



COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THE SOCIO ECONOMIC AND ENVIRONMENTAL IMPLCATION OF FARMLAND  
CONVERSTION TO INDUSTRIAL PARK: EVIDENCE ON THE FOOD SECURITY OF  
EXPROPRIATED SMALLHOLDER FARMERS IN DEBRE BERHAN CITY  
ADMINSTRATION

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**APPROVAL OF THE THESIS**

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I declared that, this thesis is my own original work on the title of “The Socio Economic and Environmental Implication of Farmland Conversion to Industrial Park: Evidence on the Food Security of Expropriated Smallholder Farmers in Debre Berhan City Administration” and it has not been submitted in any universities. All sources of materials used for this study have been properly acknowledged.

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## List of Acronyms

ANRS	Amhara National Regional State
DFID	Department for International Development
FDRE	Federal Democratic Republic of Ethiopia
FAO	Food and Agricultural Organization
FANTA	Food and Nutrition Technical Assistance
FCS	Food Consumption Score
GDP	Gross Domestic Product
HEIAS	Household Food Insecurity Access Scale
HDD	Household Dietary Diversity
HCSI	Household Coping Strategy Index
IFPRI	International Food Policy Research Institute
MOFED	Ministry Of Finance and Economic Development
PSM	Propensity Score Matching
TLU	Total Livestock Unit
UNDP	United Nation Development Program
USAID	United States Agency for International Development
USD	United States Dollar
UN	United Nation
UNICEF	United Nation international Child and Education Fund
WFP	World Food Program

## *Abstract*

*Many farmers around Debre Berhan were expropriated due to the town expansion. This is because the town is expanding horizontally and different development investments were undertaken on lands that were utilized by farmers living in the Periphery of the town. The objective of the study is to examine the socio-economic and environmental implication of farmland conversion to industrial area on food security of expropriated smallholder farmers in Debre Berhan city administration. This study focused on 2037 expropriated and non-expropriated smallholder farmers in five Kebeles of Debre Berhan city administration. It is cross-sectional study and had collected data from 335 randomly selected smallholder farmers' household heads. The method of analysis employed descriptive, binary logit and propensity score matching econometric model. The result of descriptive statistics shows that 47.46 % of the respondents were expropriated smallholder farmers and 52.54 % of the respondents were non-expropriated smallholder farmers. Out of total sample 335 of 59 % households were food insecure and 41 % of were food secure. In propensity score matching model, the effect of expropriation on food security mean of expropriated households food security less than non-expropriated households. The binary logit model outputs shows that eight variables were significant effect of household food security status. These were, Family size and farmland ownership had negative relationship to food security. Whereas Farming experience, total income, marital status, expropriation, current cultivated land and level of education are statistically significance and positively relationship to food security. Furthermore, result shows that households also used different coping strategies against food security and these include, borrowing food or cash from relatives or neighbor's', reduced number of meals, reduced meal size, sale of livestock and to consume less preferable food items. Finally, limiting population size through integrated health and education services and giving priority to old aged headed households in interventions, introduction of water harvesting technologies to practice intensified agriculture were also suggested to improve food security status of households.*

*Key words:*

*Farmland conversion, food security, expropriation, binary logit, city administration*

# Chapter One

## Introduction

### 1.1 .Background of the study

Farmland is one of the most important aspects of life. In agricultural production, the role of land as the main input is irreplaceable. Economically, farmland is the most efficient wealth-generating asset for farmers. According to this, in the worldwide 1.5 billion hectares of farmland can be classify as suitable for arable production (Alexandratos 2010). Farming accounts for about 22 percent of the global agricultural value chain (Deininger and Byerlee 2011). There are 41.9 million hectares of non-agricultural areas and there are 1.8 million producers globally (Willer, 2011).

The social and economic development for most of the African population is relied on the access to land, since majority of the population depends on land and land-based resources for their livelihoods (Berihu, , Bihon, and Mewcha 2015). About 630 million hectare of land in Africa is suitable for cultivation, supporting the majority of the people through subsistence and commercial agriculture (Berihu et al. 2015) .The existing farmland in Sub-Saharan Africa provided to households and communities are critical to food security and income stability of the people. Majority of African farmers are dependent on subsistence farming for their sustenance (Berihu et al. ,2015).

A growing population of nearly 80 million puts tremendous pressure on the farmland, pasture, and natural resources that are the foundation of the country's economic growth. Ethiopia also remains one of the poorest countries in the world, with one in four Ethiopians living on less than \$1 a day. Even though Ethiopia considered as the most stable country in the Horn of Africa, there are a lot of dominant internal and external security challenges surround the country (Berihu et al. 2015)

Land is also a scarce resource in Ethiopia, a country whose population relies on farming as the primary source of livelihood. As farming is an essential factor in the Ethiopian economy, land utilization and allocation is an important undertaking in the country. Agriculture is dominating the economy in Ethiopia; it accounts for 37% of the gross domestic product (GDP). In Ethiopia most of farmlands changes to industry area / urbanization (Kassahun 2018).

Farmland expropriation with only monetary compensation disproportionately affects the livelihood of poor people by diminishing the natural resource available to them. However, monetary compensation suggests by many people that it is not an appropriate mechanism to rehabilitate an affected person and even the payments of cash are inadequate. If the expansions of expropriation continue to the surrounding rural areas of Ethiopia, there is a high probability that many rural people will soon face a crisis in their livelihood and would have been exposed to economic deprivation. Since Pre-urban land is a potential area of interest, there is a high probability of arising potential conflicts. The compensation, which is pay for victim farmers, is not fair and insignificant. Monetary compensation is also not the best mechanism to rehabilitate evicted landholders and cannot solve their economic problems (Temesgen 2020).

Food security as well as ensuring food for all is an important challenge for the world community. Food security refers to the situation “when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (Louise and Kimberly 2011). Among them most of the people live in rural areas and depend on agriculture for meeting their daily necessities as well as for their livelihood. From that sense, to boost up the rural economy, mainly through intensifying agricultural production as well as increasing agricultural productivity and resource use efficiency are the principal instruments for reducing poverty, increasing food security and improving rural livelihoods (Mozumdar ,2012).

There are four main components of food security: (i) availability of food: consist of three elements related to production, allocation and exchange; (ii) access to food: connected with affordability such as income and wealth, provision and preferences and (iii) utilization of food: essential elements associated with dietetic value, social value ,food safety and finally to stability and sustainability over time.(Jemal, 2014). Food security has well-off and typical fast growing economies typically have reasonably priced food supplies, whereas slow-growing poor countries suffer from food shortage and malnutrition. It means that developing, least developing and slow growing poor countries have to progress agricultural production and increased agricultural productivity is requisite to ensure self-sufficiency in food, which is the first constituent of food security (Rosegrant, et al. 1995).

