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Research Article

Evidence for Land Fragmentation and Awareness Around Agricultural Cooperatives

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Abstract

Small landholders face numerous problems in their daily life in India today namely, lack of access to financial credits and uneven access to technology in different regions of the country [1] and "limited procurement of food grains by the government institutions, and its failure to provide proper remunerative prices" are some of the pressing issues faced by small landholders. Along with this, the average size of Indian agricultural lands is much smaller compared to other grain-producing nations around the world.

Previously available literature argues three main factors for boosting land fragmentation in India – "the law of inheritance of paternal property, the absence of a progressive tax on inherited land, and underdeveloped land markets [2].

Land fragmentation might, however, according to the previous literature available also "drive untoward crop diversification, which may act as a risk-reducing strategy, especially in areas suffering from labor scarcity, natural disasters, and successive droughts." The majority of farmers in the country complain about irregular rainfalls, and draughts, which lead to the loss of a certain percentage of crops cultivated each year. The objective of this research study is dual-faced – on one hand, it aims to confirm the practice of land fragmentation in India and what small farmers think about this increasing trend. Secondly, the research strives to understand the small-holding farmers' understanding of cooperative societies and their demands and suggestions for a good functioning agricultural cooperative in their respective geographical regions. Last but not least, the business problem attempted to solve through this study includes the loopholes in the functioning of the existing cooperative society in respondents' villages and the gaps between the literature and the study's findings around the presence and acceptance of cooperative societies in Uttar Pradesh, a state in the north of India.

Keywords: Evidence; Land Fragmentation; Awareness; Agricultural Cooperatives

Introduction

In India, a decrease in the size of agricultural lands is a major challenge in maintaining productivity. On the economic side, lack of access to financial credits and uneven access to technology in different regions of the country [3] and limited procurement of food grains by the government institutions, and, its failure to provide proper remunerative prices are some of the pressing issues faced by small landholders.

Despite being, traditionally, an agriculture-based economy and its ability to increase production by four folds in the past few decades, the average yield of Indian farms is lower than other crop-producing countries of the world. Along with this, the average size of Indian agricultural lands is comparatively much smaller. The majority of farmers in the country complain about irregular rainfalls and the loss of some portion of crops every year. These problems and challenges overtake their financial and emotional capacities, often leading to acute stress and depression for small farmers. In many cases, the farmer ends up committing suicide to end this distress.

In this research project, I will test *the hypothesis*: "With decreasing agricultural farmland sizes and lesser incentives to farmers from the government, cooperatives can play a role in guiding and bringing together smallholder farmers to assist them in crop production, better yield, and sustainability of their farm income."

Through this research, I will try to find evidence for land fragmentation in India based on survey analysis, previous research, and government data available. The research aims to justify the hypothesis by critically studying the cooperative system in place and finding the functional gap based on the survey results. The essence of this research is the opinion and view of a small farmer.

The paper will proceed as follows: First, a detailed definition, causes, and effects of land fragmentation; second a note on the methodological approach used for the research; third the empirical approach utilized to explore the relationship between land fragmentation, its consequences and agricultural cooperatives is discussed, followed by conclusion and business recommendations at the end. The research paper has been kept simple and precise to make it easier to understand and for further analysis.

Literature Review

Land Fragmentation

Causes of land fragmentation around the world

Issues of fragmentation have long been discussed in the literature. Studies using the number "Land fragmentation, where a single farm comprises numerous individual parcels of land, is a common agrarian feature of many transitioning economies [4]. "In developing countries, land fragmentation is frequently linked to inheritance customers" [5].

[6], studied a trend of a steady decrement in "landholding size and an increasing number of land parcels caused by a tradition of paternal property subdivision among household heirs" and sentimental attachment to the paternal property.

This literature review gives more details about land fragmentation from an Indian society's perspective and how it is shaping the agricultural economy within the country. The survey analysis is expected to shed light on the farmer's opinions and problems faced by them because of increasing land fragmentation within the subcontinent.

Negative effects on farm productivity and cost of production

Many researchers conclude that land fragmentation is often an "obstacle to improving agricultural productivity and revenue" [5]. Tan., *et al*., 2008, revealed that land fragmentation induces inefficiencies in agriculture since it increases the costs of production and suggested that farmers with more and smaller plots tend to adopt fewer modern technologies as compared to farmers with larger-sized land farms. According to research by (Amer S. Jabarin, 1994), [6] "the average variable cost of producing wheat is a decreasing function of field size." (Shenggen Fan, 2005) [9] also showed that "a positive relationship exists between the farm size and labor productivity, hence the income."

Many other studies confirm that land fragmentation" has a significant detrimental effect on farm productivity" [7]. We will see from the results of the survey conducted in this research study how to land fragmentation is affecting the financial state of small farmers. Also, whether it is beneficial or detrimental to the productivity of their farmlands will be concluded.

Positive effects of land fragmentation

While it has been evidenced that "land fragmentation is often detrimental to the farmer's economic situation" and productivity of the land, there are a couple of situations when fragmentation can also benefit the farmers. Since, additional fields are added to the farmer's land portfolio, "aggregate production variance and the risk of failing to meet the minimum needs are reduced." By pooling the harvests of dispersed and scattered fields, households get a buffer from "production shortfalls in an environment characterized by temporally and spatially unpredictable microclimatic and agro-ecological factors. Moreover, farmers can take advantage of this de-facto diversification and grow products that would be marketed at different periods during the year." [8] "Land fragmentation might, however, also drive crop diversification, which may act as a risk-reducing strategy, especially in areas suffering from labor scarcity, natural disasters, and successive droughts" (Gopal B. Thapa, 2008) [4].

On one hand, fragmentation exerts a direct negative effect on land productivity. Greater fragmentation definitely will reduce revenues. On the other hand, there is an indirect positive effect on the farmer's situation. "More fragmentation also increases farm crop diversification, and this, in turn, has a positive effect on profitability. The reduction in revenues due to higher levels of land fragmentation can thus be buffered by the positive role that fragmentation has on diversification [9]. In addition, diversification can contribute to improvements in soil fertility, if crops with different nutrient requirements use soil resources more optimally. Farmers also apply fertilizers differently to different Fan and Chan, 2005, Is small beautiful? Farm size, productivity, and poverty in Asian agriculture crops and ultimately some sort of balanced application of fertilizer is ensured" (A.V. Manjunatha, 2013) [10]. For instance, (Goland, 2008) [11] found that South Peruvian farmers were ready to tolerate a reduction in productivity due to fragmented land because it reduces production risks since smaller plots allow crop diversification.

Diversification of the produce portfolio is considered a key benefit of the fragmented land holdings. It allows the agricultural land to include different attributes such as cropland, pastures, orchards, vineyards, etc. Doing this reduced the vulnerability to price risk or losing one single crop due to its "sensitivity to excessive rainfall, drought, or pests" (McCloskey, 1972) [12]. Moreover, it may ease bottlenecks and allow the smooth seasonal supply of farm labor (FENOALTEA, 1976) [13].

Land fragmentation in India

In India, "limited off-farm employment and high risk coupled with insurance market imperfections are argued to have historically provided strong justification for fragmentation, with modest productivity losses and substantial benefits due to this phenomenon" (SENGUPTA, 2006) [14]. "Development of labor markets and a national employment guarantee scheme to provide implicit insurance [15]. that increased the cost of wage labor, and thus the relative advantages of mechanization, may have changed this, making an empirical investigation using microdata desirable".

"Overtime, in the process of land reform, there has been an increase in land fragmentation, a decrease in farm size, an increase in land degradation, and a redistribution of resource ownership" (Jha, Nagarajan, and Prasanna, 2005), (Mearns), [19].

"The literature argues for three main factors for boosting land fragmentation in India. These are the law of inheritance of paternal property, the absence of a progressive tax on inherited land, and an underdeveloped land market" [16]. Consequently, the country is inter alia experiencing a decline in farm size and an increase in the number of operational holdings. Between 1990-91 and 2000-01, the number of operational holdings increased from 106.64 million to 119.93 million, while the operational farm size reduced from 1.57 ha to 1.33 ha [3].

"This is the opposite of the trend in East Asian countries like Japan and South-Korea. In these countries, the farm size is getting larger and the number of operational holdings is reduced. In these countries, a gradual shift of the labour force from agriculture to nonagricultural sectors is experienced due to the availability of relatively attractive income opportunities outside the agricultural sector. This has resulted in land consolidation and encouraged commercialization, which has helped the farms towards more efficient utilization of labor and other inputs, thereby improving farm efficiency" [4].

"Au contraire, in India, land fragmentation has discouraged commercialization, thus promoting inefficiency in agricultural production [20,21]. Some of the contributing factors to inefficiency are a sub-optimal application of farm inputs, excess traveling time, loss of productive land due to bunding or hedging, difficulties in the use of modern technology as well as problems with monitoring [20,21].

