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THE NEXUS OF RAPID POPULATION GROWTH WITH LAND FRAGMENTATION AND FOOD INSECURITY IN DISTRICT RAJAN PUR, PAKISTAN: PHENOMENOLOGICAL DESIGN

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Abstract

Background: *The rapid population growth in many developing countries has led to a complex nexus with land fragmentation and food insecurity, exacerbating the challenges of sustainable agricultural development and food availability.*

Objective: *To explore the relationship of population growth with land fragmentation and its impact on agricultural productivity and food security in District Rajan Pur, Pakistan.*

Materials and Methods: *This study employed a phenomenological research design to explore the relationship between population growth, land fragmentation, and food security. A mixed-target population approach was used, comprising 64 landholders from 8 villages and 8 key informants (government officials). Convenience sampling was utilized to select landholders, while focus group discussions (FGDs) and key informant interviews (KIIs) were conducted to collect data. Thematic analysis was employed to identify and interpret patterns and meanings within the data. This methodology allowed for an in-depth examination of the lived experiences and perceptions of farmers and communities affected by land fragmentation, providing a comprehensive understanding of the research phenomenon.*

Results: *Thematic analysis revealed a cascading relationship in District Rajan Pur, where rapid population growth—driven by early marriage, early childbearing, high fertility, and increased household formation—has intensified land fragmentation through repeated land subdivision, rising input costs, a lack of mechanization, and seasonal migration. This fragmentation, in turn, has led to insufficient land use and declining agricultural productivity, collectively exacerbating food insecurity and placing long-term pressure on the region's already vulnerable food systems.*

Conclusion: *Rapid population growth in District Rajan Pur has led to land fragmentation and reduced agricultural productivity, intensifying food insecurity and necessitating targeted policy interventions in family planning, land management, and sustainable agriculture.*

INTRODUCTION

Rapid population growth continues to be a critical concern for developing countries, particularly in South Asia, where it exacerbates pressure on land, food, and socio-economic systems. Pakistan's population has more than tripled since 1951, growing from 34 million to over 241 million in 2023 (Pakistan Bureau of Statistics [PBS], 2023). This growth is especially pronounced in rural and underdeveloped districts such as Rajan Pur, where traditional practices like early marriage, high fertility rates, and limited access to family planning services contribute to population pressures (National Institute of Population Studies [NIPS], 2019). Scholars argue that unchecked population growth not only stresses public services but also disturbs the ecological balance and agricultural sustainability (Bongaarts, 2016).

One of the most profound consequences of rapid population growth in agrarian regions like Rajan Pur is land fragmentation. As families grow, landholdings are subdivided among heirs, resulting in smaller plots that are often too limited for economically viable farming (Ali & Khan, 2013; Niroula & Thapa, 2005). This phenomenon leads to declining agricultural productivity due to the loss of economies of scale, limited mechanization, and increased input costs (Chand & Kumar, 2016). Studies from Nepal and Bangladesh have shown that fragmented land significantly reduces the efficiency of farming operations, thereby worsening rural poverty and unemployment (Pandey & Dhungana, 2017; Rahman & Rahman, 2013).

Consequently, land fragmentation directly threatens food security in vulnerable districts. Smaller landholdings restrict crop diversity and volume, while declining yields reduce household food availability and income stability (Maxwell & Wiebe, 1998; Ntagoma & Mugisha, 2017). This link between rapid population growth, fragmented land, and food insecurity is particularly evident in Rajan Pur, where agriculture remains the primary livelihood source.

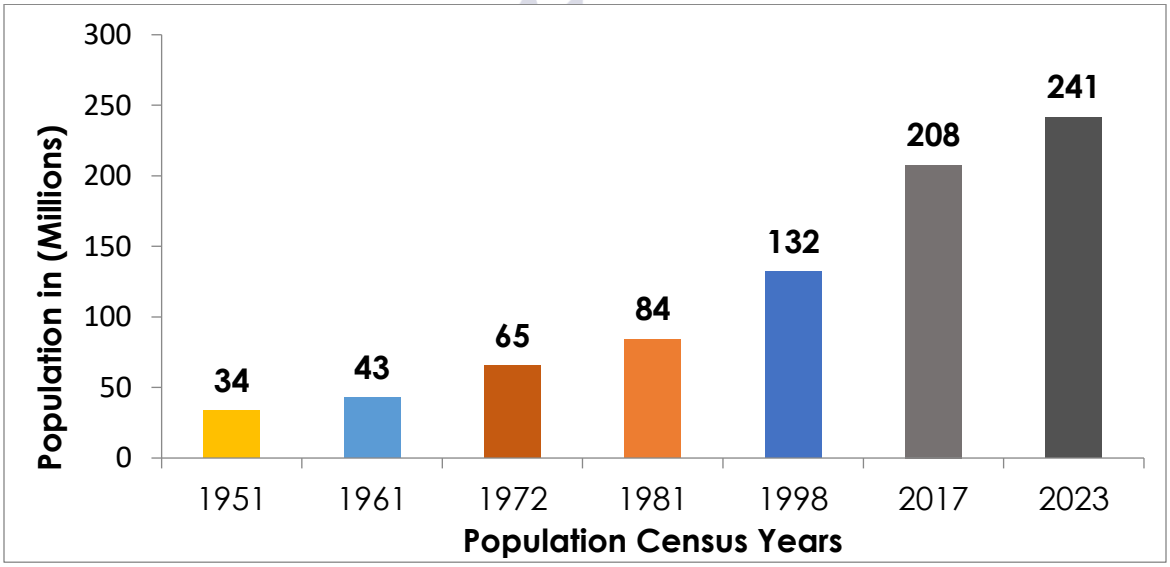


Figure 1. Historical Analysis of Population Growth in Pakistan (19951-2023)

Pakistan's population has surged over seven decades—from 34 million in 1951 to 241 million in 2023—growing more than sevenfold with accelerating rates, especially in the past two decades, posing serious challenges to agriculture and food security (Pakistan Bureau of Statistics, 2023).