## 1.2 Statement of the problem

Debre Berhan expands dramatically, and the demand of land for industry expansion increases rapidly with non-existent urbanization process. In response to these, the government is taking large tracts from pre-urban areas. As a result, large numbers of local landholders who mainly engage in agricultural activity for their livelihood have been forced to lose their land rights (Achamyeleh, 2014). This problem of this study is the implication of farmland conversion to industrial Park. This problem is one of the most debated and very controversial topics in this time; partly, the cause of the existence of conflicting views on its implication on smallholder farmers in the country. Because the farmers have used their lands for farming, grazing and other purposes. Consequently, the topic is subjected to ongoing debates not only among researchers, but also among politicians and policy makers. Various studies were conducted in this research area (see, Fazal (2000), Gadisa (2020), Diriba Dadi et al. (2015), Emebet 2019). These studies have a limitation as their focus was only on the importance of industrialization. Moreover, their employed methodology has a paucity in lack of taking representative samples. While this study employs probability methods in two-stage sampling design with stratified sampling technique based on access of food in sampled households. The data were analyzed by using descriptive and econometric analysis (logit and PSM model). Which enables to the effect of expropriation on food security status of smallholder farmers. As a result, this study was aimed to fill the above gaps by investigating the socio economic and environmental implication of farmland conversion to industrial park on the food security of expropriated smallholder farmers in Debre Berhan city administration.

## 1.3 Research questions of the study

1. What are the socio-economic implication caused by the farmland conversation to industrial park on expropriated smallholder farmers?
2. What are the environmental implication caused by the farmland conversation to industrial park on expropriated smallholder farmers?
3. What are the determinants of food security of smallholder farmers in the study area?
4. What are the expropriated smallholder farmers, patterns of coping strategies adopted in response to the shortage of farmland caused by their conversation to industry in the study?

## 1.4 Objectives the study

### 1.4.1 General objective

The objective of the study is to explore the socio economic and environmental implication of farmland conversion to industrial park on the food security of expropriated smallholder farmers in Debre Berhan city administration.

### 1.4.2 Specific objective

- To examine the socio-economic and environmental implication caused by the farmland conversion to industrial park on expropriated smallholder farmers.
- To investigate the determinant of food security of smallholder farmers.
- The effect of expropriation on food security of smallholder farmers.
- To explore the expropriated smallholder farmers, patterns of coping strategies adopted in response to the shortage of farmland caused by conversation to industry in the study.

## 1.5 Significance of the study

Industry in Debre Berhan town growing rapidly, demand for the conversion of large mass of agricultural farmland areas to industry area for the purpose of built up for investments and construction of houses for residence. Industry expansion has reversely affected the livelihood assets /food security status of the displaced farmers found in the before-industrialization areas when expropriated from their farmlands. By through field observation of the study area, face-to-face interview with expropriated smallholder farmers; the study analyzed the situation on the ground and helped to provide a real understanding beyond the theory and type of the actual implication of farmland conversion to industrial park in the study area. To this end, the findings of the research will have paramount significance for policy makers, practitioners, decision makers, researchers, and academicians in making informed decision based on realities on the ground.

Moreover, the finding of the study will further serve as a source of information and literature review for researchers interested to conduct their study on the local urban government strategy for creating income source of sustainable livelihood situation among the expropriated landless farmers in the study area.

### 1.6 Scope of the study

The implication of farmland conversion to industrial park could be studied by looking at a range of factors such as social, economic, environmental, cultural or even political. However, this study was delimited itself to the socio-economic and environmental implication of farmland conversion to industrial park on expropriated smallholder farmers and food security. Thus, the study limited itself to Debre Berhan City Administration, North Showa Zone of the Amhara Regional State, Ethiopia.

### 1.7 Limitation of the Study

The study faced certain limitations because of resources, for example, shortage of time, finance and others. In addition, the study lacked well document records. Moreover, it also faced with a limiting factor from lack of willingness from the respondents to provide full data (with the 'pretext' confidentiality' requirement). Effort was made to fill these gaps by using methodological triangulation from secondary sources, as there was also usually tendency by the interviewees to direct you to such secondary sources for further information or data.

### 1.8. Organization of the study

The study was organized under five chapters. The first chapter was concerned with the introductory part including background, problem statement, and objectives of the study, significance of the study, scope of the study, limitations of the study and organization of the study. The second chapter dealt with literature review, which comprised the conceptual framework of the study area. The third chapter revealed about methodology used for data gathering, analysis and hypothesis. The fourth chapter dealt with analysis, results and discussion, and chapter five incorporated conclusion and recommendations.

## Chapter Two

### Review of Related Literature

#### 2.1. Theoretical review

##### 2.1.1. Farmlands converted urban uses

Farmland conversion is a process by which land was converted from agricultural to urban uses. There is a dispute on whether agricultural land fringing should be maintained or converted to other uses. This debate could be revealed from both the pro-ruralist and the pro-urbanist perspectives. In the pro-ruralist's view, land conversion has negative impacts; the loss of prime agricultural land reduced agricultural jobs and devastated investment in irrigation infrastructure. Consequently, it could affect agricultural production and intimidate the food security (Maisam 2015).

Pro-ruralists conclude that agricultural land should be reserved to maintain food production. On the other hand, the pro-urbanites argue that land conversion is a logical outcome of urban growth. The decrease of agricultural production, they suggest, can be resolved by intensification and technological development. Hence, land conversion was not thought of as a threat in their view. Land conversion is a phenomenon that is almost inevitable during economic development and population growth periods. However, uncontrolled land conversion has a greater impact on the environment in general and agricultural yield in particular (Maisam 2015). In subsequent years, some countries such as China, Japan and the USA have tried to conserve agricultural land from being transformed to other uses. It was found that in China, since 1980, the transfer of agricultural land to non-agricultural land has been extensive and intense. Higher population density, rapid economic development and the urbanization process were assumed to be the main factors of resulting agricultural land conversion (ALC) in China (Lichtenberg and Ding, 2008). In 1995, ALC accounted for more than two-thirds of the loss in cultivated land in several areas. During 1996–2000, the rate of ALC in The Netherlands was only 17ha per day while in Germany in 2006 the rate was 114ha per day. Such rates are much lower than in China and Indonesia, which respectively experienced 802 ha in 2004, and 514ha per day in 2000–2002. The above report makes it clear that the rate of ALC is different in both developed and developing countries. It is therefore vital to discover the main drivers of ALC in different countries (Maisam 2015).