Usually, credit institutions focus more on large farms considering the higher repayment capacity and risk-bearing ability. Due to this, small farms have to rely on informal credit markets where the interest rates are up to 40% per annum. Additionally, banks provide loans for income-generating activities mostly on their land but not to buy agricultural land (personal communication). Therefore, the farmers, especially the small ones need some special credit facilities to be able to increase their farm size.

State of agriculture in India

About half of the working population is employed in the agriculture sector. However, only 17.5% is the contribution of the agricultural sector to the GDP of the country (at current prices in 2015-16) [17]. Over the past decades, manufacturing and the services sectors have gained momentum and started contributing increasingly to economic growth, while the agriculture sector, whose contribution used to be above 50% in the 1950s, has dropped by more than half over these decades. India is often ranked among the top "producers of wheat, rice, pulses, sugarcane, and cotton." It has been the "highest producer and consumer of milk for some years now." Also, amongst the largest producers of fruits and vegetables in the world.

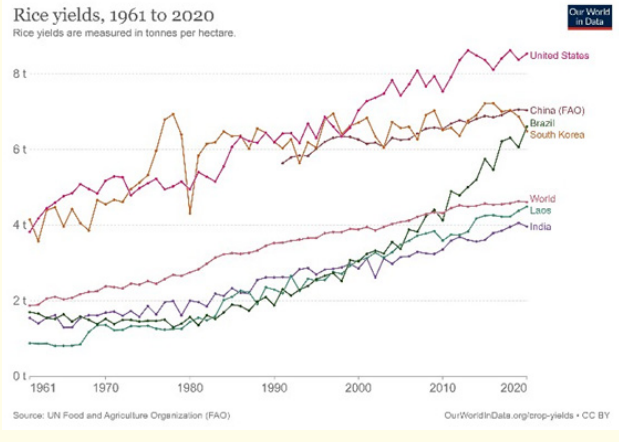

Figure 1: Wheat Yield (tonne/ha)
Source: Our world in data.

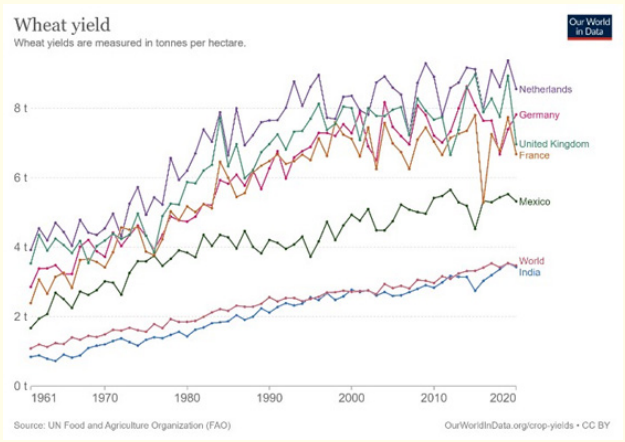

Figure 2: Wheat Yield (tonne/ha).
Source: Our world in data.

However, it has been found that the average yield of the crops is less when compared to other top producers like China, Brazil, and the United States. For instance, although India is ranked third when it comes to rice production, its yield is much lower than that of Brazil, China, and the United States. A similar trend has been observed in the case of pulses.

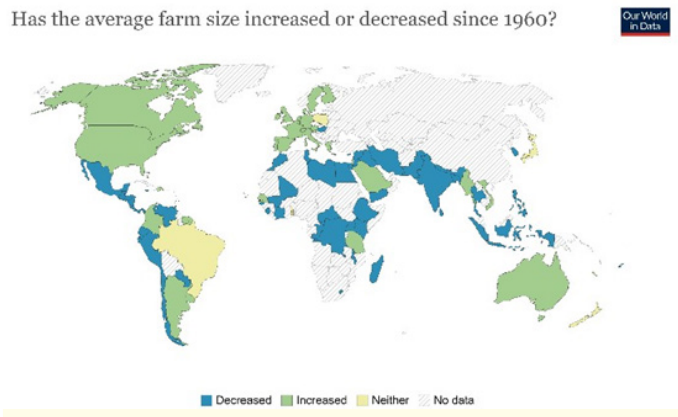

Figure 3: Increase or decrease in average farm size around the world since 1960.
Source: Our world in data.

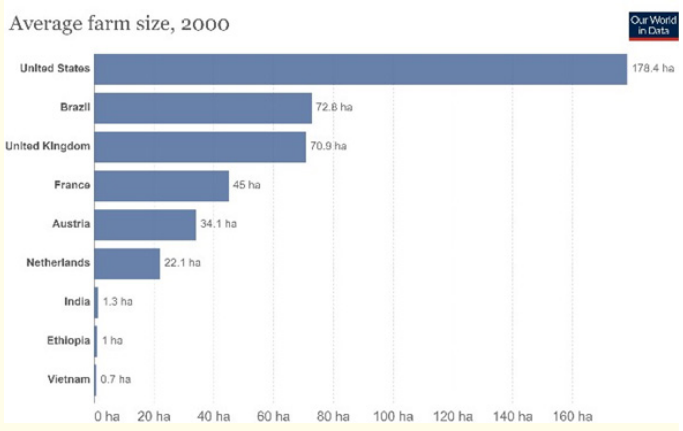

Figure 4: Average farm size in year 2000.
Source: Our world in data.

As seen in figure 3, which gives evidence based on findings by [18], the average farm size has decreased in most parts of Africa and south.

Asia, including the whole subcontinent of India. Moreover, when compared to other grain-producing nations, in figure 4, we see that India's average farm size in 2000 was comparatively much lower than others.

"The country's requirement for food grains to provide for its population is projected to be 300 million tonnes by 2025" (*Food and Agriculture Organization of the United Nations; PRS*). Excluding the events of adverse weather such as excessive and very low rainfall, extreme temperature conditions, and natural calamities, the productivity and yield of farms in India have been generally seen to increase. According to a response by the ministry of Agriculture and Farmers Welfare, research data shows that the average yield in India has been seen to be increasing past two decades [19] and is well on track with a 2% increase to reach the "target of 300 million tonnes by 2025".

"The Department of Agriculture, Co-operation and Farmers Welfare conducts an agriculture census every five years to collect data on structural characteristics of the agricultural sector including the size of agriculture land holdings in the country. As per the latest information available from Agriculture Census, the average size of operational holdings has decreased from 2.28 hectares in 1970-71 to 1.84 hectares in 1980-81, to 1.41 hectares in 1995-96, and 1.08 hectares in 2015-16." [20]. If we take into account the

trend observed in the agricultural land sizes and keep in mind the estimated increase in the population over the next decade, the fragmentation of land due to inheritance is most "likely to continue and the overall average size of operational land holdings in India is forecasted to decrease further" unless concrete measures are taken.

The government of India claims to be taking multiple steps and policy developments to make small farms more viable and productive for small farmers. It claims that promotional measures are being taken to include the "adoption of modern technologies and practices such as multiple cropping, intercropping, and integrated farming systems". The Indian Council of Agricultural Research (ICAR) has indeed been conducting research programs to develop region-specific crop varieties and farming technologies to enhance the productivity and grain production yield of Indian farmers, as evidenced by the increased yield of farmlands over the last two decades. What remains vague and questionable is the implementation of government laws and policies on the ground to increase the farm income and livelihood of small holders.

The situation of farmers in India

According to the *10th Agricultural census 2015-16*, "Uttar Pradesh accounted for the largest number of operational holdings or farmers at 23.8 million followed by Bihar" (16.4 million). Also, 1.08 hectares is the average land holding in India which is very small compared to other developing countries. For instance, more than half the farms in the United States are 445 acres or 180 hectares (United States Department of Agriculture, 2022), whereas, in Brazil, the average farm size is 10 hectares or less [21].

Moreover, it's unfortunate that every second farmer in the country is in debt. Most farmers make a lesser profit through agriculture than through their household expenditure. The consequences of this situation are critical as the suicide rate among Indian farmers keeps increasing as years pass by and farmer suicides account for about 7.4 percent of all suicides in India. Not to mention the effects of climate change in India, with an estimated drop in income by up to 25 percent over the upcoming years.

91% of the country's annual income through agriculture is earned by only 15% of the farmers, which shows an overwhelming inequality in this sector. Unsurprisingly, the brunt of debt and poverty is bore by the low-income and small landholders.

Factors affecting agricultural productivity in India.

Increase in small land holdings

"Since smaller land holdings are either fragment of larger holdings which have been passed on within the family or have been informally leased by a large holder, farmers who cultivate these holdings often do not have a formal lease agreement. The absence of such land records does not allow these farmers to access formal credit or be eligible for government benefits such input subsidies or crop insurance schemes" [22].

Land records and informal leasing

Out of the total land area in India, 10% of it has been given out on agricultural leases, with the percentage varying among the different states. Laws of tenancy also vary across states, not all states have laws protecting tenants' right to their produce. To protect land owners' security of ownership rights and secure land tenants' tenancy, the NITI Aayog [23] has proposed a Model Land Leasing Law.