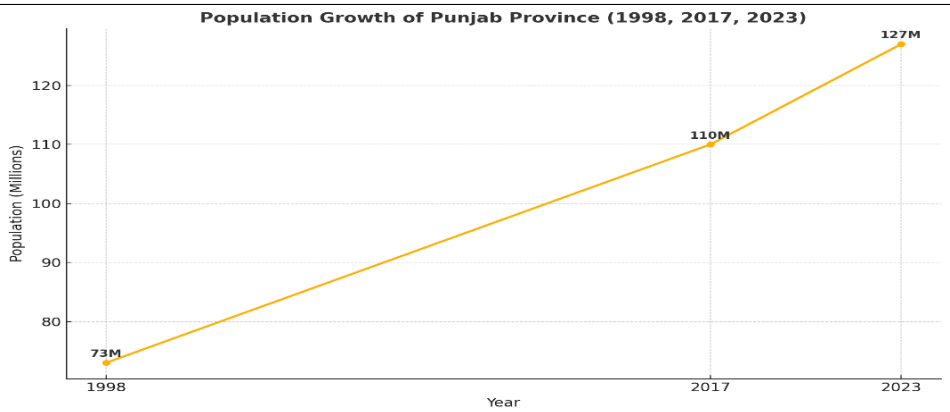


Figure 2. Historical Analysis of Population Growth in Punjab

The graph illustrates the steady rise in Punjab's population from 73 million in 1998 to 127 million in 2023, highlighting a significant demographic growth over 25 years. ((Pakistan Bureau of Statistics, 2023)

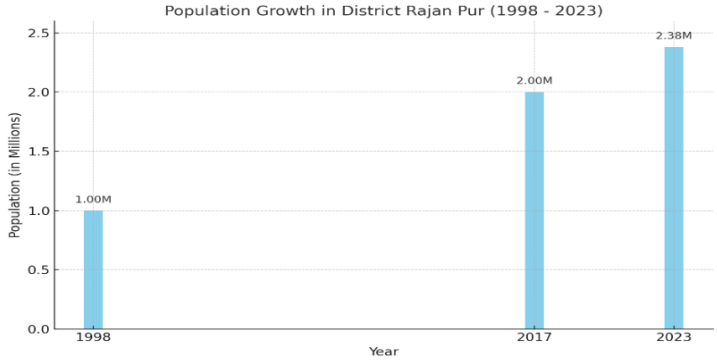


Figure 3. Historical Analysis of Population Growth in District Rajan Pur

District Rajan Pur's population surged by 116.4% from 1998 to 2023, reflecting sustained high growth rates that raise critical concerns about land fragmentation, declining agricultural productivity, food insecurity, and increased seasonal migration (Pakistan Bureau of Statistics, 2023)

1.1 Land Fragmentation and Food Security in Pakistan

The data reveals a concerning trend of increasing population and land fragmentation in Pakistan between 1980 and 2000. While the number of landholders grew from 4.07 million to 8.26 million, the population surged from 78.05 million to 179.4 million, outpacing the growth in landholders. This resulted in a decrease in average landholding size and an increase in the population-to-landholder ratio, indicating land fragmentation. The slower growth in landholders compared to population suggests that more people are competing for smaller landholdings, potentially leading to reduced agricultural productivity, increased poverty, and food insecurity (Table 1).

Table 1: Number of Landholdings in Pakistan

Sr. No.	Landholding (Million)	Years	Total Population (Million)
1	4.07	1980	78.05
2	5.07	1990	107.6
3	8.26	2010	179.4

Source: Agriculture Census 2010.

The data reveals a concerning trend of increasing land fragmentation in Punjab between 2000 and 2010. The proportion of small landholders surged from 85.4% to 91%, indicating a significant increase in fragmented landholdings. Conversely, medium and large landholders saw a decline, from 9.5% to 7% and 5.1% to 2% (Table 2).

Table 2: Number of Landholdings in Punjab

Sr. No.	Category (%)	Years		Total Population (Million)	
		2000	2010	2000	2010
1	Small	85.4	91		
2	Medium	9.5	7	75.63	93.49
3	Large	5.1	2		

Source: Agriculture Census 2010.

A. Small Farmer: Landholding of under 12 acres
B. Medium Farmer: Landholding of 12 to under 25 acres
C. Large Farmer: 25 to above 25 acres

The increasing land fragmentation in Punjab, as evident from the rising proportion of small landholders from 85.4% in 2000 to 91% in 2010, poses a significant threat to food security in the region. With a growing population and decreasing average landholding size, agricultural productivity is likely to decline, leading to reduced crop yields and decreased food availability. This trend is particularly concerning in Punjab, which is often referred to as the "breadbasket" of Pakistan, accounting for a significant portion of the country's food production. The fragmentation of landholdings can lead to reduced economies of scale, increased costs, and decreased investment in agriculture, ultimately resulting in food insecurity and potential shortages.

1.2 Research Objective

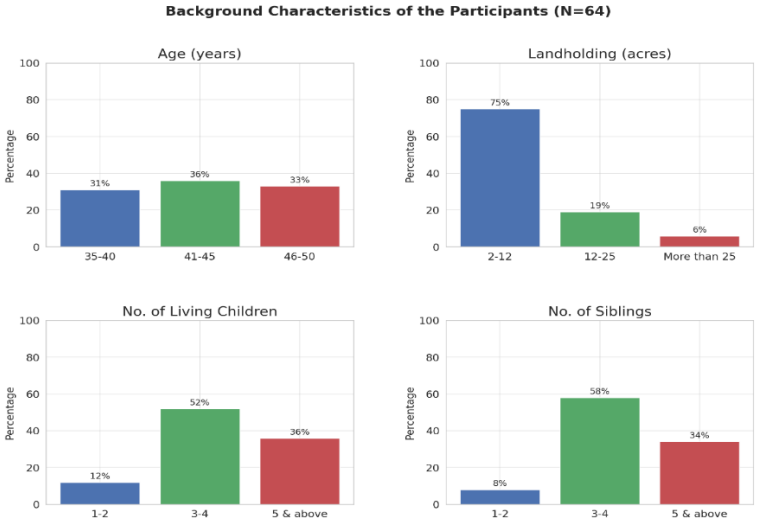
To explore the relationship of population growth with land fragmentation and its impact on agricultural productivity and food security in District Rajan Pur, Pakistan.