Agricultural Land Conversion Drivers, The phenomenon of ALC in different countries is different in terms of intensity and trend. According to (Lichtenberg and Ding, 2008) there are two major drivers that contribute to ALC; internal and external. Land degradation & development and industrialization .The internal drivers land degradation was related to the location and land potential including land productivity, ownership pattern including land size and household size and income. The later includes urbanization, socio-economic conditions and government policies. External driver is Industrialization. Industrial development is widely seen as an engine for economic growth. From (Maisam 2015) stated that, China, is known for its rapid economic growth. During the 1980s–1990s, Chinese growth was strongly support by the development of China’s rural nonagricultural sector, particularly the expansion of enterprises owned by rural communities, known as township village enterprises (TVEs) In China, rural industries are located in areas where agriculture is better developed and located close to urban centers. The 62% of TVEs were located in coastal provinces; hence, the rural industries exerted significantly more pressure on rural communities to divert from agricultural land to nonagricultural uses. From the Firman(1997) found that industrial estates development, mainly in regions surrounding Jakarta, was the main reason of causing widespread ALC in Indonesia. This land conversion followed by other transformations also. Some regions show a transition from agricultural economy to industrial and service-based activities. This conversion also reflected by employment structure. The employment structure converges from a primary economy to secondary and tertiary industries. Additionally, the number of households involved in agricultural actions was declining. The policy to attract foreign direct investments and to develop global competitiveness in Indonesia’s industrial sector exacerbates rapid ALC in the urban periphery. This strategy stimulates the development of many light industries such as footwear, electronics and plastics manufacturing. The strategy has therefore made the ALC more severe (Tommy 1997).

This period mostly influenced by a policy that encouraged the expansion of industries in rural areas and made land conversion a general phenomenon in the City. Infrastructure development, such as road construction also contributes to ALC in most countries. China has faced such pressures about two decades ago (Tommy 1997). The industry grows rapidly, the agricultural sector becomes commercialized, the people’s income grows, and the number of commuting

people increases, China's insufficient road system becomes more congested. A reliable and efficient transport infrastructure is need for sustainable economic growth (Lichtenberg and Ding, 2008) .According to (Lichtenberg and Ding, 2008) the various road projects in China needs a large amount of agricultural land. Many scholars consider the road construction that supports industrial development and links to highways, had led to encroachment on fertile agricultural land.

#### 2.1.2. Effect of farmland conversion on Agricultural productivity

.Land conversion phenomenon occurs because of rising need for space for housing and life fulfillment. Based on the necessities of life, people will tend to utilize land that has high economic value. Location factors of course would be a consideration for anyone in utilizing land. In general, the location can be a decisive factor in the economic development of a region. In an area of zone-zone land use will appear, in the downtown area will vary with the suburban areas or there is a real difference in land use between rural and urban areas (Rika et al. 2012). Conversion of agricultural land in developing countries occurs due to structural transformation of the economy and demographics. Structural transformations in the economy took place of which was originally based on agriculture to a more industrial direction. While the demographic, rapid urban population growth resulted in conversion of agricultural use-to-use non-remarkable farm(Rika et al. 2012).

Theoretically, the conversion of agricultural land could pose a negative effect that the loss of productive land as food producers, but conversion also benefit economically in the form of income from activities outside agriculture. Thus, it is indeed not easy to make a calculation about the benefits and disadvantages resulting from the conversion of farm fields, let alone pretty much as well as the benefits and losses to its intangible (unable to race directly). Negative effects (loss) due to land conversion are mainly on the loss of the "opportunity" to produce agricultural products on converted wetland, which is directly proportional to the size of its land area. Types of losses include agricultural production and its value, income, and employment on the farm, the loss of income and employment opportunities in economic activity that created directly or indirectly from the forward linkage and backward linkage of farming activities, such as rice milling and tractor business. (Rika et al. 2012) expressed attainment of food security can be measured from the process indicators and effects indicators. Process indicator is the food

situation addressed by the availability and access to food. The availability of food related to agricultural production, access to natural resources, climate, land management and markets. Food access includes the source of income, access to capital and household strategy to meet food shortages (Rika et al. 2012).

The phenomenon of conversion of agricultural land, particularly land rice fields around major cities shows that the dynamics of changes of the land conversion is becoming increasingly intensive with the growing economy of the region. Issue of land conversion cannot be separated from the process of transformation of economic structure based the primary sector (agriculture) to the secondary and tertiary sectors (industry, services and trade). It is a reasonable thing to be one of the consequences of development. Economic activity is growing along with the population growth is required for housing, land and infrastructure industry supporting more. Competition to land use for farming and non-farming will be hard to avoid(Rika et al. 2012).

Land use conversion from agriculture to non-agriculture will give an effect on agricultural production and productivity and the balance of the environment. Efforts to control the conversion of agricultural land productive and unproductive land use need been done. Optimization of utilization of resources as is available, with or without damaging the existing resources. An effect (losses) directly from the conversion of agricultural land utilization form is dwindling farmland that directly affects a decrease in agricultural production. Food security is a condition in which food for the household in terms of the amount awarded, quality, and guarantee security to access both in terms of physical or economic and equitable distribution(Rika et al. 2012).

### 2.1.3. Land expropriation and compensation

Land expropriation and cash payments are inextricably linked components of the policy intervention. There is a large literature on both expropriation and cash payments individually, but very little that studies their effect together. The study of aftermath of a land expropriation in India, where the government in Singur, West Bengal acquired farmland from households to build a car factory. In this setting, compensated households experienced slower income growth in the 5 years following expropriation and a majority of households reported spending their payment on house improvements and savings in the bank, rather than investing in new businesses. Households that relied heavily on agriculture for their livelihoods – owner cultivators and

agricultural waged workers - were adversely affected by the policy and largely than households headed by non-agricultural wage workers. The large body of research on land expropriation tends to focus on the effect of expropriation risk on ex ante investment incentives and on the impact of improving tenure, security in countries where the risk of expropriation is high, rather than on evaluating what happens to households that lose their land. typically, households that anticipate expropriation adjust their land-based investment, avoiding investments that are immovable or where the value cannot be verified. In some cases, households respond in the opposite way, investing in immovable assets precisely to reduce the risk of expropriation (Anthony 2015).