Unequal access to agricultural credit and insurance

It's important to have a land title to access agricultural credits and insurance. Since, "small and marginal farmers, who account for more than half the total land holdings, and may not hold formal land titles, are unable to access institutionalized credit."

Long Term and short-term credit

Farmers require short-term capital for the purchase of inputs, weeding, harvesting, and transportation or long-term uses such as investing in agricultural machinery and equipment or irrigation during cultivation. Access to loans is a determining aspect of the upcoming crop cycle, for a lot of farmers [24].

"Small and marginal farmers, who account for about 86% of total land holdings, take more short-term loans than farmers with medium or large holdings. This group also has the highest number of borrowings from informal sources of credit such as moneylenders, family, and friends."

Inadequate access to crop insurance

As of 2011, about 10% of Indian farmers were covered under a crop insurance scheme [25].Major persistent problems with this crop insurance system are:

- "Unawareness about insurance schemes and assessment of crop loss-related damages."
- "Inadequate coverage of insurance schemes and timely settlement of claims".

Inadequate availability of water for irrigation

Water is another major issue in Indian agricultural farms. 51% o of the farms are irrigated through tube-wells, wells or canals, and tanks. The rest depend on rainfall for water requirements in the farm. In the last few decades, most states in North India have over-exploited ground water resources, especially for the cultivation of intensive crops such as rice. Punjab, the region famous for its long basmati rice, has over-exploited 75-90% of its ground water units.

Alternative forms of irrigation

India is known for flood irrigation in the agricultural field, where water is allowed to flow freely during the cultivation season. This leads to a lot of wastage and un efficient use of water resources. Alternate forms of irrigation like drip irrigation and sprinkler irrigation would immensely help in finding a sustainable solution to this problem.

India utilizes "twice or thrice as much water for irrigation to produce one tonne of grain as other countries like China, Brazil, and the United States [31].

Degrading quality of soil and fertilizers

"While the levels of food production have increased over the past few decades, it has also led to issues such as imbalance of nutrients in the soil, the decline in the water table as well as the quality of water, and overall depletion of soil health. The ministry of agriculture has noticed that the quality of Indian soil is deteriorating. About 5.3 billion tonnes of soil gets eroded annually, at a rate of about 16.4 tonne/hectare." An imbalance in the use of fertilizers in the soil also might result in loss of fertility. It's a dire need to make the farmers aware of the kind of fertilizer and the quantity of the same required in the field, otherwise, the productivity of the soil will be subsequently affected [32].

Alternatives to synthetic fertilizers

To tackle the growing use of chemical fertilizers and deterioration of land as a result of imbalanced use of these, there are other alternatives like intensive farming techniques and the use of bio fertilizers. I will discuss more of them in the coming sections of this article.

"The Economic Survey 2015-16 noted that the use of pesticides without proper guidelines has led to an increase in pesticide residue being found in food products in India." [33].

Affordability and access to quality seeds

Although farmers might develop certain seed varieties on their land, high-yielding varieties have to be purchased from the market. "The cost of these varieties is too high for marginal and small farmers to afford, thus disincentivizing them from purchasing these varieties."

Agricultural machinery

Only 50% of the operations in Indian farms are mechanized. To increase agricultural productivity, durable and cost-effective farm equipment needs to be made available to small and marginal farmers.

Post-harvest operations

Storage

The highest losses are seen amongst fruits and vegetables followed by pulses and oil seeds. Problems with storage conditions are inadequate capacity and poor storage conditions as per the requirement of the grain or crop. Apart from warehouses run by the government, cooperatives can play an important role in preserving fruits and crops during post-harvest operations. Cold-storage warehouses are essential in the case of fruits and vegetables but they are not easily accessible to the farmers.

MSP and its effectiveness

The minimum support price from the Indian government to the farmers is mostly limited to four crops: Sugarcane, paddy/rice, wheat, and cotton, although there are 23 officially notified crops for MSP. The provision of irrigation sources and MSP make farmers more interested in growing these crops on a larger scale, which often leads to more production than the national demand for these crops. It remains to be seen through the survey analysis of this research, how effective and acceptable is MSP for the smaller farmers in the state of Uttar Pradesh, which represents the greatest number of small holders in the country.

Marketing of agricultural produce

In 1938, *the Government of India* prepared a Model Bill, which made way to the 'Agricultural Produce Markets Regulation (APMR)' acts during the 60s and 70s in various states. These

measures finally "led to the creation of a well-laid-out market yard and subyard in each district or every few districts and for each of these market areas, an Agricultural Produce Market Committee (APMC) was constituted to frame the rules and enforce them. Thus, the organized marketing of agricultural produce came into existence through regulated markets in the 80s" [26].

System of agricultural marketing cooperative societies in India

Cooperatives for agricultural marketing came into being after 1956 in India. The reason for their establishment was similar to credit cooperative societies. The main objective was to intervene in the middlemen-trader-money lender system that has been exploiting farmers, especially the small holders. Today, there exists a cooperative market network spread all over India with about 10,000 marketing societies operating within different regions. However, only 50 percent of these societies deal with agricultural produce at the grass-root levels, and the rest work with special commodities. National Agricultural Cooperative Marketing Federation (NABARD) is the government institution guiding these societies. The marketing societies at the producers' level usually cooperate with the state or national level federations to deal with larger markets internationally to facilitate the export trade of agricultural produce.

The chief purpose of introducing marketing cooperatives was to eradicate the exploitation of farmers by middlemen. To provide the farmers with a fair share in the profit from the sale of agricultural goods and thus bridging the gap between the large and small landholders. The cooperatives are also allowed to grant loans to the farmers at lower interest rates, which is a better alternative to lending money from the moneylenders who also act as middlemen and charge very high-interest rates from poor farmers. Marketing cooperatives are supposed to provide agricultural machinery, highquality fertilizers, modern farming technologies, and better-yielding seeds for an improved production rate at the end. Post-harvest operations like transport of produce, cold storage, emergency funds, package, and grading, which require higher capital expenditure from the farmer's pocket and are often associated with private functionaries, can be facilitated by the marketing societies at a cheaper cost. This protects the farmers from unfair interest rates charged by the private parties and unjust negotiating positions in the contracts.

The organizational and membership structure of these societies includes two categories of members. A) Ordinary Members who constitute individual farmers who want to sell their produce, small co-operative farming societies, and service societies of the region of the operation. They have the right to participate in the decisions of the cooperative, deliberations, and share in the annually earned profit. B) Nominal Members are the traders and other members of the value chain who establish business dealings with society. They do not have the entitlement to participate in the decision-making process or share the annual profit earned.

Constraints in the marketing of agricultural produce by farmers

APMC act divides the states into various fragmented markets that are highly fragmented within the state and country level without any standard rules for proper market access to the farmers.

Incomes from agricultural produce of small farmers are very low compared to large farmers, not specifically because their income sources are insufficiently diversified or they are unproductive but because their land endowment is small. "The share of income from crops is highly and significantly correlated with farm size; crop income comprises only about 1/4th (27%) of the total for small farmers compared to about 3/4th (74%) for large ones." [27].

Despite the predesigned structure and designated functionalities of the marketing societies, they have not been able to perform well over time in India. The main reasons are improper functioning, weak organizational structure, poor asset management if they do have assets at all, lack of financial facilities, high marketing costs, and inadequately qualified staff.

Cooperative marketing societies should be able to trace new market opportunities for the farmers and educate the society members regarding the objectives of the organization and promote active participation in business activities rather than limiting the involvement of the farmers. Farmers are looking for post-harvest produce processing opportunities because they cannot afford to have it themselves; cold storage, branding and quality checks and standardizations, market links will help improve the quality of the final consumer product and give more income to the farmers through value addition. Activities and opportunities such as banking facilities, and ATMs (automatic teller machines) for the convenience of farmers would help a lot. All these activities help in better marketing of farmer produce, developing the value chain, and a sustainable enterprise structure for cooperatives.

As observed by [36] an effective marketing system would require quick transport facilities along with cold storage to avoid losses of produce due to weather conditions. To maintain an efficient value chain, society has to keep a watch on the demand-supply forces to

ensure remunerative prices to the producers. According to previous studies, the profit share of farmers is higher when the product is marketed through cooperatives rather than other marketing channels such as middlemen. (Shah, 2021) Unfortunately, India is yet to achieve an adequate number of cooperatives dealing with the marketing of agricultural produce at village levels.

To improve the performance of these cooperative societies in India, several measures in terms of policy and awareness are required to be taken to increase the presence and functioning of marketing cooperatives in the villages and remote parts of the country, to specifically benefit the small-scale farmers. Only then can we truly exploit the potential of the cooperatives which were established in the first place.