2. Materials and Methods

The research adopted a phenomenological design to explore the lived experiences of landholders and land administration officials regarding the nexus of rapid population growth, land fragmentation, and food insecurity. The target population consisted of primary stakeholders—specifically landholders with at least 2 acres of cultivable land and aged between 35 and 50 years—as well as key informants from land administration. The study was conducted in villages characterized by high population growth and substantial cultivated land. Using a convenience sampling technique, a total of 64 participants were selected. Data collection was carried out through focus group discussions (FGDs) with landholders and interviews with key informants to gather in-depth insights. The collected data were analyzed using thematic analysis, enabling the identification of recurring themes and patterns reflective of participants' perspectives and experiences.

3. Results

3.1 Background characteristics of the participants (N=64)



3.2 Thematic Analysis: Thematic analysis was applied on the focus group discussions and KIIs. The following themes and sub-themes emerged from the data.

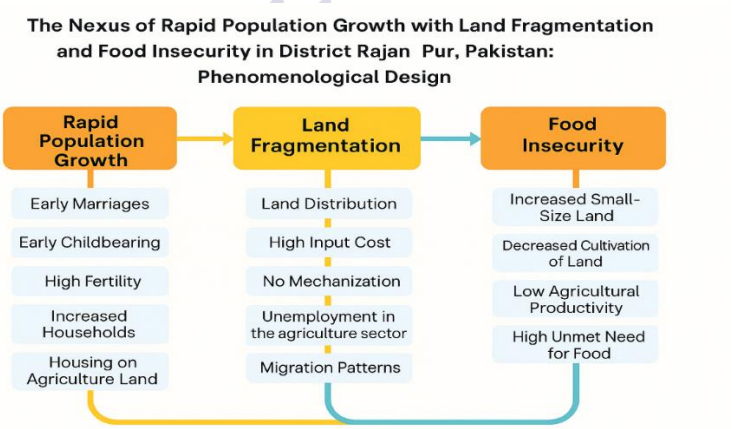
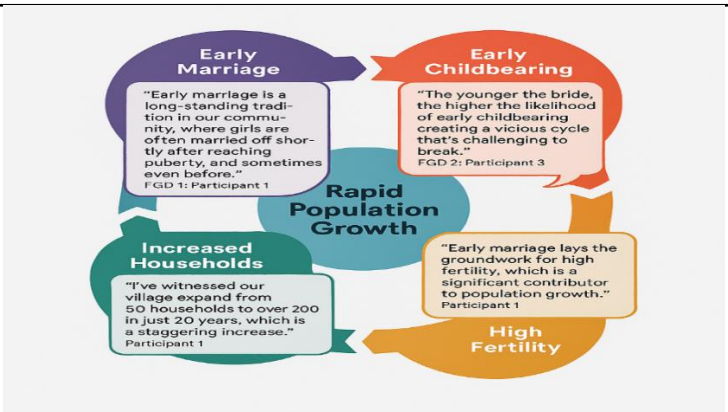


Figure 4. Categories of Themes and Sub-themes

Theme 1. Rapid Population Growth: Under the theme of rapid population growth, the sub-themes were discussed below by referring to the quotations of the participants:



Sub-theme 1.1: Early Marriage: A Persistent Trend

Many respondents described early marriage as a norm passed down through generations. As one participant reflected, "Early marriage is a long-standing tradition in our community, where girls are often married off shortly after reaching puberty, and sometimes even before". This intergenerational continuity was further elaborated by another, who stated, "In our society, it's customary for girls to be married at the tender age of 16 or 17, while boys are married at 18 or 19. This practice has been perpetuated over generations".

Others spoke about the perceived protective and moral function of early marriage. "Early marriage is perceived as a means of securing a girl's future and ensuring her well-being. However, it ultimately perpetuates a cycle of poverty and limited opportunities", highlighting the contradiction between intent and outcome.

The practice was also linked to socio-economic rationales. A government official remarked, "Families often believe that marrying off their daughters at a young age will alleviate financial burdens and shield them from unnecessary educational pursuits", indicating that poverty and gendered expectations continue to reinforce early marital arrangements. The normative force of early marriage appears difficult to resist, even among those with higher education. "The prevalence of early marriage is so widespread that even educated families are not immune to its influence. It's a societal pressure that's challenging to resist", one official explained.

Sub-theme 1.2: Early Childbearing: A Consequence of Early Marriage

As one participant stated, "The younger the bride, the higher the likelihood of early childbearing, creating a vicious cycle that's challenging to break", emphasizing the recurring nature of this phenomenon within communities. Social pressures further entrench this pattern, with another participant noting, "Families often desire to see grandchildren soon after marriage, placing pressure on couples to conceive quickly, which leads to early childbearing and, ultimately, rapid population growth". A few respondents reflected on how delaying marriage could offer a policy lever for addressing this trend. "Early childbearing is a direct consequence of early marriage and significantly contributes to population growth. Delaying marriage can, in turn, delay childbearing and slow population growth", suggesting the demographic impact of cultural timelines around marriage.