(Anthony 2015), explicitly model land expropriation in a setting where farmland can be expropriated by a property owner or local government and sold on to an industrialist, showing that the size of compensation payment, even if it is not link to land quality or verifiable investments, affects ex ante investment incentives for farmers. In contrast, this paper illustrates the ex post consequences of expropriation and gives some suggestive evidence about the adequacy of the compensation in the Ethiopian setting.

Industrial growth or industrialization created expanded economic and job opportunities that in turn facilitates rural-urban migration. Whereas, commercialization and trade accord cities and urban area better commercial opportunities and return, which it increases the rate of urbanization? Social factors are other reasons for the rapid urbanization process. This means the abundance of social services like education, health services, better living standards, and effective and efficient service have long been contributed for the dislocation of individuals, households, and families from the rural side into urban settings(Besfat and Melaku 2019).

In Ethiopia industrial sector is, however, still in its infancy, contributing only a small share to the GDP. Realizing the need for economic growth, and promoting job creation as a priority agenda, the Ethiopian Ministry of Finance and Economic Development (MOFED) initiated the Sustainable Development and Poverty Reduction Program (SDPRP) in 2002 which envisions the overall development goal of reducing poverty (MOFED 2002). The SDPRP and the subsequent development plans aimed at building a modern economy with a productive agricultural sector using enhanced technology. As well as modernizing the agricultural sector, the Ethiopian

government gave due attention to providing better opportunities for domestic and foreign private-sector investments in the industrial sector(MOFED ,2002).

The Ethiopian government has set a plan of shift the nation's agrarian economy to manufacturing based. The proliferation of industrial parks is part of the country's ambition. Debre Berhan Industrial Park, which was started in 2017 with 75.4 million USD, would have massive significance in bolstering the industrial sector. In addition, it would maximize foreign currency earnings through producing value added and quality produces. Debre Berhan is the most preferable investment destination in Ethiopia. In addition to the government built parks, domestic and foreign investors have been engaging in various investment endeavors. Turkish company has been involving in glass, garment and apparel and leather products. Indian and Chinese companies are also active in Debre Berhan. Conducive climate, abundant natural resources, energetic human power and its nearness to the capital Addis Ababa and to the port of Djibouti makes the town the best investment destination area in the country (EIC).

#### 2.1.4. Conceptual of food Security

The idea of food security evolved through different stages due to changes in development thinking in general, change in level of analysis and change of the food problem in the real world. According to IFPRI (1999), about 250 food security definitions exist in the literature world, which developed and used by different organizations/institutions mostly with small alterations or differences. The world food conference in 1975 defined food security as: "Availability at all times of adequate world supplies of basic food-staff to sustain a steady expansion of food consumption and to offset fluctuations in production (Muluwork 2014).

The main concern during the 1970s was therefore food availability at national or global level either through own production or import. Latter, it has realized that the food availability at national and global level (supply security) cannot guarantee food security at household level. The shortcomings of the early understanding of food security causes for the development of new insights that shift the understanding of food security form global and national level to household level (Muluwork 2014).

Amartya Sen credited as the Pioneer economist initiating the development of the concept of access and 'entitlement'. According to him, households may suffer food insecurity in a region or a country where adequate food is available because of lack of access due to their inability to produce by their own or purchase food, i.e. because of failure in entitlement 'endowment' or 'exchange' entitlement. Therefore, both availability of food and access to food are two essential determinants of food security. Although the first is the necessary condition, yet it does not necessarily ensure the latter. Thus, in the 1980s, the focus of unit of analysis shifted from national and global (macro) to household (micro) level; and from aggregate food supply to access (Muluwork 2014).

#### 2.1.5 Causes of Food Insecurity

According to Maxwell and Frankenberger cited in (Muluwork ,2014) risk to food security could originate from natural causes (such as drought, human and animal epidemic, flood, earthquake), institutions and policy failure (tax, removal of subsidy, property right), market failure, lack of employment opportunities and change and failure in community obligations. On the other hand, according to Maxwell and et.al (1998) particularly in the pre- urban settings loss of livelihoods asset such as agricultural farmlands for the purpose of house construction and industrial development in the process of urban expansion is a cause of food insecurity. Based on their degree of response to different shocks, households are divided in to three categories: enduring Households (households that maintain household food security on a continuous basis); Resilient Household (are households which suffer shocks, but recover very quickly); and Fragile Households (are households increasingly insecure in response to shocks. According to (IFAD, 1992 cited in (Muluwork 2014)), household food security determined by a number of interrelated factors starting from immediate factors that affect food supply at household level to basic factors, which conditioned the overall economic system of a given country. Among the most important determinant factors of food security at household level include: access to different resources such as social support systems, land, presence of adult labor in the family, physical capital (functioning of market and infrastructure), cash, livestock holding; agro-ecology, and level of diversification (presence of non-farm income).

### 2.1.6. Food Security Indicators

Household food security is an important measure of social being. Food security measurement is a delicate, complex and difficult task, requiring careful planning and inquiry in order to avoid wrong or misleading conclusions. It is advisable to devise workable indicators of household food access in order to identify the food insecure and characterize the nature of their food insecurity (IFPRI, 1999 cited in (Muluwork 2014)). Given the multidimensional nature of food security, practitioners and policy makers have long recognized the need for a variety of means of measurement. Different writers said that up to 450 foods security indicator tools developed and used by different practitioners, organizations or institutions. Food security coping strategy index is one of the food security measurement tools has used by various organizations and institutions to monitor food security status at household and community levels (Muluwork 2014). According to as cited in (Muluwork 2014) coping strategies define as a response to unfavorable events or shocks. On other hand as cited (Muluwork 2014) say that “all the strategically selected acts that individuals and households in a poor socio-economic position use to restrict their expense or earn some extra income to enable them to pay for the basic necessities such as food, clothing, shelter and not fall too far below their society level of welfare”. The most important advantages of the coping strategy index of food security measurement as indicated by easy to implement, typically taking less than three minutes per household and directly captures notions of adequacy and vulnerability. According to (Muluwork 2014), the household questionnaire information from sample groups summarized by counting number of strategies used by households in which the higher sum is the more food insecure, and calculating a weighted sum of these different coping strategies, where the weights reflect the frequency and the severity of the household's response. Coping strategy index of food security indicators measured behaviors in terms of index scale expressed in to four ranks of categories based on range of severity. According to (Muluwork 2014) it is often useful to simplify the food security scale into a small set of categories, each one representing a meaningful range of severity on the underlying scale and to discuss the percentage of the population in each of these categories.