Co-operatives and their management

According to [37], cooperation is the motivation coming from organizations or specific groups that agree to act voluntarily towards a common interest or interests. [38] Described it as a relationship, where all parties can benefit, while in an otherwise competitive relation, it's harder to reach objectives simultaneously [28] said that it's possible to reach a good internal connection between stakeholders that will improve sharing of information and also facilitate an understanding among partners – thus forming cooperation. The main aim of cooperative is to provide adequate services to its members, rather than maximize profits. Members at the end of the harvesting season, are paid out of the profits of the cooperative society.

The genesis of cooperatives in India

During the British raj in the subcontinent, an officer called Nicholson suggested to introduce the Raiffeisen method (named after a German mayor, *Friedrich Wilhelm Raffeisen*, who is considered a pioneer of cooperatives) of farm and agricultural credit cooperative system. Eventually, "the British government introduced the Cooperative Credit Societies Act", of 1904 which enabled agricultural credit cooperative societies in the rural parts of India. These cooperatives were sponsored by the government.

Farmer's role in cooperatives

Results from previous studies indicate that farmers are actively expanding their roles in production activities through cooperation among each other. This is due to "better access to information, sales opportunities, technical assistance, and, mostly, a favorable environment for the exchange of knowledge". Also, the relationship between cooperative members and cooperatives stands out in terms of trust. However, the fidelity of membership that sustains the system can be weakened by "opportunistic actions that may affect the continuity and fulfillment of the objectives of the cooperative over time."

40

Democracy, Trust, and Infidelity among the leaders and members

Although the membership of co-operative societies is voluntary because they are supposed to work in a completely democratic way, there should always be in place some basic ethics for the stakeholders – the farmers. Any farmer is free to join a co-operative and leave it after giving proper notice. One proof of democracy in co-operative is the principle of "one man one vote." Each member of the cooperative has one vote, which has equal in importance and status as any other vote, irrespective of the number of shares held by him/her.

[40] Cooperation Challenges in Agricultural Cooperatives Amanda Regina Leite, Ana Claudia Machado Padilha, Erlaine Binotto.

Infidelity is "an act characterized by a rupture of balance, since one of the economic agents breaks the coalition and transacts its products in the form of purchase or sale with other companies, harming its cooperative system" [29] *Chaddad, 2002* explains how some of the cooperative members can take advantage of the benefits given by the cooperative organization, but at the same time, they do not realize the costs of those generated benefits. What this means is that the members "participate in the cooperative only when it offers better business than the market." "Opportunism weakens trust, which is one of the bases that support the foundation of interactions between individuals and organizations." [30].

Manipulation of the elections and then functions of the cooperatives by influential people being elected to the top management positions hijacks the spirit of cooperation and profit sharing between the members. This is piled up with a lack of modern banking solutions for uneducated farmers, and a lack of awareness among members regarding the objectives and goals of the society, followed by a lack of structure and professionalism within the management and limited power of farmer members in the decision-making process. World Bank's Global Financial Development Report 2014, "suggests that financial inclusion is important for development and poverty reduction".

Problems in the Indian agriculture cooperative societies

Mismanagement and taking undue advantage of the opportunities and responsibilities given to the top management of these soci-

eties is a major hurdle to their proper functioning. The essence of the cooperative movement, that is, a democratic and nondiscriminatory way of functioning, has been betrayed ever since the inception of cooperatives in India. The idea of equal treatment of members irrespective of their landholding sizes has become polluted with the evil of corruption and human greed. This allowed the bigger landholders to have a greater say in decisions and more power when it came to procuring inputs for the farm. Even the elections within the cooperatives are influenced by money, totally disregarding the pious democratic process that was supposed to be followed to elect the chairman or vice chairman of the society. Thus, this has turned these cooperative elections into a mini battle for power.

Another issue hindering the independent functioning and freedom of cooperatives in India is the interference and interventions by the government. Since the inception of cooperatives, the government assumed the role of holding the position of management of these societies very tightly within its control, so much that they almost fall in the ambit of the government now. However, doing this hampers the growth of cooperative farming among the farmers, they do not feel powerful and free enough to practice their own strategies and manage the cooperative on terms suitable to them. Also, farmers' voice and right to opinion is often taken away due to the never-ending corruption.

This is topped by negligence of cooperative management when it comes to coordination between banking institutions and primary agricultural cooperative societies. There is often a lack of willingness to cooperate among leaders and people in rural areas, they fail to recognize the horizontal and vertical linkages in the farming sector. Then the large landholders try to exploit by taking a much more share in benefits, thanks to the advantage given by their large share holdings, political influence, and nepotism in cooperative management. All these undemocratic activities lead to a doubling of finances given to the defaulters and ultimately a non-viable cooperative society with heavy over dues.

[31]. "Emphasize the importance of knowing your partner, evaluating the work philosophy and style, receptivity and cooperation for joint problem solving." [32] demonstrated that parties' ability to trust, communicate and coordinate affect alliances, "since their success depends on the strategic fit between partners' products, markets and goals".

In India, a cooperative society needs to register itself under the Cooperative Societies Act and comply with the rules and regulations of the state in which it is operating. This registration makes the cooperative society a separate legal entity that can make agreements on the purchase and sale of assets under its name and carry out other legal matters under its name. However, most of the time these agricultural cooperatives are without adequate technical, administrative, and monitoring support, which is another reason for the poor performance and non-viability of cooperatives in many regions of the country [33].

Land fragmentation and cooperative societies

There have been theories and research relating land fragmentation with productivity and revenue but nothing so far finds a relationship between land fragmentation and the role of cooperatives. A cooperative will work as an "autonomous association of small farmers united voluntarily to achieve their common economic, social, and cultural objectives and aspirations through a jointly owned and democratically controlled enterprise." [34].

As evidenced by the literature, "cooperatives have inherent advantages in tackling the problems of poverty alleviation, food security, and employment generation." Its potential is vast in areas where the public and the private sector both have failed, because cooperatives are responsible for recruiting local talents, and are led by local leaders who know the roots of their problems and already have tentative solutions in their minds. This might also lead to a reverse migration, where the youth and laborers move back to the rural areas as cooperatives help generate an ample number of self-employment opportunities.[44]

Cooperative societies can be subdivided into clusters based on their primary function.

- Production Cooperatives that deal with harvesting and post-harvest operations such as processing of the raw materials.
- Marketing Cooperatives, whose main function is to market agricultural produce.
- Service Cooperatives that are obliged to render services for the member farmers.
- Examples include Credit cooperative societies, agricultural banks, etc.
- Allied Service Cooperatives are the ones that deal with necessary activities and operations of daily farm businesses in terms of agriculture farm operations.

The purpose of mentioning all the above points in this literature is to elaborate on the major issues concerning Indian agriculture so that it's easier to understand the potential solution and also to have a pre-context to the qualitative interviews I conduct as the main part of this research. Not to mention, it shows all the potential areas where cooperatives can come in and play an important role with the farmers as well as with the government to make the agricul-

tural sector more sustainable and efficient.

The research questions attempted to answer through the literature review and this study are

- Is there evidence for decreasing size of agricultural farm lands in the state of Uttar Pradesh, India?
- Are small farmers aware of the role of cooperative societies and do they trust these cooperatives?
- An alternative to cooperatives in India for small farmers: a business solution to increase the farm income of small holder farmers.

Methodology

From the literature review mentioned above, we have seen that there's a positive and a negative correlation between farm productivity, profitability, and land fragmentation, however, the relationship between land fragmentation and cooperative management hasn't been analyzed before and I aim to fill this gap with the help of this research paper, keeping in reference the researches mentioned before. To conclude, this research will focus on the Indian agricultural scenario by conducting qualitative interviews with farmers from the North of India.

The qualitative survey questions for this research revolve around farmers' average land size and the source of this farmland as an asset (either through inheritance or purchase from another landholder), crops grown on these fields, major problems, and challenges faced by the respondent followed by their methods for maintaining productivity, selling and marketing their produce. All the above-mentioned topics are succeeded by questions on the respondent's level of awareness and opinions about cooperative farming and cooperative societies. The goal of asking these questions to get information about the key aspects affecting farmer land's productivity and farmer's income; the effects of small sizes of agricultural lands on productivity, how much is the dependence on monsoon rainfall for irrigation, and the state of their soil's quality and fertility and the awareness around the importance of soil maintenance in terms of moisture holding capacity and nutrient level. Last but not least their sources of obtaining adequate technology and machinery required, the feasibility of modern agricultural technologies, and formal agricultural credit. The questionnaire ends with a discussion on the viability of cooperative society and its role in benefiting the farmers in the farm income.

I asked questions regarding the land owned by farmers and whether it is inherited by them from their father or grandfather or if it was purchased by the farmer himself. This question was followed by the number and kinds of crops grown on the field. I have tried to find out the size of the original land that was owned by the grandfather and then the father of the farmer, as this would help in finding out the extent of fragmentation in one piece of land. It was also interesting to note whether these farmers rent some agricultural land as well along with farming on their fields.