The absence of institutional support, particularly in education and reproductive health, was seen as exacerbating the problem. A local official emphasized this structural gap, stating, "The lack of access to education and family planning resources often results in unplanned and frequent childbearing, exacerbating the issue".

Sub-theme 1.3: High Fertility

As one participant put it, "Early marriage lays the groundwork for early high fertility, which is a significant contributor to population growth". Several participants confirmed that girls married in their teens were more likely to have multiple children due to extended reproductive windows. "When girls are married at a young age, they're more likely to have

multiple children, resulting in higher fertility rates", and "Early childbearing extends the reproductive years, leading to more children and increased fertility". The participants collectively viewed this pattern as a "straightforward equation" with vast consequences. "Higher fertility rates are a direct consequence of early marriage and early childbearing – a straightforward equation with far-reaching implications". Others underscored the demographic urgency of this cycle: "Early marriage and early childbearing lead to a higher total fertility rate, which is a pressing concern", and "The younger the mother, the higher the fertility rate – a trend that needs to be reversed to mitigate population growth". In addition to population pressure, participants pointed to the socioeconomic and environmental consequences. "Early high fertility puts immense pressure on resources, infrastructure, and the environment, underscoring the need for urgent action", and "Early high fertility leads to larger family sizes, which puts additional pressure on land resources and infrastructure, exacerbating the challenges of sustainable development". The urgency of intervention was further stressed: "Addressing early marriage and early childbearing is crucial to reducing high fertility rates and slowing population growth".

From a policy standpoint, the recommendation was clear. "Early high fertility is a critical factor in population growth, and addressing it through education and family planning is essential to mitigating its impact". These insights reflect both the lived experiences of the communities and the administrative observations of local officials, collectively revealing a culturally reinforced demographic pattern that requires targeted policy and awareness-based interventions.

Sub-theme 1.4 Increased Households: A Reflection of Unrestrained Population Growth

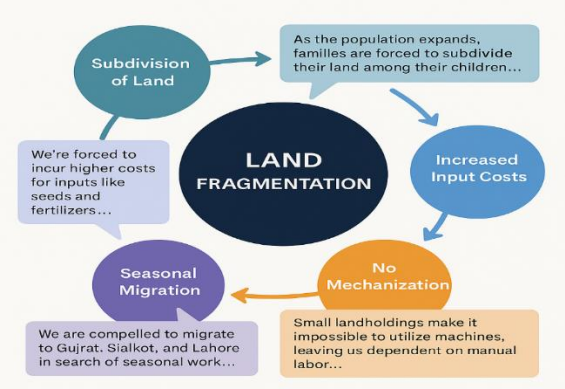
Participants narrated these changes through concrete experiences. "I've witnessed our village expand from 50 households to over 200 in just 20 years, which is a staggering increase". Another participant noted, "I recall when our village had only 20 households; now it's over 100 – a remarkable increase that warrants attention". This observed expansion of households was consistently associated with growing pressure on limited infrastructure and services. The implications of this rise were described as far-reaching and unsustainable. "The number of households has grown exponentially, placing immense pressure on resources and infrastructure", while others highlighted that "More households translate to more mouths to feed, more children to educate, and increased pressure on healthcare services". From a planning and development perspective, the increase was seen as overwhelming: "The growing number of households is unsustainable, leading to increased demand for resources that outstrip supply".

Administrative officials echoed similar sentiments grounded in professional observation. "As patwaris, we've documented a significant surge in households over the years, which is a pressing concern". Another official remarked, "The increase in households adds complexity to resource management and infrastructure development", while Patwari added, "We've observed a substantial rise in households, which strains our record-keeping and data management systems." The Tehsildar summarized the cumulative challenge: "The growing number of households puts unsustainable pressure on resources, infrastructure, and services, necessitating a comprehensive response." This reflection captures a shared experiential reality where population expansion has translated into structural stress, reinforcing the need for strategic interventions that integrate family planning, infrastructure development, and population governance.

Theme 2. Land Fragmentation

Rapid population growth and land fragmentation are intricately linked, as the former drives the latter. As the population expands, the demand for land increases, leading to the subdivision of existing landholdings into smaller parcels, resulting in land fragmentation. This, in turn, leads to reduced farm sizes, decreased agricultural productivity, and increased pressure on natural resources, perpetuating a cycle of inefficiency and degradation. The fragmentation of land also leads to reduced economies of scale, increased costs for farmers, and decreased food security, ultimately exacerbating the challenges posed by rapid population growth. Conversely, land fragmentation can also contribute to rapid population growth by displacing rural communities and driving migration to urban areas,

further straining resources and infrastructure. This interconnected dynamic underscores the need for sustainable land use planning, efficient agricultural practices, and population management strategies to mitigate the far-reaching consequences of rapid population growth and land fragmentation.



Sub-theme 2.1: Subdivision of Land

A grassroots participant articulated this cause-effect relationship: "As the population expands, families are forced to subdivide their land among their children, leading to smaller and more fragmented plots". Similarly, another stated, "Rapid population growth creates an insatiable demand for land, resulting in fragmentation and reduced farm sizes", establishing a direct link between demographic pressure and land subdivision. The phenomenon was described as not only widespread but structurally consequential. A participant highlighted, "Land fragmentation is a direct consequence of rapid population growth, rendering farming less viable and threatening the livelihoods of rural communities".

Supporting this, Patwari remarked, "We've witnessed landholdings dwindle over the years due to the relentless pressure of population growth and fragmentation." These insights reflect a shared experiential reality—where intergenerational land division weakens agricultural viability. Participants also expressed the economic and food security implications of this trend. Patwari explained, "Smaller landholdings lead to decreased agricultural productivity, increased poverty, and a vicious cycle of economic hardship." Naib-Tehsildar echoed the structural concerns: "Rapid population growth exerts immense pressure on land resources, leading to fragmentation, reduced farm sizes, and decreased economic viability." Both Naib-Tehsildar and Tehsildar drew attention to broader development risks, stating respectively: "Land fragmentation is a pressing challenge in our area, driven by the rapid growth of the population and the resulting strain on land resources" and "Land fragmentation is a critical consequence of rapid population growth, leading to reduced agricultural productivity, compromised food security, and increased vulnerability to poverty." Participants unanimously underscored the need for sustainable responses. As one official concluded, "To mitigate the adverse effects of rapid population growth and land fragmentation, we need to adopt sustainable land use planning and agricultural practices that prioritize efficiency, productivity, and environmental sustainability".