- 1) Food secure — Households that show no or minimal evidence of food insecurity.
- 2) Food insecure without hunger — Food insecurity is evident in household members' concerns about adequacy of the household food supply and in adjustments to household food management,

including reduced quality of food and increased unusual coping patterns. Little or no reduction in members' food intake reported.

3) Food insecure with hunger (moderate) — Food intake for adults in the household reduced to an extent that implies, adults have repeatedly experienced the physical sensation of hunger.

4) Food insecure with hunger (severe) — At this level, all households with children have reduced the children's food intake to an extent indicating that the children have experienced hunger. For some other households with children, this already has occurred at an earlier stage of severity. Adults in household with and without children have repeatedly experienced a more extensive reduction of foodstuff intake.

## 2.2 Empirical review

### 2.2.1. Role of Industry in Ethiopia

Despite the government's efforts to increase the role of industry in achieving rapid economic development, the industrial sector has shown little growth in Ethiopia and still lags far behind the GDP contributions of the agricultural and service sectors. National sectoral economic reports show that the total contribution of industry to the GDP was about 10% in 2001, compared to about 13% in 2011. In 2002, the government adopted an Industrial Development Strategy as part of its efforts to vitalize the manufacturing sector. The strategy clearly identifies the priority areas of the manufacturing sub-sectors and suggested how to ensure the development of vibrant industries in the country. Ever since, in the last 12 years, the Ethiopian government has made numerous successive and proactive adjustments to the countries' structural, institutional and financial systems in order to encourage domestic and foreign private investments. To encourage the investments, the inflow of foreign capital and technology in to Ethiopia. Numerous incentives have been put in place, such as exemption from import and export customs duties, income tax holidays of up to three years, withholding of profit tax, and access to credit services, as indicated in the investment proclamation No. 280/2002 (Diriba et al. 2015).

### 2.2.2 Food security situation in Ethiopia

The national food security strategy (FDRE,1996) reports that as the Ethiopia population grew from 15 million in 1951-1955 during early the 1990s,the production of cereals, dropped on per capita basis by more than 25 % from around 200kg in early 1950, to 150kg in 1992. The

proportion of population unable to attain their minimum nutritional requirements is estimated at 52% of the rural population and 36% of the urban population Cited in (Birara, Mequanent and Samuel ,2015).

Drought and famine have become an everyday reality in Ethiopia. The country has faced three major famines and numerous famines like situations in the past three decades. The recurrent of famine in 1970s 80s and 90s has affected significantly the country's food production .during the period between 1958 and 1977 over 25 million peoples were directly affected by famine and drought. The number of death was estimated between three and five million people. The 1984/1985 famine alone had taken the lives of 300,000people (Birara et al. 2015).

Many factors are contributing to trap Ethiopia in the current state of food insecurity and poverty. These includes production fluctuations low non-farm employment, low income , regional fragmentation of markets high rate of natural degradation ,low level of farm technology, high level of illiteracy and inadequate quality basic education ,poor healthy and sanitation ,high population growth, poor government and interstate, intrastate military conflicts and wars. These factors impede the achievement of food security and sustainable economic development. It has one of the lowest per capita incomes in the world and high incidence of Absolut poverty with 50% of the population below the poverty line (Birara et al. 2015).

According to the FAO(2010) cited in(Birara et al. 2015),41% of the Ethiopia population lives below the poverty line and more 31 million people are undernourished .however, the latest undernourishment numbers show appositve trend (1990-1992,71% of the population ,1995-1997 :64%, 2000-2002:50% ,2004-2006 ,44% ). The concentrations of food insecurity and malnutrition are prevalent in rural areas with a population of six to seven million seasonally food insecure.

With more than 90 million people, Ethiopia is the second most populous country in sub –Saharan Africa and has one of the fastest growing economics in the world. The foundation of its economic growth is agriculture, which employs 80% of the population. Ethiopia could potentially reach middle –income status by 2005 with an emphasis on boosting domestic savings rates, private sector development and improving the trade logistics. However, poverty is still a big obstacle to overcome in Ethiopia. Nearly one third of the population lives below the poverty

line and vast majority depends on subsistence agriculture. Consequently, chronic and acute food insecurity is prevalent, especially among rural populations and smallholder farmers. About 10% of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15 % during frequent drought years. 2.7 million People will require emergency food assistance in 2014 and 238,761 children require treatment for severe acute malnutrition in 2014 cited in (Birara et al. 2015).

The overall food security is deteriorating following poor rains, both in livestock keeping and farming areas, swarms of locust have affected food production in eastern parts of the country. Ethiopia is a disaster prone country. Around 12 million people in the country regularly exposed to droughts, floods, landslides epidemics and earthquakes .these regular shocks have many negative consequences such as forced internal displacement of population, destructions of assets and livelihoods extreme poverty under nutrition and extreme food insecurity cited in (Birara et al. 2015).

### 2.2.3. Determinants of food security

Factors that affect household food security in various developing countries especially in Africa have been documented in some literature and these factors or determinants are most often than not location –specific ( i.e different study areas were found to have variant attributes as food security determinants with some attributes recurring) (Aidoo, Mensah, and Tuffour, 2013).

Several studies revealed that different factors affect both household food security and insecurity in Ethiopia because of difference in resource availability, topography time dimension and other factors. The study by Tilaye (2004) using binary logit model indicated that farmland size ,small ruminant holding in TLU and oxen holding in TLU affect household food security positively; whereas , family size has negative effect on it, cited in (Birara et al. 2015).

Alem (2007) in a study of food security using household food balance model and discriminant analysis showed that family size, low annual production ,small farm size attitude on food aid and poor wealth status significantly affect food security status . On the other hand ,Fekadu (2008) using multivariate logistic regression analysis indicated that age household heads ,labor and market accessibility have shown significant and negative effect on food security ;whereas

,cultivable land size ,fertilizer utilization ,engagement in rain water harvesting have shown significant and positive role food security cited in (Birara et al. 2015).

The study conducted by(Bogale and Shimelis 2009) using binary logit model revealed that age of the household head ,cultivated land size ,livestock owner ship ,total income of the household ,irrigation and amount of credit received have negative and significant effect on household food insecurity ;on the other hand ,family size has positive and significant effect . Similarly ,as studied by others ,using binary logit model showed that age of the household head ,size of land cultivated , use of fertilizer ,livestock ownership ,soil and water conservation practices and oxen ownership have positive and significant relationship with household food security. whereas ,education of household head ,household size (AE) and Of-farm /Non-farm income have negative and significant influence on household food security cited in (Birara et al.2015).

