative consequences for yourself or your farming activities. All questions about the research, its aims and outcomes will be answered openly and honestly. If you wish to be anonymized, your name and personal information will not be sharing in public discourse, it will be coded and quoted as an anonymized participant. While I retain final editorial control over what we choose to write, you are free to withdraw any information you have contributed at any stage by contacting us and indicating your wish to do so.

Tahwan jo sutho khiyal kayo wendo ain tawhan khe asooli hisab sa sachai sa har sawal jawab pucho weendo. Tawhan jeke jawab deenda uhe bhi sachai sa deenda. Je agar tawhan hin tehqeeq main gumnam rahan chahyo ta bhi rahi sagho tha.

What will happen to the data after it is collected?

Maloomat jeka hite milndi un khe kean istemaal kayo weendo?

In all cases, nothing you say will be attributed to you individually. Your anonymity will always be the number one priority. Only I and my supervisor (Dr. Charles Levkoe) will have access to the interview

transcript and identifiable materials (including audio recordings, hand-written notes and your consent form). All raw data, audio recordings and typing up of interviews will be encrypted and stored on password protected computers and in locked filing cabinets for up to five years. The final research results will be submitted as my graduate thesis.

Jeke bhi maarhun aahin unhan khe gum naam rakhbo. Har maalomat muhnje ain muhnje ustaad (Dr. Charles Levkoe) je wich main rehndi. Baaqi sabh maaloomat tareeqa sa sambhaely rakhbi. Sirf panj salan tain bachae rakhbi

If you have further questions about these processes or feel uncomfortable with any aspect of them, please let us know as soon as possible.

Wadheek maaloomat lae tawhan asan khe budhae sagho tha.

This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca.

Thank you again for your time and assistance,

Batool Fatima

Lakehead University

bfatima@lakeheadu.ca

Dr. Charles Z. Levkoe

Lakehead University

t. 807-346-7954

clevkoe@lakeheadu.ca

Appendix C: Consent Form

Name of Participant _____

(Please print)

- I have discussed the details of this research project and agree to participate in the research.
- Moun hin kam je baarey main budho aahe ain aon raazi aahyan hin kam main hiso wathanr lae.

- I understand that the purpose of the research is to **explore traditionalfarmer's knowledge in Pakistan.**
- Aon samjhan tho ta hin kam jo maqsad **Pakistan main rivayati haari ji zaraati tajrubey ain maaloomat tey galhaenr aahe.**

- I understand that my participation in this study will bring minimal risks or harm.
- Aon samjha tho ta hin kam sa muhnjo ko bhi jismani ya nafsiyati nuqsan konh theendo.

- I understand that there are risks of contracting COVID-19 during in-person research.

- I understand that my participation in this study is voluntary and that I may withdraw at any time for any reason without penalty.
- Aon smajhan tho ta muhnjo hiso wathnar muqamal azad feslo aahe ain aon un ma kenh bhi waqt pehnjo wasto khatam kare saghan tho.

- I understand that there is no obligation to answer any questions that I feel are invasive, offensive or inappropriate.
- Aon smjhan tho ta agar aon ko bhi sawal ghair zaruriyah nuqsaan pohchaendar disandas ta jawab konh deendas.

- Unless explicitly agreed to otherwise, I understand that information I provide will never be attributed to myself individually.
- Jeka bhi maloomat dini aahe un khe aon pehnje naale sa sadaendas.

- I understand I may ask questions of the researcher at any point during the research process.
- Aon samjhan tho ta kenh bhi waqt tehqeeqar kha sawal kare sagha tho.

- I understand that the results of this study will be shared with Dr. Levkoe and to the greater audience in terms of thesis findings.
- Aon samjhan tho ta hi tehqeeq Dr Levkoe khe budhaebi ain wadheek biyan marhan taeen bhi pohchandi ain unsa mukhe ko bhi aitraz konhe.

- I agree to have this interview recorded (please circle one):
- Aon hin interview ji recaarding lae raazi aahyan. Yes No

- Would you like to meet to discuss the results when complete (please circle one):
- Chha tawhan chahyo tha ta tawhan khe hin research jo natejo budhayo wane? Yes No

- I would like to remain confidential (please circle one):
- Aon hin tehqeeq main gum naam rehanr chahyan tho Yes No

I am fully aware of the nature and extent of my participation in this project as stated above.

Aon hin tehqeeq ji har marhaley khe changi tarah smajhan tho.

_____ _____

Participant's Signature Date

Hisedaar jo dastakhat Tareekh

OR

Verbal consent obtained for _____ [PARTICIPANT NAME] by _____ [RESEARCHER NAME] on _____ [DATE].

If you have any questions or concerns about this study, please contact Dr. Charles Z Levkoe (clevkoe@lakeheadu.ca; 807-346-7954) and Batool Fatima (bfatima@lakeheadu.ca; 0092-333-271-1362). If you have questions about your rights as a research participant in general, please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.