Sub-theme 2.2 Increased Input Cost

For many, the subdivision of land across generations has led to holdings too small to remain profitable. As one farmer explained, "The subdivision of land has resulted in decreased landholdings, rendering it increasingly challenging to farm efficiently and profitably". This pattern has created diseconomies of scale, where input costs for fertilizers, seeds, and irrigation no longer match the meager output. As another participant stated, "With smaller landholdings, we're forced to incur higher costs for inputs like seeds and fertilizers, eroding our profit margins". Participants expressed the growing sense of economic strain with clear urgency. One noted, "Land fragmentation has led to a significant increase in input costs, reducing our profitability and threatening the sustainability of our farms", while another observed, "We're compelled to purchase inputs at higher prices

due to reduced economies of scale, further exacerbating the challenges faced by farmers". These statements reflect not only material hardship but a deeper existential concern: "The combination of decreased landholdings and increased input costs is a recipe for disaster for farmers like us, threatening our very existence".

This concern was echoed by government officials, who offered corroborative perspectives. A patwari confirmed, "We've witnessed landholdings shrink, leading to increased input costs and reduced agricultural productivity, compromising the livelihoods of farmers". A naib-tehsildar further articulated the macro-level risk: "Land fragmentation leads to increased input costs, reduced farm sizes, and decreased agricultural productivity, threatening the sustainability of agriculture". Tehsildar 1 emphasized the systemic nature of the issue, "Land fragmentation has resulted in decreased landholdings, increased input costs, and reduced agricultural productivity, underscoring the need for comprehensive solutions." As Tehsildar concluded, "To ensure sustainable agriculture, we need to address land fragmentation and its impact on input costs, exploring innovative solutions to mitigate these challenges."

Sub-theme 2.3: No Mechanization: A Consequence of Land Fragmentation

The small and scattered nature of landholdings emerged as a central constraint. One farmer explained, "Small landholdings make it impossible to utilize machines, leaving us dependent on manual labor, which is time-consuming and inefficient". Another participant echoed this concern, stating, "Due to the small size of our landholdings, investing in machinery is not feasible, so we're stuck with manual farming, which is less productive". These views reflect the experiential reality that land fragmentation is not just a logistical issue—it directly restricts access to technological advancement. The impact on productivity was frequently noted. "The fragmented nature of our landholdings precludes the use of mechanized farming, relegating us to traditional methods that yield lower productivity". This was reiterated in multiple focus groups, with one participant noting, "Land fragmentation has made it impossible to adopt mechanized farming, resulting in reduced productivity and efficiency". Others viewed it as an economic barrier: "Mechanization is a luxury that's beyond our reach due to land fragmentation, forcing us to rely on manual labor."

The administrative stakeholders corroborated these sentiments. A patwari noted, "We've observed that land fragmentation forces farmers to resort to traditional methods, which negatively impact their productivity". Similarly, a naib-tehsildar remarked, "Mechanization is essential for efficient farming, but land fragmentation makes it unattainable", while another asserted, "The lack of mechanization due to land fragmentation has resulted in decreased agricultural productivity and income". From a strategic standpoint, the Tehsildars emphasized the broader policy implications. "Land fragmentation has led to a lack of mechanization, compromising agricultural productivity and food security". To counter this, the Tehsildar proposed, "Addressing land fragmentation is crucial to enabling mechanization and improving agricultural productivity."

Sub-theme 2.4: Increased unemployment in the agriculture sector

Several participants highlighted how the subdivision of agricultural land has limited their capacity to sustain larger workforces. "With smaller landholdings, we can't employ as many people as we used to, leading to reduced unemployment". This was echoed by others who linked declining productivity with less labor demand: "Low agricultural productivity means less labor is required, resulting in decreased unemployment". Participants across villages expressed a shared reality of constrained hiring capacity: "We can't afford to hire many laborers due to low productivity and small landholdings". The phenomenon, however, was interpreted not as a positive indicator of economic improvement, but rather as a symptom of structural agricultural distress. One participant remarked, "Unemployment in agriculture has decreased, but it's not a good sign, as it indicates reduced productivity and viability".

This paradox was further reinforced by administrative insights. A patwari noted, "We've seen a decline in agricultural employment due to land fragmentation and low productivity", while a naib-tehsildar observed, "Land fragmentation and low agricultural productivity have resulted in decreased employment

opportunities in agriculture". From the perspective of policy and planning, tehsildars emphasized the broader implications for rural livelihoods. "Land fragmentation and low agricultural productivity have led to a decline in agricultural employment, which is a concern for rural livelihoods", urging that "We need to address land fragmentation and low productivity to create more employment opportunities in agriculture".