According to studies conducted in Ethiopia ,ownership of livestock ,farmland size ,family labor, off farm income ,market access , use of improved technology ,education ,health amount of rainfall and distribution ,croup diseases ,number of livestock and family size are identified as major determinants of household food security cited in (Birara et al. 2015).

### 2.3. Methods Used to Assess the Food Security Status of Sample Households

This method will use to know the household food security status means that the household is food secure or food insecure in many ways: like household food insecurity access scale, household dietary diversity, food consumption score and calorie intake per household per day

#### 2.3.1. Household Food insecurity Access Scale

Food and Nutrition Technical Assistance (FANTA) Project and its partners have identified a set of questions. Household food insecurity access scale generic questions (in appendix IV) that have been used to distinguish the food secure from food insecure households. The HFIAS consists of two types of related questions. The first question type is called an occurrence question. This are nine occurrence questions ask whether a specific condition associated with the experience of food insecurity ever occurred during the previous four weeks (30 days). Each severity question followed by a frequency-of-occurrence question, which asks how often a reported condition occurred during the previous four weeks. Each occurrence question consists of the stem (timeframe for recall), the body of the question (refers to a specific behavior or

attitude), and two response options (0 = no, 1 = yes). Each HFIAS frequency-of-occurrence question asks the respondent how often the condition reported in the previous occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often) (Jennifer, Anne and Paula ,2007). The HFIAS indicator categorizes households into four levels of household food insecurity (access): food-secure, mild, moderately and severely food insecure. Households are categorize as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently.

### 2.3.2. Household Dietary Diversity scores

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods. Data on household dietary diversity was collected using 24 hours of recall dietary intake. The information collected on dietary consumption allowed to calculate a dietary diversity score, defined as the number of different food groups consumed by household members over 24 hours. A list of meals, all food items and beverages consume in the last 24 hours was recorded. The twelve food groups, recommended by literature were used to assess household dietary diversity scores (HDDS). The consumed foods were allocated to the following food groups as composed : Cereals (1) White tubers and roots (2), Vegetables( 3), Fruits (4), Meat (5), Eggs (6), Fish and other seafood( 7), Pulse/ Legumes( 8), Milk and milk products (9), Oils and fats (10), Sugar or Haney (11), Spices, condiments and beverages (12). Yes and No categories were used. Yes was given a score of one (1) to each food group if the household consumed at least one food item within 24 hours. No was given zero (0) score for a particular food group if the household did not consume any food item from that food group. Finally the scores were counted from each food group and household dietary diversity scores (HDDS) were calculated based on the FAO guidelines for measuring household dietary diversity. A HDDS of less than 3 food groups was regarded as low household dietary diversity. Four to five food groups was regarded as medium dietary diversity and  $\geq 6$  food groups was regarded as high dietary diversity(Anne and Paula ,2006).

### 2.3.3. Food Consumption Score

To estimate the FCS, foods grouped into eight standard food groups (Table 2.1 below). The Food Consumption Score (FCS), a tool developed by WFP, is commonly used as a proxy indicator for access to food. It is a weighted score based on food frequency and the nutritional importance of food groups consumed. Data was collected on the number of days in the last 7 days a household ate specific food items.

Table 2.1: Food Items, Food Groups and Weights for Calculation of the FCS

Food items	Food group	Weight
Cereals: Corn, Wheat, Sorghum, Rice, Bread Roots and Tubers:	Staples	2
Pulses/Beans/Nuts	Pulses	3
Milk/ Milk Products	Milk	4
Animal Proteins: Fish, Meat, Eggs	Meat and fish	4
Vegetables (including green, leafy vegetables)	Vegetables	1
Sugar/ Honey	Sugar	0.5
Fruits	Fruits	1
Oil and fats	Oil	0.5

Source: World Food Program (2008).

The Household food consumption score (FCS) was calculated by multiplying each food group frequency by each food group weight, and then summing these scores into one composite score. The weighting of food groups has been determined by (WFP ,2008) according to the nutrition density of the food group. In line with the explanations given above, the most basic estimation equation for the Food Consumption Score used for this study is:

$$FCS = a \times f(\text{staple}) + \beta \times f(\text{pulse}) + \gamma \times f(\text{vegetables}) + \gamma \times f(\text{fruit}) + \delta \times f(\text{animal}) + \varepsilon \times f(\text{sugar}) + \delta \times f(\text{dairy}) + \varepsilon \times f(\text{oil})$$

Where FCS = food consumption score,

$f$  = frequencies of food consumption = number of days for which each food group was consumed during the past 7 days,

$\alpha, \beta, \gamma, \delta$  and  $\varepsilon$  = weight/nutritional value of each food group. According to (WFP, 2007; IFPRI, 2008), households with poor food consumption have a food score of 0-28, households with borderline food consumption have a food score of 28.5- 42 and households with adequate food consumption have a food score of above 42 which is viewed as acceptable.