Then the chief qualitative questions asked to the respondents were directed toward the problems they face on the farms and in their farming practices. Respondents were prompted to answer in detail about the main challenges. I followed this by asking about respondents' opinions about the small agricultural land sizes in India and what they think are the advantages or disadvantages of this trend. It was also important to ask about the benefits they get from the government's side as aid for their agricultural fields and help in the sowing or harvesting season and does this help from the government meets the needs of the farmers. Farmers were prompted to share their average yield in a year and the factors affecting it. Another vital question was about the practices followed by the respondents to maintain the productivity of their farms and the soil specially to keep it healthy and fertile. Then, the respondents were evoked to share their process of selling the produce – either in the market or directly from the farm and whether they take help from intermediaries in this process. This was followed by the ways respondents used to obtain other inputs for the farm such as machinery and irrigation services. The last part of the survey interview was reserved for the questions and discussion with the respondents around the topic of cooperatives and their functioning. I asked their opinions on this format of farm management, their suggestions for a better functioning cooperative society in their region, and whether they have adequate information about the objectives of forming such a society in the small towns and villages.

Most of the interviews for this research were conducted by a third-party agency. The interviewer was first educated and properly guided on the objective and methodology of the survey to be conducted. The reason behind taking help from a third-party agency was as follows

- Helped in achieving the required number of interviews in a few days since the interviewer was solely focused on this one task.
- Often the respondents gave an appointment to talk to them, so it was needed to keep a record of the timings given by the farmers so as not to collide with their work schedule.
- It was more comfortable for the farmers to talk to the interviewer as she spoke to them in the respondent's native tongue.

Last but not the least, the contacts of the farmers were taken

from a district-wise contact list taken from the Indian team of crop analysts, Cargill. Out of 50 contacts provided, 30 farmers were interviewed and 24 interviews out of them are considered for this research study. The reason for not selecting the 6 other interviews was the lack of getting concrete answers from the farmers due to hurdles faced because of internet issues and background activities from the farmers' end.

This research project will give an analysis of Indian farmers based in the state of Uttar Pradesh (the most populated Indian state and connected with two major rivers: Ganges and Yamuna). Responses to the first two quantitative questions are expected to confirm the increasing land fragmentation in the country and to get an idea about how farmers are utilizing their small lands – the number of seasonal crops cultivated. The qualitative survey analysis is expected to conclude major issues regarding the maintenance of their farm and then the crops produced from it, non-viability of the cooperative societies in today's India. The results from the analysis will contribute to the betterment of the cooperative sector in India, suggest solutions towards cooperative farming models, and take into consideration farmers' wishes and demands before they integrate themselves into cooperative farming systems, which will ultimately aid in improving the farmland performance and efficiency, a decent market coverage for farmers, easy availability of loans and formal credit from external agencies and possibilities of export for the small and marginal farmers, who are often left out from the bigger market.

The business problem attempted to solve through this research study: Determining factors behind the incompetence of cooperative societies in India and a properly functioning cooperative at the ground level as a potential solution to the growing trend of land fragmentation.

Key findings

Here are the key findings from the survey analysis

- There is clear evidence for land fragmentation in the state of Uttar Pradesh, India among small and medium farm-holders.
- Crops grown per farm holding are two or more in the case of all the farmers surveyed.
- Chief challenges faced by the respondents include the destruction of crops due to wild cattle. Secondly, irregular rainfalls and problems with irrigation, and lastly, plant diseases.
- Half of the farmers surveyed claimed that they receive government aid in the form of 6000Rs deposited into their account per year in three small and equal instalments but it doesn't meet their needs.
- To maintain productivity of the farm, most famers use organic manure, mulching and fertilizers in some cases.
- 50% of the respondents sell their produce through middlemen.
- Almost half of the farmers interviewed have very less or no information regarding agriculture cooperatives. Those who are aware, mentioned briefly about the inefficiency of these societies near their village.

Discussion

This chapter provides a summary and analysis of the responses received from the survey conducted and the figures are related to the responses to the relevant questions asked. Wherever a respondent provided certain information relevant to another question, this has been analyzed accordingly and summarised in this chapter under the most relevant sub-heading.

Land sizes and evidence of land fragmentation

The responses to the questions about land size and source of land as an asset are consistent with what was found in the literature. Almost all of the farmers interviewed had inherited the farmland from their fathers, and the land gets divided in each generation depending on the number of sons the farmer has. In some cases, the farmland is cultivated among all brothers but the landholder title remains with the father. For instance, in the western part of Uttar Pradesh, the district Moradabad is close to the capital region of New Delhi, and a respondent from a town in Moradabad has 5 hectares of land which is shared between him and his three brothers. In his further elaboration, it is noted that the land size decreased from 15 hectares owned by his grandfather (generation 1) to 5 hectares owned by his father (generation 2), which now belong to the respondent's siblings (generation 3). Now, whenever further division of land takes place, if it does at all, these 5 hectares will be divided into further four fragments.

According to Press Information Bureau [35] in the 2015-16 agricultural census, the operational land holdings were categorized into 5 classes

- Marginal (below 1 ha)
- Small (1-2 ha)
- Semi-Medium (2-4 ha)
- Medium (4-10 ha)
- Large (10 ha ana above)

Using the same classifications, it has been attempted to classify the respondents in this research study as well.

The state of Uttar Pradesh recorded an average land size of 0.73 compared to the national average of 1.08 during the agricultural census 2015-16. Figure 5 shows that most of the farmers i.e., 9 out of 23 respondents, who gave their land-size measures, have farmlands of size falling between 2 and 4 hectares. Hence, they can be categorized as semi-medium farmers. This is followed by 5 farms of sizes somewhere between 0 and 1 hectare (marginal farmers), while there is a comparatively lesser number of farms with sizes larger than 4 hectares. It has been observed from the interviews that most farms with sizes greater than 4 hectares have the potential to be fragmented in this decade or the next if the law of inheritance is practiced by the current generation of farmers. That would bring the sizes of these farmlands in the range of 2 and 4 hectares. It is interesting to notice that the opinions regarding the consequences and effects of land fragmentation remain similar across the board. Almost all the farmers agreed that it is harmful to the sustainability of farm income and the yield from farmlands. To support this, respondents gave reasons such as higher input costs and not enough profit generated from the harvest, conversion of small farmlands into non-agriculture-based commercial areas due to lack of awareness about modern farming practices, or less profit generated from farming activity. Most respondents agreed that there is a high probability of continued land fragmentation as the population increases and they expect the inheritance law to stay put.

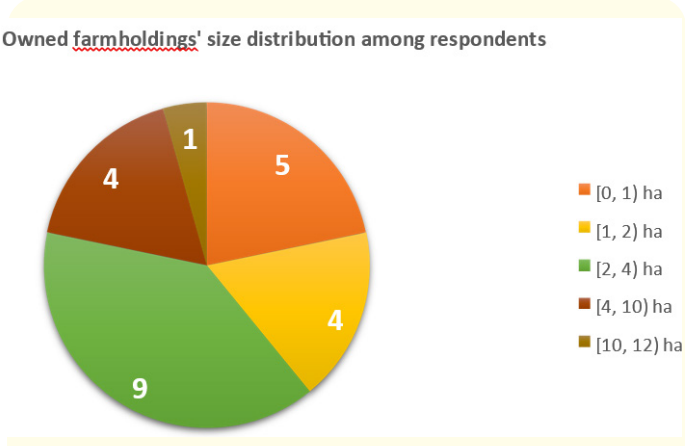

Figure 5: Number of farms in each land size range. Source: Areeba Masroor, master's thesis.

Number of crops grown per farmland

It is also observed that land fragmentation is a determining factor in farm profits and farm crop diversification. All the farmers surveyed use their farmlands to grow two or more seasonal crops [36]. All the farmers surveyed are following either intercropping [37] or mixed cropping [38] or both these methods to increase the income generated from their farms as well as to maintain the nutrient level of the soil (either knowingly or unknowingly). An average number of crops cultivated by the respondents on their farm lands is 3 crops per year. However, this research did not focus on the awareness of cropping systems and soil health among the farmers surveyed. That remains a topic to be covered in another study. In the "India Rural Development Report 2012 – 12" [39], it was observed that even though small farmers are efficient, especially in the cultivation of labor-intensive crops and animal husbandry, their land holdings are too small to generate sufficient household income from the farms alone. It is observed from this survey that small and medium-sized farmers practice some modern agricultural methods such as multiple cropping, integrated farming systems, and intercropping. It remains unclear as per this research whether these practices have been followed traditionally or promoted by the government bodies as they claim to.