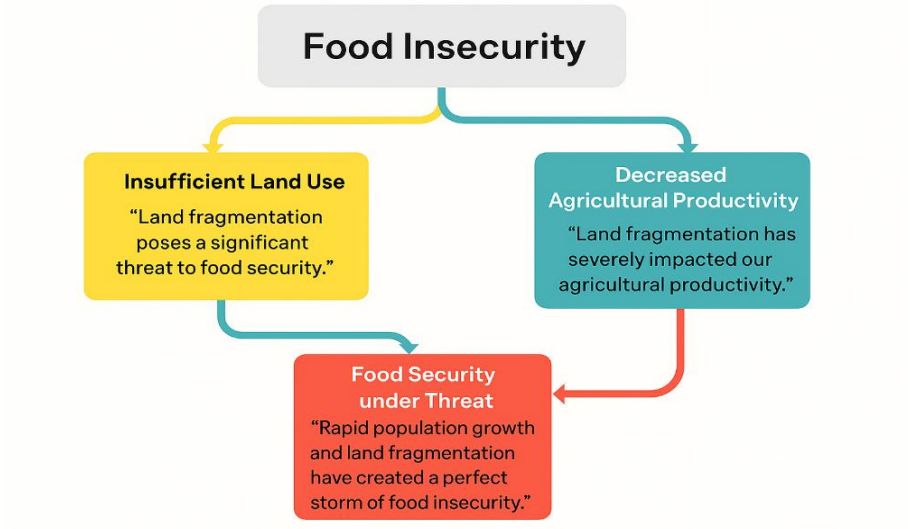
Sub-theme 2.5: Seasonal Migration: A Coping Mechanism for Livelihood

Several participants shared how shrinking land sizes and poor yields have made year-round sustenance untenable. One participant explained, "We are compelled to migrate to Gujrat, Sialkot, and Lahore in search of seasonal work, as our agricultural yields are insufficient to sustain us throughout the year". Echoing this view, another remarked, "Seasonal migration has become our only viable option to supplement our income, as agriculture alone cannot provide a stable livelihood". Migration was not limited to a specific time but spanned across seasons and districts. "During the off-season, we venture to central Punjab in search of work, as our local land cannot support us year-round". The recurring theme of migration as necessity rather than opportunity was reiterated: "Migration has become a necessity due to the fragmentation of land and low productivity, which severely limits our livelihood options".

Administrative officials affirmed this pattern. One patwari observed, "A significant number of people from our area migrate seasonally to central Punjab in search of work, due to the decline in agricultural yields". A Naib-Tehsildar added, "The fragmentation of land and low agricultural productivity have directly contributed to seasonal migration, resulting in reduced livelihood options". The shared consensus was that agriculture alone no longer guarantees economic stability, compelling even traditionally rooted farmers to leave. One Tehsildar succinctly summarized the issue's depth: "Seasonal migration is a pressing concern, as it highlights the decline in agricultural productivity and limited livelihood options in our area". The need for systemic solutions was articulated as well: "To mitigate seasonal migration, we need to address its root causes, such as land fragmentation and low productivity, and create more livelihood opportunities locally".

Theme 3: Food Insecurity

Rapid population growth leads to land fragmentation, which in turn reduces agricultural productivity and increases food insecurity, as smaller landholdings are less efficient and productive, making it challenging to meet the food demands of a growing population.



Sub-theme 3.1: Insufficient Land Use

Participants viewed fragmentation as directly responsible for declining food production. One landholder noted, "The fragmentation of our landholdings has severely compromised our ability to meet the food demands of our growing population", while another reflected on its intergenerational consequences, stating, "We're grappling with the challenge of producing sufficient food due to land fragmentation, which has dire implications for the future of our children". The decline in traditional seasonal crops was repeatedly cited as a visible consequence. "The decline of sugarcane, rice, and wheat due to small land sizes has devastated our food security and livelihoods," shared one participant. Similarly, a respondent added, "Land fragmentation has made it increasingly difficult to achieve food self-sufficiency".

Key informants corroborated these observations. A patwari noted, "The majority of landholders in our area possess small landholdings, which are woefully inadequate to meet the food demands of a burgeoning population". Another highlighted the severity of crop loss: "The fragmentation of land has led to a precipitous decline in seasonal crops, compromising food security". Administrative officers also stressed the broader implications. "The impact of land fragmentation on food security is nothing short of alarming," observed a Naib-Tehsildar, while another pointed to the cascading effects on productivity: "We're witnessing a significant decline in agricultural productivity due to small land sizes". The urgency of intervention was echoed by senior officers. "Land fragmentation poses a significant threat to food security, necessitating urgent attention and action," stated a Tehsildar, and another added, "The decline of seasonal crops due to land fragmentation is a pressing concern... we must promote sustainable agricultural practices".

Sub-Theme 3.2: Decreased Agricultural Productivity

Several farmers noted that small and scattered plots hinder efficient cultivation, with one stating, "The fragmentation of land has severely impacted our agricultural productivity, rendering it increasingly challenging to meet the food demands of our growing population." Another participant elaborated, "Small landholdings often lead to inefficient farming practices, resulting in diminished yields and compromised food security." This perspective was echoed throughout the data, especially in regions where land has been divided over generations. As one landholder put it, "We're grappling with the consequences of land fragmentation, which has significantly reduced our agricultural productivity and threatens our food security." Another reflected on the broader livelihood implications, saying, "The decline in crop yields due to land fragmentation has had a profound impact on our livelihoods and food security."

Key informants from the revenue and administrative sector confirmed this link between fragmentation and productivity loss. A patwari noted, "Land fragmentation has resulted in a notable decline in agricultural productivity, affecting food availability and security." Another observed, "The small size of landholdings hinders the adoption of efficient farming practices, leading to reduced productivity and food insecurity." Administrative officers called for urgent interventions, with a Naib-Tehsildar stressing, "Land fragmentation poses a significant threat to agricultural productivity and food security, requiring immediate attention." Another emphasized sustainable practices, noting, "The alarming decline in agricultural productivity highlights the need to promote sustainable solutions to this pressing issue." Finally, Tehsildars reflected on the long-term consequences for food systems and intergenerational equity. "The impact of land fragmentation on agricultural productivity is far-reaching and demands a comprehensive response," remarked one. Another concluded, "To ensure food security for future generations, we must address land fragmentation and implement effective measures to restore productivity."