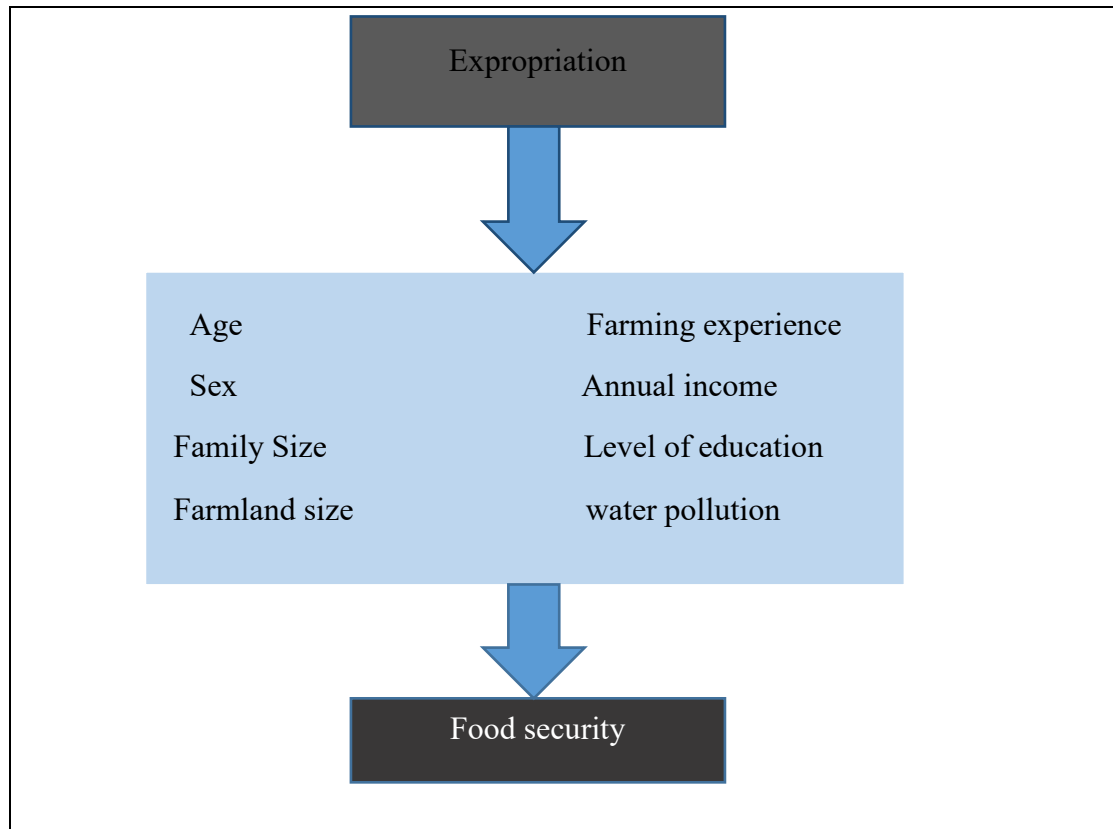
#### 2.3.4. Household Coping Strategies Index

The coping strategy index is a group of questions that asked in a household to find out how they manage to cope with the shortage of consuming enough food. The coping strategy index estimated by measuring behavior, such as the things individual household do when they cannot acquire sufficient food (Daniel 2008). The person who is responsible for preparing or consuming the food often identifies the coping strategies. Thus, the coping strategies observed usually linked to food practices in the short-term. Several studies have used the coping strategy index to measure the extent of household food insecurity. The most common short-term coping strategies employed by households are eating foods that are less preferred, reduction in the quality of food taken, limiting portion size, borrowing money to buy food and skipping meals(Daniel 2008).

#### 2.4. Conceptual framework of the study

The farmland conversation to industry area” is one of the most debated and very controversial topics of our time; because farmland to smallholder farmers main source of income to live. Then the farmland changed to other purpose implication on the farmers due to socio economic and environmental. The framework shows that the linkage between expropriation and household food security with variables assumed that affect household food security in study area. According to their nature, these variables are categorize under two categories. Demographic and socio-economic variable which include age, sex, educational level of the household head, family size, Cultivated farmland size and annual income, farming experience and environmental factors like water pollution.

### 2.4.1 Diagram of conceptual framework



Source: Own construction, 2021

## Chapter Three

### Methodology of the study

In order to acquire the best results, this research would apply the way of triangulation. A combination of qualitative as well as quantitative method were used. The chapter begins by presenting an overview of the study area, followed by instruments of data collection, the sampling design and data analysis techniques of the study.

### 3.1 Study Area

Debre Berhan is found in North Shewa Zone of ANRS. It is astronomically located in an approximate geographical coordinates between 90 38'00''-090 41' North Latitudes and 390 30'00''-390 32' East Longitudes. In relative terms, it is situated at about 130 kms road distance from Addis Ababa (the national capital) and at about 696 kms from Bahir Dar (the regional capital) on the main road to Dessie. The town is bounded by weredas of North Shewa Zone of ANRS. Currently, it is classified with 9 kebeles ; it serves as municipal as well as capital city for North Shewa Zone and Basoena werana Wereda.

The total area of Debre Berhan under the municipal (wereda level) jurisdiction (including the surrounding rural areas) is estimated to be about 18,000 hectares.

With an average elevation of 2750 meter above sea level (m.a.s.l), Debre Berhan was classified under Dega agro-climatic zone having favorable climate and abundant rainfall. This is favorable for human settlement and to undertake any developmental activities. In addition, this helps to sufficiently recharge the ground and surface water, and made the town the most preferable area with ample water supply coverage attracting different investments where water is one of the inputs of production. Moreover, its location encouraging for the avoidance of pollutant establishments (industries) that emit any smokes, dusts, sounds, and odors as its is clearly indicated its structure plan preparation (EMA, 2014) With an average maximum temperature of 20.1co and average minimum temperature of 6.5 co, the town has mean annual temperature of 13.3co 2008 to 2013. This, though may be cold for some times (October, November and December), Debre Berhan, with mean annual rainfall of 965.25mm from (2008-2013), has moderate annual rainfall amount that is sufficient to undertake any developmental activities,

### 3.2 Research design

The study used a cross-sectional study design. The target populations consisted of expropriated and non-expropriated smallholder farmers, who resided in the study area, which was Debre Berhan City Administration.

The research strategy will be guided by the quantitative and qualitative methodological approaches. Quantitative and qualitative data will collect through household survey based structured questionnaires. The questionnaires will be used to collect information about demographic and socio-economic determinants of the respondent in sampled households. In addition, secondary data will be obtained from records of administrative offices, publications, journals, books and other sources relevant to this study will be important to enrich the investigation.

### 3.3. Data Source and collection Methods

There are two types of data source. These are - primary data source and secondary data source.

#### 3.3.1 Primary Data collection

Primary Data was collected through household survey based structured questionnaires, face-to-face interviewing methods. The questionnaires used to collect information about demographic and socio-economic characteristics of the respondent in sampled households. This face-to-face interviewing method of data collection used tablet technology which developed by using Csprow software.

#### 3.3.2 Secondary Data collection

Secondary data is existing information, which previously been collected and reported by some individual or organizational for their own purpose. Thus, it would be obtained from records of administrative offices, publications, journals, books and other sources relevant to this study and important to enrich the investigation.

### 3.4 Sampling Method

Two-stage sampling design would be employed in order to select respondents who reside in the study area during the reference period. In the first stage, out of the target population, expropriated and non-expropriated respondents will be selected using stratified sampling techniques. In the

second stage, from the fresh list of each kebele, samples would be selected using stratified simple random sampling techniques.