Chief Challenges faced

Wild cattle

Major problems and hurdles in better yield of the farms are recorded as plant diseases and wild animals. A lot of respondents in the survey mentioned that wild cattle can eat up or destroy all of their corn, wheat, or pearl millet crops in a single night if the farmers are not vigilant. And since most of the small farmers do not have enough land size to compensate for the loss of other crops, they are left with nothing to harvest and sell after spending months taking care of their crops. The government of Uttar Pradesh has released an unofficial ban on the use of barbed wires, which were utilized by farmers to keep stray cattle away from farms. Along with this, the Cow Slaughter Act, of 2020, prohibits the transportation of cattle or its progeny for slaughter within Uttar Pradesh and outside of it. Anyone caught transporting cattle in and out of the state can be punished by the law. This policy has led to a decline in the transportation of aging cattle out of the state and the closure of dozens of slaughterhouses within the state. As a consequence of this law, aging cattle are allowed to roam free with no one to claim their ownership. Farmers who are not able to feed their cattle due to increasing prices of cattle feed also let their cattle roam freely in the villages. Therefore, at present thousands of starving cattle can be seen roaming around village roads looking for food and they of-

ten end up in small farmlands, if the landholders are not cautious. In many cases, farmers have to stay up all night on their farms irrespective of the weather conditions to safeguard their produce against wild cows and bulls. As many as 9 respondents out of 24 described wild cattle as a major problem affecting their annual harvest and consequently the farm income.

Plant diseases

Another chief problem faced by farmers comes in the form of plant diseases, especially for the ones who grow vegetables like potatoes and tomatoes. 14 respondents out of 24 sow and harvest potatoes on their farms. Almost all of these respondents harvesting potatoes, complained of loss due to viral diseases in potato farms. Farmers call this bacterial disease smallpox of the potato plant, its scientific name being 'Potato Scab' [40]. The only remedy used by farmers is spraying bactericides or fungicides and other medicinal sprays at appropriate time intervals. These extra medicinal sprays add to the input expense by the farmer. Upon further research, it is found that local newspapers advise these smallholder farmers to get their potato seeds checked before sowing, try to keep changing the potato variety grown on the farms, and make sure the soil is rich enough in calcium and boron. Farmers are also advised to use Single Super Phosphate (SSP) [41] in place of Di-ammonium Phosphate (DAP) [42], in the farms. 7 in 14 respondents who practice potato farming, asserted that disease affecting potatoes is their biggest problem. The newspaper article also mentions that it's advisable to avoid sowing corn during summer and rather leave the farmland as it is after tilling in the summer season to aerate the soil.

However, it remains unknown whether farmers are aware of the proper remedial methods and procedures to save their potato farms from this disease. This is evidenced by the claims by several farmers that even after spraying medicine and fertilizers, their potato plants still get infected by viruses and late blight.

Irregular rainfall and irrigation

Irregular rainfalls pose another hurdle in proper cultivation and desired harvest from farmlands. 10 out of 24 farmers interviewed indicated towards rainfall was their major issue. 6 of them claimed that heavy rains this year destroyed a big chunk of their potential harvest and the estimated loss of crop goes up to 50% in some cases due to the heavy rainfall. If the farm is already facing problems due to diseases, heavy rainfall adds up to the problems, and both of these factors if combined can destroy more than half of farmers' produce in a particular crop season. Few respondents also claimed to have delayed corn sowing because of the heavy rains. While the rice was destroyed in most farms, wheat and corn are expected to have a good harvest in farms where their sowing was delayed. 4 respondents asserted the shortage of irrigation water in their farms. They complained of inadequate irrigation facilities from the government or lack of maintenance and consistency in irrigation water provided. For instance, a lot of farmers use public irrigation canals to irrigate their fields. The canals in some cases have not been taken care of and cleaned by the concerned authorities for years now. In such a scenario, the farmer has to either take water from a neighbor's tube well or a private service provider or get a tube well installed on his farm. But electricity is not guaranteed at all times of the day and it's necessary to run the tube-wells.

Other minor problems mentioned by farmers include a lack of advanced knowledge and technology when it comes to taking care of vegetable crops like tomatoes, financial issues, shortage of farm labor in some crop seasons, and hurdles in obtaining a fair price for their produce.

Help from the government

When asked about what help they get from the government regarding their farms, 11 out of 24 respondents said that they get a sum of 6000 Rs i.e., 72 Euro in three installments per year as a part of Kisan Samman Nidhi [24]. Most farmers agreed that this sum of money is of little help in their expenditure for farm inputs as only fertilizers and medicinal sprays cost them 2000 Rs in a sowing season; while few of the respondents appreciated this little effort from the government to help them. Only of the respondents mentioned getting the government's further help a few years ago when there was a dry spell and he received.

1300Rs [43] as compensation for the crop loss due to an extraordinarily dry crop season. Some respondents mentioned the presence of government centres that provide seeds and fertilizers to the farmers but at very little price difference from the private sellers. To save time and energy from taking several visits to these centres for seeds and fertilizer purchases, many farmers choose to buy from private sellers. A similar story goes for the procurement of crops like wheat and rice by government institutions - a few respondents claimed that it takes up to a year for the amount to be credited into the farmer's account

if the harvested crops are procured by the government. Instead, they find it wiser to sell their produce through middlemen even though these middlemen buy their harvest at a slightly lower price than the government. Respondents say that at least this way, they

will have the capital to invest in the inputs required for the next crop.

Over the years, the government of India launched several other policy reforms in the agricultural sector but their benefits have not reached the small farmers either directly or indirectly. Reforms around agricultural credit and loans often benefit large farmers with a higher quantity of produce, who also have more accessibility to modern farming technology. Although 2 in 5 farmers claim to receive the Kisan Samman Nidhi each year, almost none of them mentioned any additional help received from the government authorities. Only a few farmers vaguely mentioned that they are aware of the schemes provided by the government in other agricultural states like Maharashtra and Gujarat. There is a discrepancy between the information reaching the large farmers and small farm holders. Often disclosing this information to the farmers falls under the responsibility of local governmental bodies. According to the survey responses, half of the farmers interviewed sell their produce in government-designated markets, called *mandis*, through middlemen. One of them mentioned that he sometimes takes a loan from these middlemen and hence it becomes obligatory for him to sell his produce through them so that the middlemen can deduct the loan amount and the interest from the crops sold. Around 10 respondents claimed that they sell their produce directly in the village markets for some or all of their crops harvested and 5 respondents sell some or all of their harvest from the farm itself because the produce is not a lot in quantity. Surprisingly, one farmer claimed to consume all the harvest within his large extended family itself.

Actions to maintain the productivity of farms

Few farmers mentioned that they get their soil checked by a biologist whenever they feel the occurrence of a disease. Most of the respondents referred to spraying medicine as a measure to control diseases and hence maintain the yield of the farm. Almost all the farmers interviewed pointed out that irrigation is a major factor affecting the yield of the farm. A major emphasis was put on the use of manure by the respondents, where most of them cultivate organic manure using cow dung. Some of them also added they include a dry leaf cover, a practice called mulching. Others mentioned timely inputs to the field such as water, medicinal sprays, and fertilizers add to the maintenance of their farm. It was observed that some farmers also keep into consideration the developments in the weather pattern. They delay the sowing process if there's excessive rain.

Marketing and selling of the produce

There is no marketing as such of the produce by the farmers, almost all of them just simply sell it in the market by themselves or through middlemen. 50% of the farmers interviewed that they sell their produce through middlemen in the markets set up by the government. These markets are called "Mandi" in the local language of the state and surrounding regions. Reasons behind the success of middlemen include: A) Farmers bring their produce to the market in bulk as transportation costs if high and they cannot bring small amounts regularly to sell a handful of it to the consumer or distributer daily. B) There is rarely any storage facility available for the small farmers, in cases where they do have to store, they do via private parties by paying rent per day. On the other hand, the middlemen can store the produce in bulk storage houses or containers. C) Farmers are worried that the produce would spoil if they wait too long before they sell the produce at the right and desirable price. D) In certain cases, farmers take loans from middlemen who then deduct the loan amount from the price they have to pay for the food grains purchased from the farmer. All these practices have been building up over the decades and have become completely normalized now where the small farmer is often exploited at the hands of wealthy middlemen. Sometimes, large farm holders might benefit from the middlemen-farmer nexus but there is no research to back it at the moment. Most of the farmers exploited by middlemen have meager income from the farm and in times of inflation, middlemen are the ones reaping the profit of rising food prices, not the farmers. 10 out of 24 respondents said that they sell their produce by themselves in the market – either village markets or the government-designated larger market nearest to them. A few of these farmers who sell directly in the market, also sell some of their crops produce directly from the farm if they get a buyer. Buyers at the farm usually purchase in small quantities. While only one farmer claimed to sell all his produce from the farm only and another one consumes the entire produce within his large family.

The agricultural marketing system has a lot of intermediaries who work in a nontransparent value chain, hence there is no way for profit to reach back to the producer level. Farmers receive a meager amount of profit from what the final consumer pays.