Sub-theme 3.3: Food Security under Threat

Participants across focus group discussions and key informant interviews consistently identified food insecurity as a critical consequence of land fragmentation, low agricultural productivity, and rapid population growth. These structural challenges have collectively undermined the capacity of communities to achieve food self-sufficiency, creating a precarious situation that affects both current and future generations.

The inefficient use of fragmented land was frequently cited as a primary barrier to adequate food production. As one participant observed, "The inefficient use of land and low productivity have severely curtailed food availability, posing a significant threat to our food security." This was reinforced by another who stated, "The rapid growth of our population and the fragmentation of land have created a perfect storm of food insecurity, making it increasingly difficult to meet the demands of our people." Several participants described how the interplay of small landholdings and low yields has significantly hampered local food systems. One noted, "The confluence of low agricultural productivity and small landholdings has made it extremely challenging to achieve food self-sufficiency." Another emphasized the compounded burden, stating, "Food security is under siege due to the trifecta of insufficient land use, low productivity, and rapid population growth."

Key informants echoed these views, adding that administrative and environmental constraints further complicate local food security. A Patwari reflected, "The inadequate use of land and low productivity have resulted in a substantial decline in food availability." Another highlighted structural pressures, stating, "Rapid population growth and land fragmentation are two major factors that have significantly contributed to food insecurity." From an institutional perspective, the urgency of these challenges was underscored by Naib-Tehsildars, with one noting, "Food security is a pressing concern due to the interplay of insufficient land use, low productivity, and rapid population growth." While another added, "The fragmentation of land has led to a notable decline in agricultural productivity, affecting food availability and security." The insights of Tehsildars encapsulated the collective concern and pointed to pathways for policy response. As one asserted, "The cumulative effect of insufficient land use, low productivity, and rapid population growth has been a significant decrease in food security." Another emphasized the way forward: "To achieve food security, we must address land fragmentation, improve agricultural productivity, and ensure sustainable land use."

4. Discussion

The literature consistently demonstrates that early marriage and early childbearing are pivotal factors contributing to rapid population growth, particularly in South Asia and Sub-Saharan Africa. Studies from Nepal, Tanzania, and Kenya confirm that girls married before 18 often experience high fertility and rapid successive births, extending their reproductive years and increasing family size (Raj, 2010; Maharjan, 2016; Mbozi, 2017; Jejeebhoy, 2017; Mutua, 2018; Islam, 2019). These trends are reinforced by socio-cultural norms, poverty, and lack of education, which pressure young couples into early parenthood. High fertility, as reported in India, Ethiopia, and Bangladesh, not only intensifies population growth but also correlates with poverty and restricted access to family planning and reproductive health services (Bongaarts, 2016; Das, 2017; Tsegaye, 2018).

As the population grows, land fragmentation becomes increasingly prevalent, leading to adverse effects on agricultural productivity, mechanization, and rural employment. Research from Ghana, Bangladesh, and Pakistan reveals that fragmented landholdings result in inefficient farm operations, increased input costs, and limited economies of scale (Niroula & Thapa, 2005; Akramov & Malek, 2012; Rahman & Rahman, 2013; Ali & Khan, 2013; Hussain & Khan, 2015; Chand & Kumar, 2016). These constraints hinder mechanization, as observed in Nepal and Ethiopia (Joshi & Kumar, 2017; Taffesse & Rashid, 2018), and reduce employment in agriculture (Jayne & Muyanga, 2018; Mmasa & Msangi, 2019), forcing many households to rely on seasonal migration as a coping mechanism (de Haan, 2017; Sharma, 2015; Khan, 2018).

The resulting food insecurity is a multi-dimensional crisis linked to insufficient land use, low agricultural productivity, and population pressures. Studies from Malawi, Rwanda, and Ethiopia highlight how shrinking and inefficient landholdings reduce the capacity to produce food, worsening food insecurity and poverty (Maxwell & Wiebe, 1998; Mussa & Masanjala, 2015; Ntagoma & Mugisha, 2017; FAO, 2017; Ayele & Ayele, 2018). This is exacerbated by low productivity and climate stress, as shown in Nigeria and South Africa, where agricultural stagnation correlates with hunger and rural impoverishment (Godfray et al., 2010; Ovwigho &

Ifie, 2016; Machete & Bahta, 2018). Food security threats are most severe where land fragmentation, population growth, and limited access to markets intersect, as evidenced in Uganda and Kenya (Nabbumba & Bahiigwa, 2015; Mugo & Ong'ayo, 2017; Conway, 2012).

Conclusion

The study revealed a significant impact of land fragmentation on agricultural productivity and food security. Participants, patwaris, naib-tehsildars, and tehsildars agreed that land fragmentation has led to reduced agricultural productivity, decreased food availability, and increased food insecurity. Rapid population growth and insufficient land use were identified as major factors contributing to land fragmentation, resulting in small landholdings, low productivity, and reduced food self-sufficiency.

To address these challenges, it is essential to adopt sustainable agricultural practices, improve land use efficiency, and promote agricultural productivity. Additionally, addressing rapid population growth and land fragmentation through effective land management policies and initiatives is crucial to ensuring food security and livelihoods. The findings highlight the need for urgent action to address land fragmentation, improve agricultural productivity, and ensure sustainable land use to achieve food security and support the well-being of future generations.

REFERENCES

Agyemang, S., & Nyantakyi-Frimpong, H. (2017). Land use planning and agricultural productivity in Ghana. Journal of Agricultural Economics and Development, 6(1), 1-12.

Akramov, K. T., & Malek, M. (2012). Analyzing the determinants of agricultural productivity in Ghana. Journal of Agricultural Economics, 63(2), 347-365.

Ali, A., & Khan, M. A. (2013). Impact of land fragmentation on agricultural productivity in Pakistan. Journal of Agricultural Economics and Development, 2(1), 1-11.