Sourcing agricultural inputs

Major sources of agricultural inputs for small farmers include private suppliers/shops near villages and some government hubs for seeds and manure. 10 farmers said they buy seeds and manure from private shops and only 2 said they get it from the govern-

mentrun stores in the village. For irrigation, farmers either use government-made irrigation canals or pay private contractors for irrigation. Sometimes, respondents claim to partner with their neighboring farmers and get a tube-well installed in their farms. Very few respondents claimed to own tube-wells for irrigation. Often, they seek help from neighboring larger farm-holders who have a proper irrigation system for their farms. When it comes to the agricultural equipment and machinery requirements, some farmers said that they buy the smaller ones themselves and for bigger machines, request large farmers to let them use them in their farms as well. As many as 11 out of 24 farmers rent their machines from private players and big farm-holders. Around 4 farmers claimed that they own the machines required in their farms, such as tractors, harvesters, etc. Two farmers mentioned that they purchased the machines by pooling money with their neighbouring farmers.

Awareness around cooperative societies.

Some of the farmers interviewed are aware of the cooperative societies in their village and very few of them are or have been members of the cooperatives. As evident from the graph below, 46% of the respondents are unaware or have very little information about agricultural cooperative societies. Those who are aware, accounting for 29% of the farmers interviewed, many among them had mentioned that the cooperatives benefit the big farm-holders only and small farmers are often neglected even if they become members of the society. So, they would rather deal with the inputs required and selling of their produce personally rather than be disappointed by the services of the cooperatives. 8% of the respondents, that is, 3 out of 24 respondents, claimed to be former members of the cooperatives in their region and stopped membership due to poor services provided. One of the respondents gave insights into his membership of 25 years, where he has been paying 4000 INR (Indian rupees) premium per year but the cooperative's functions have been stalled for a period of 3 years no due to lack of proper management and very little or no supply of inputs. Two farmers mentioned that they were supposed to get reimbursed for the damage and loss caused by rains in their crop field this season because they hold crop insurance but the cooperatives have been of little or no use to them. Most of the respondents who were aware of cooperatives said that these institutions only provide them with manure – many of them obtain DAP fertilizer and Urea from the cooperatives, with DAP often getting out of stock before it reaches them. For instance, one respondent, who claimed to be a member of a cooperative near him, said that he can take DAP fertilizer at 200 Rs less than the private shops, which is good for him. However, because of the high corruption level within the cooperative and the reduced supply of fertilizer for some crop cycles, he is unable to source DAP from there. Another respondent said that only farmers with connections and contacts with the employees of the cooperative can buy DAP from there.

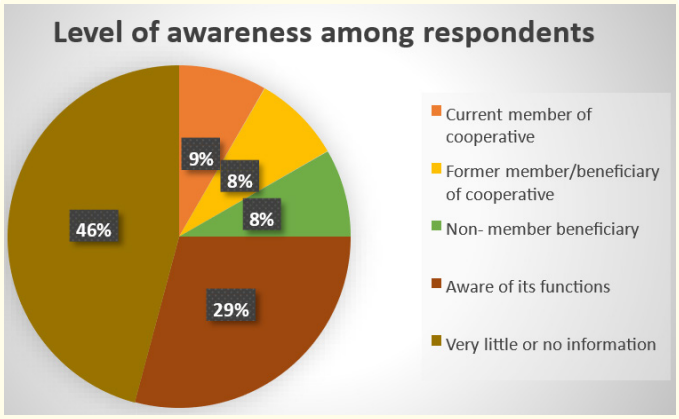

Figure 6: Awareness level distribution.
Source: Areeba Masroor, master's thesis.

Farmers' opinions and suggestions about the functions of cooperative societies

Many farmers said that they believe cooperatives are of no use to them. Going there and asking for any favor is a waste of time and energy for them because these cooperatives that run in some of their villages or nearby fail to provide any benefits to small farmers. Also, almost all farmers mentioned that the agricultural cooperative nearest to them is affiliated with or run by the government. Those farmers who have an opinion on the functioning of cooperatives, want corruption to end there and reduce the interference of government as that might help reduce the level of corruption. A few farmers suggested better crop insurance systems with a promise of social and economic justice for the smaller farmers. They also want the cooperative to run democratically with the power to opine and make decisions vested in each member. The decision-making process should be made collective or a team event rather than amongst the director and his close aids only. Respondents were annoyed at the fact that they have to make several visits to the institution to get the services that should be provided to them with priority because they pay for them. One farmer suggested an organization structure and rules for members and non-members of the cooperative. An interesting suggestion to take up from one of the respondents is to run the cooperative under the village head (called 'Pradhan' in India) as it would make sure that cooperatives are run at smaller village levels and each farmer gets to participate in the decision-making process, ensuring adequate amount of aid and benefits

reach to each member. Enough stock and storage should be maintained within the cooperative for the members at least. There has to be a system of accountability from the management and proper records of members. Social equity has been emphasized by several respondents where each member farmer must be given an adequate quantity of fertilizers, and seeds according to his farm size during the crop season without delay. Other demands included facilities for the protection of the farm from wild cattle, and a collective approach to negotiating with the government regarding the cattle protection law in the state. Other respondents who did not have information regarding cooperatives, suggested that such a society be started in their village and they are interested to see how it would work. Most respondents thought that cooperatives would be beneficial for them if group meetings and collective decisions are taken within the cooperative. Starting a cooperative, some respondents agreed will require a lot of courage, resilience, and collective team work but then surely, more cooperatives will help more farmers. The tough task is to bring the village farmers together and manage the organization, which includes but not exclusively ensuring everyone's voice is heard, fair price and remuneration, adequate supply of essential agricultural inputs, and financial credit services for those who need them.

Conclusion

One-third of the world's crop production is made by small holder farmers. Every six farms in the world consist of less than two hectares. (FAO, 2021).

This research study is based on a qualitative survey conducted among 24 farmers in the state of Uttar Pradesh, India. Uttar Pradesh has the maximum number of smallholding farmers in the country with an average operational farm size of 0.73 ha compared to a national average of 1.08 ha, which makes it an interesting region to confirm the evidence of land fragmentation. Land fragmentation has traditionally been practiced in India, where agricultural land is equally divided between the sons of the family. This is evidenced by the survey analysis as well as the literature available on the topic. Even though the yield of crops in India has seen an increase over the past decade, the land sizes have seen a steady decline. Despite being efficient at their jobs, small farmers are not able to suffice themselves or their families through income from their farms. The consequential problem arising from land fragmentation is multifaceted. On one hand, every small farmer gets to own a piece of land and can at least grow crops to be consumed by the family, if not sold in the market. However, hurdles like high input costs compared to the profit, inability to avail financial credits, and high vulnerability to crop loss due to abrupt weather changes are high among these small farmers. While the literature mentions the fault lines in the management of cooperatives in India, the qualitative survey analysis confirms it from the members' perspective and the general opinion of farmers. The literature sheds light on the agricultural cooperatives but there's a gap in the literature available, where there is no text on the linkage between small fragmented lands and efficiency enhancement along with farm income through agriculture cooperative societies, involving active participation by small-holding farmers in India.

I will further deep dive into the recommendations from a farm management perspective on how to maximize profit while keeping in mind the essence of the democratic way of management and the importance of sustainability.

Why this research on the Indian agricultural sector? India has a population of 1.27 billion [44], making it the world's second most populous country and it is the seventh largest country in terms of geographical area which is "3.288 million sq. km. India has a long coastline of over 7,500 km" and with 22 major languages and 415 dialects spoken, it is the most culturally diverse country on the planet. The highest mountain range-the Himalayas in the north, the Thar desert to its west, the fertile Gangetic delta to its East, and the Deccan Plateau in the South, India boasts of a rich agroecological diversity. It is the largest producer of milk, pulses, and jute in the world, and also "ranks as the second largest producer in rice, wheat, sugarcane, groundnut, vegetables, fruits, and cotton". Not to mention, "the leading producer of spices, fish, poultry, livestock, and plantation crops" like tea. Last but not least, India's economy is "worth 2.1$ trillion, making it the world's third-largest economy after the US and China" [45,46]. Agriculture along with its allied sectors is the major and primary source of livelihood in India, with "82 percent of the farmers being small and marginal."

Alternative to monocropping: On one hand, cultivating and harvesting only one crop per field at a time and perhaps repeatedly enables the farmer to increase the efficiency of the machine used in planting and harvesting and the farmer needs to have inputs suitable for just one kind of crop. On the other hand, monoculture farming is dangerous for the soil's health in a long run. It leads to infertile soil to a point where large additional nutrients are to be incorporated into the soil to make it sustain the crop, which also adds to extra expense from the farmer's pocket. Cultivating a single crop, as evidenced in a report published by European Union, increases the risks of pest and disease attacks. This would mean a greater number of pesticides and herbicide usage. And then these pesticides pollute and poison rivers and lakes nearby the farms.