Ali, S., & Khan, H. (2013). Land fragmentation, input cost, and agricultural productivity. Pakistan Journal of Agricultural Economics, 26(1), 55–72.

Ayele, G., & Ayele, S. (2018). Land use efficiency and agricultural productivity in Ethiopia. Journal of Agricultural Economics, 69(2), 347-358.

Bongaarts, J. (2016). Global fertility and population trends. Population and Development Review, 42(2), 231-244.

Bongaarts, J. (2016). Slow down population growth. Nature, 530(7591), 409–412. https://doi.org/10.1038/530409a

Chand, R., & Kumar, P. (2016). Land fragmentation and its impact on agricultural productivity. Economic and Political Weekly, 51(10), 49–55.

Cohen, J. E. (2017). Human population: The next half century. Science, 358(6362), 635-638.

Conway, G. (2012). One billion hungry: Can we feed the world? Cornell University Press.

Das, S. (2017). Determinants of high fertility in India. Journal of Population Research, 34(2), 141-155.

De Haan, A. (2017). Livelihoods and migration in rural India. Journal of Development Studies, 53(1), 85-101.

FAO. (2017). The state of food security and nutrition in the world. Food and Agriculture Organization of the United Nations.

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., ... & Toulmin, C. (2010). Food security: The challenge of feeding 9 billion people. Science, 327(5967), 812-818.

Hussain, A., & Khan, M. A. (2015). Impact of land fragmentation on agricultural productivity and profitability in Pakistan. Journal of Agricultural Economics and Development, 4(1), 1-10.

Islam, M. M. (2019). Early childbearing and fertility in Bangladesh. Journal of Biosocial Science, 51(2), 247-258.

Jayne, T. S., & Muyanga, M. (2018). Smallholder farm sizes and agricultural commercialization in Kenya. Journal of Development Studies, 54(1), 85-101.

Jejeebhoy, S. J. (2017). Women's autonomy and reproductive health in India. Journal of Biosocial Science, 49(2), 147-158.

Joshi, P. K., & Kumar, P. (2017). Impact of land fragmentation on agricultural productivity in India. Journal of Agricultural Economics, 68(2), 347-358.

Khan, A. U. (2018). Seasonal migration and rural livelihoods in Bangladesh. Journal of Rural Studies, 61, 141-152.

Lanjouw, P., & Murgai, R. (2017). Poverty and inequality in rural India. Journal of Development Economics, 128, 137-149.

Machete, C. L., & Bahta, Y. T. (2018). Agricultural productivity and food security in South Africa. Journal of Agricultural Economics and Development, 7(1), 1-13.

Maharjan, R. K. (2016). Early marriage and reproductive health in Nepal. Journal of Adolescent Health, 59(4), 441-446.

Maxwell, D., & Wiebe, K. (1998). Land tenure and food security: A review of concepts, evidence, and methods. Land Tenure Center Working Paper No. 129, University of Wisconsin-Madison.

Mbozi, P. S. (2017). Early marriage and fertility in Tanzania. Journal of Population Research, 34(1), 35-49.

Mmasa, J. J., & Msangi, J. P. (2019). Land fragmentation and agricultural productivity in Tanzania. Journal of Agricultural Economics and Development, 8(1), 1-12.

Mugo, F. W., & Ong'ayo, M. (2017). Land fragmentation and food security in Kenya. Journal of Agricultural Economics and Development, 6(2), 1-12.

Mussa, E. C., & Masanjala, W. H. (2015). Land tenure and food security in Malawi. Journal of Agricultural Economics and Development, 4(1), 1-11.

Mutua, M. K. (2018). Early childbearing and fertility in Kenya. Journal of Biosocial Science, 50(2), 193-204.

Nabbumba, R., & Bahiigwa, G. (2015). Climate change and food security in Uganda. Journal of Environmental Science and Health, Part B, 50, 345-354.

National Institute of Population Studies (NIPS). (2019). Pakistan Demographic and Health Survey 2017–18. Islamabad, Pakistan: NIPS and ICF.

Niroula, G. S., & Thapa, G. B. (2005). Impacts of land fragmentation on input use, crop yield, and production efficiency in the mountains of Nepal. Land Degradation & Development, 16(3), 337–350. https://doi.org/10.1002/ldr.665

Ntagoma, J., & Mugisha, J. (2017). Land fragmentation and food insecurity in Rwanda. African Journal of Agricultural Research, 12(19), 1633–1640. https://doi.org/10.5897/AJAR2017.12241

Ovwigho, B. O., & Ifie, P. A. (2016). Agricultural productivity and food security in Nigeria. Journal of Agricultural Economics and Development, 5(1), 1-10.

Pakistan Bureau of Statistics. (2012). Agriculture census 2010: All Pakistan report. Government of Pakistan. https://www.pbs.gov.pk/content/agriculture-census-2010-all-pakistan-report

Pakistan Bureau of Statistics. (2023). 7th Population and Housing Census – 2023. Islamabad, Pakistan: PBS.

Pandey, V. L., & Dhungana, B. R. (2017). Land fragmentation and its impact on mechanization and productivity: A study from Nepal. Journal of Agriculture and Environment, 18(1), 1–9.

Rahman, S., & Rahman, M. (2013). Land fragmentation and productivity: Empirical evidence from Bangladesh. Land Use Policy, 35, 34–40. https://doi.org/10.1016/j.landusepol.2013.04.011

Raj, A. (2010). When the mother is a child: The impact of child marriage on the health and human rights of girls. Archives of Disease in Childhood, 95(11), 931-935.

Todes, A. (2018). Urbanization and population growth in South Africa. Journal of Urbanism, 11(2), 141-155.

Tsegaye, A. (2018). High fertility and population growth in Ethiopia. Journal of Population Research, 35(2), 121-135.

Widyastari, D. A. (2019). Population growth and resource management in Indonesia. Journal of Environmental Management, 233, 137-144.