Centuries ago, farmers used to produce multiple crops on their fields to feed their families and sell additional products for some income. They also practiced crop rotation to replenish soil nutrition and maintain productivity. As observed from the survey, small and medium farm holders are already practicing inter-cropping and perhaps crop rotation as well (it is unclear as of this survey). As a measure to improve the productivity of the soil and maintain the yield, farmers could easily be provided with extra knowledge through specific seminars and individual support from the cooperative to utilize modern sustainable farming methods in the farms. The advantages are numerous – it would limit soil erosion, help in carbon sequestration, and preserves the microorganisms and bird species living in the soil. On top of that, the new sustainably aware consumer would be happy to consume food grown in an environmentally friendly way. Through cooperatives, we can provide sustainably sourced food to the consumer and healthy fertile soil for farmers' future crops. Doing this could also attract large companies which are looking for greener alternatives to their raw material sourcing. Companies are including transparency and traceability in their brands, as demanded by today's aware consumers. It helps these enterprises increase consumer engagement and also decrease their carbon footprint in supply chains. As farmers would see a market in sustainable farming, they would be willing to readily implement new modern technologies. Not to mention, it is easier for small and medium farmers to make this change because they are already practicing multi-cropping.

- **Land-use change:** A few farmers also mentioned that the fragmented lands, sometimes, are too small to generate impressive farm income and the land owners often convert this field into other profitable business activities such as a restaurant, an automobile showroom, an amusement park or rent it as a marketplace. If the land is managed properly and is generating enough profit, the farmers might keep going on with growing crops instead of converting that land for other profit-bearing activities. Last but not least, the resource-intensive agricultural farming practices in India have led to the depletion of natural resources at an alarming rate, raising some serious sustainability issues. The farming methods need a revamp and rethinking of the related policies.
- **Voice of farmers:** It is interesting to notice that these cooperatives cover a large number of farmers – one respondent reported that the cooperative nearest to him covers 7-8 villages. This leaves the small farmers with a very little or negligent share in benefits and decision-making processes. Although the main purpose of setting up the cooperative societies was to provide speedy redressal to farmers at the grassroots level and the small farmer families are often left out of all kinds of participation. Most farmers agreed that these agricultural co-operative societies only benefit the large farm holders and are of little or no use to the smallholders.

The disparity between paper legislation and its implementation on the ground: For marketing, the government of India has developed and launched several platforms to aid farmers in cold storage, transportation, and marketing as well as selling of their agricultural produce but due to all the bureaucratic processes and lack of reach, farmers remain unaware of these extension services provided by the government. The government needs to compartmentalize different platforms and related procedures along with adequate management and teams responsible to manage and delegate the information on the ground. Only through better organization and advertising of government schemes, can they reach small farmers living in villages. One way to make this process easier is to seek help from cooperatives run by small farmers, who can convey the message and provide extension services to non-member small farmers as well. Since cooperatives are local and know the needs of individual farmers who are members of it, it'll be easier to assign them a relevant platform to make storage and sale of their products easily. For instance, the government has launched an online National Agricultural Market (eNAM) [47] to allow farmers to trade their produce on a unified national market. However, most small farmers are not educated enough to use this platform by themselves. Here comes the role of the cooperative in coaching and training the farmers and perhaps trading the aggregated produce as a whole for more negotiating power.

Climate change threats on small landholders: With increasing water scarcity and more irregular rainfall patterns, small farmers are at a mercy of nature and climate change caused by the wealthy citizens of the earth. India is geographically at a very vulnerable location to climate change. The brunt of climate change is born by the poor population of nations including small farmers. With the level of fresh groundwater going lower into the earth, governments are placing a ban on its use. That means, lesser options for farmers when it comes to irrigating their fields. The world leaders like every year, are meeting in Egypt this time, for the 27th Conference of Parties (COP27) [48] to take concrete steps to keep the global temperature rise below the 1.5-degree threshold before it gets too late. However, the climate of our earth seems to be a ticking clock. In the more fragile farming households of developing countries like India, where the sustainability of agriculture is under threat, it's imperative to bring the change-intended and futuristic plans now. If agriculture is not given enough priority, the new generation will

not see it as a profitable business and that would make it harder to feed the ever-growing population of the world. Therefore, enough required investments and policy changes are necessary to make this profession viable and feasible for the young upcoming generation of farmers in India, so that they see a future and sustainable income and value with agriculture. To envision a future for young farmers, we need to work with them on the ground, take constructive feedback like I have attempted in this study and provide appropriate solutions to their challenges that resonate with the farming communities.

Green energy and natural resource optimization strategies should start from the small level, that is, with the marginal and small landholders in towns and villages of India. We need sustainable supply chains built around water use efficiency and mitigation of postharvest losses, all while keeping the farmer's income stable and up to the living income standards of the country. It's high time that India starts investing in sustainable agricultural practices like carbon sequestrations, afforestation and forest restoration, agroforestry, and the promotion of green energy for tractors and irrigation machinery. The farmers want the government to regulate the existing agricultural supply chain and market systems and prioritize sustainable income targets for the farmers. The farmers do not want corruption but rather innovation and social justice within the farming communities and associated institutions like agricultural cooperative societies. This is the only way to enlarge the farming community, spread awareness regarding all the innovative and modern sustainable practices through cooperative management, and as a result, provide our small producers a fairer and happier world by making them central in all the decision-making processes that affect their livelihood and their community's progress. Active participation by the farmers is a powerful fuel to change and a positive difference in their own lives.

Any government policy if implemented correctly has a tremendous effect on the social, economic, and environmental matters of the farming communities, therefore it is vital to include people from these communities in the decision-making processes. This way, together with the private and public sectors, we can use our skills and knowledge to protect the planet as well as our farmers from the aftermath of drastic climate changes.

It takes a lot of effort for a community to adapt but with the right energy and enthusiasm, it is an easy feat to achieve [49].

Food security: Food security is one of the growing concerns in India as the population rises. Even though the country has achieved self-sufficiency in grain production, India is home to over 190 million undernourished people. The incidence of poverty as well as pegged above 30% [50]. The country has some of the highest incidences of anaemia with over 50 percent of pregnant women and 60% of children affected. Possible ways to improve on the nutrition front include: better farm management to grow some nutrientrich crops along with the usual crops grown, a rise of women-headed households and proper education about personal and child's nutrition requirements, growth in farm incomes with diversified sources for farming households, design of careful policies and subsidies by the government to promote the growth of nutrient-rich cash crops. Along with all these points, it's important to strengthen resilience and promote a considerable increase in skilled and educated labor force participation in the agricultural sector.

Benefits of forming an agricultural cooperative with small-holder farmers

The basic idea of a Cooperative is to form a group of farmers and run the group as a private company where every member's vote counts and the final profit and associated benefits are shared with everyone as per their share. This kind of cooperation allows the group to utilize the capabilities and skills of different members accordingly and give an upper hand to the group as a whole while negotiating market prices and input costs.

Since more than 80% of the farms are owned by small or marginal farmers, it's not economical for them to bear the transport cost and individually take their produce to larger government markets, where several buyers including private food companies come to purchase raw material in bulk. Cooperatives are more suitable and accessible to small holder farmers. It will play a major role here in lowering the logistics cost and also increasing the net quantity since several farmers can consolidate their produce here before selling, which can then be purchased by large food companies giving these farmers a comparatively higher price margin. Creating a cooperative will increase the bargaining and negotiating power of the farmers, hence improving the economy of scale as the cost of production will decrease due to the aggregation of farms, crops produced, and also the agricultural inputs, logistics cost, and extension services. As a company, it can align with the digital platforms launched by the government to aid farmers and tap into marketing and selling platforms like 'eNAM'.

There is a need to create a reverse value chain and increase the traceability of the product so that the producers i.e., the farmers get their fair share of the profit made by selling the finished consumer product.

The public-private partnerships regarding agriculture should begin at the farm gate to drive progress and sustainability from the grassroots. If farmers are not successful at their job, none of us will be. A nation's capability to drive a safe and nourishing economy will depend on how its farmers are treated and how they are encouraged to innovate and execute new, sustainable and disruptive thinking on the ground. This is a key ingredient in the success of communities and the world as a whole in the fight against malnourishment, poverty, and climate change. It's not hard to understand that the most impactful solutions for the world are rooted in agricultural practices with the earth itself providing us with the required energy, food, and balance in nature to survive. It is imperative to create a sustainable supply chain starting from the farmer to the final consumer. Constructive efforts at the start of value chains create huge impacts at the end of it.

Limitations of this Research Study

This research contains a rich literature review on the land fragmentation, incompetence of cooperative societies in India, and their failure to improve the economic situation of smallholder farmers, whereas such cooperatives are highly successful in other cropproducing nations like Brazil, the United States, and many European nations such as Germany and France. However, the data and research conducted are hampered by the uneven geographical distribution of respondents and the geographical limitation of the research study to just one out of 29 states in India.

Much of the data and figures included in this report come from the Agricultural Census conducted by the Government of India in the year 2015-16 since no authentic formal data is available for years after 2015-16.

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