### 3.5. Population, Sampling Frame and Sample size determination

#### 3.5.1 Population

The population of the study included all expropriated and non-expropriated smallholder farmer households in the five Kebeles. The researcher used the expropriated and non-expropriated smallholder farmers as population who lost their farmland for private project investment like Industry Park and non-loss farmers. The total number of smallholder farmers were 2037 households who are live in Debre Berhan city administration. Out of these households, almost half of the population were expropriated from their farmland for the past five years from five Kebeles namely Keeble 01, Keeble 06, Keeble 07, Keeble 08 and Keeble 09.

#### 3.5.2 Sampling frame:

From the total population list, the researcher selected the sample frame from the Debre Berhan town land administration office expropriated and non-expropriated smallholder farmers list recorded 965 households who lost their farmland due to the expansion of industry and 1072 non-lost households from the year 2016-2020.

#### 3.5.3 Sample size determination:

Even though, the data was collected from a large sample size is more accurate and represented the population on which the study is conducted, it takes more time, money, materials and it could be difficult to manage. To the inverse, if the numbers of samples are too small the collected data could be inaccurate or not represent the population, hence the required amount of sample size determination is very important. To determine the desired sample size from the target population, the following statistical approach is employ with the following equation. This study determined the sample size by using Yamane's (1967), formula present as follows:

$$n = \frac{N}{1+Ne^2}$$
$$n = \frac{2037}{1+(2037)(0.05)^2} = 335$$

Where: n = the desired sample size, N = the total population e = 5% the error term at 95% of confidence level or error term; no sample was perfect; the researcher decide the permute error

that was 5% error permute. The above formula would determine the whole sample size; stratification of this sample size has made based on the proportion of each expropriated and non-expropriated smallholder farmers as first stage and each kebele as second stage strata since all five kebeles have not the same number of expropriated and non –expropriated farmers. In doing so, the researcher calculate the sample size of each kebele as follows.

$$n_i = \frac{N_i * S}{N} , \text{ where } n_i = \text{sample of each strata will be select,}$$

$N_i$  = total population of each strata,  $S$  = total sample selected and  $N$  = total population of selected Kebeles

$$n_1 = \frac{965 * 335}{2037} = 158.7 , \text{ approximate to } 159$$

$$n_2 = \frac{1072 * 335}{2037} = 176.29, \text{ approximate to } 176$$

then the second stage of stratified sample selection in each Keeble is shown below:

Table 3.1: Number of Sample Households for Two Strata from each Keeble

Sample Keeble	Expropriated farmers		Non-Expropriated farmers		Total Sample
	Total	Sample	Total	Sample	
Kebele 01	56	9	72	12	21
Kebele 06	154	25	173	29	54
Kebele 07	266	45	300	49	94
Kebele 08	250	41	251	41	52
Kebele 09	239	39	276	45	84
Total	965	159	1072	176	335

### 3.6. Method of data analysis and food security measurement

After data collection, editing, and coding are completed and then entered into computer using STATA software. For the purpose of this particular study, the collected data was analyzed in different ways. Based on the objectives of the study, both descriptive, inferential and econometric model are adopted.

As descriptive statistics, frequency distribution, charts, mean, maximum and minimum, percentage distribution and standard deviation was employed to analyze the quantitative data. As inferential statistics, chi square was used to identify the associations between categorical variables and independent t- test was used to compare mean differences between two groups across the study variable, while considering the research objective. The qualitative data that was obtained from expropriated smallholder farmers' was analyzed in qualitative way.

There are different metrics used for food security measurements, including, Food Consumption Score (FSC), Household Food Insecurity and Access Scale (HFIAS), Coping Strategies Index (CSI), The Household Hunger Scale (HHS), Household Dietary Diversity Score (HDDS), among others (Swindale and Bilinsky 2006).

We used HDDS, which is a commonly applied tool and recommended by the FAO as a proxy for food access. Moreover, it is a low-cost tool, fast and easy to manage. Due to this reason, I used HDDS Method.

(Swindale and Bilinsky 2006) noted that HDDS is the number of different food groups consumed over a given reference period, commonly 24 hours' recall period by the household as a whole but not as a single member.

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods. Data on household dietary diversity was collected using 24 hours of recall dietary intake. The information collected on dietary consumption allowed to calculate a dietary diversity score, defined as the number of different food groups consumed by household members over 24 hours. A list of meals, all food items and beverages consumed in the last 24 hours was recorded. The twelve food groups, recommended by literature were used to assess household dietary diversity scores (HDDS). The consumed foods were allocated to the following food groups as composed : Cereals (1) White tubers and roots (2), Vegetables( 3), Fruits (4), Meat (5),

Eggs (6), Fish and other seafood( 7), Pulse/ Legumes( 8), Milk and milk products (9), Oils and fats (10), Sugar or Honey (11), Spices, condiments and beverages (12). Yes and No categories were used. Yes was given a score of one (1) to each food group if the household consumed at least one food item within 24 hours. No was given zero (0) score for a particular food group if the household did not consume any food item from that food group. Finally the scores were counted from each food group and household dietary diversity scores (HDDS) were calculated based on the FAO guidelines for measuring household dietary diversity. Accordingly, data on 12 food groups consumed over 24 hours prior to the survey period was collected from farm households to guide the computation of the score, which ranges between zero being a minimum score and 12 as the maximum score (Swindale and Bilinsky 2006). Cognizant of this, we employed HDDS to serve as a proxy for household food security status. The computed score was grouped into dummy variable, where the score value above average was taken as “food secure, coded as (Y =1)” and the score value below the average was used as “food insecure, coded as (Y =0)”(Taruvunga, Muchenje, and Mushunje, 2013).

### 3.7. Model specification

#### 3.7.1. Binary logit model

According to Gujarati (1995), three types of models have been proposed in the econometric literature for estimating binary choice models: the linear probability, logit and probit models represented by linear probability function, logistic distribution function and normal distribution function, respectively. These functions were used to approximate the mathematical relationships between explanatory variables and the food security situation that is always assigned qualitative response variables. According to Hosmer and Lemeshow (1989) the major point that distinguishes these functions from the linear regression model is that the outcome variable in these functions is dichotomous. Besides, the difference between logistic and linear regression is reflected both in the choice of a parametric model and in the assumptions. Once this difference is account for, the methods employed in analysis using logistic regression follow the same general principles used in linear regression. Available evidence shows that the logistic function is the most frequently used function in food security studies. According to Hosmer and Lemeshow (1989), there are two primary reasons for choosing the logistic distributions: from mathematical point of view; it is an extremely flexible and easily used function; and it lends itself to a

meaningful interpretation. The interest of the study with regard to this objective is to analyze the determinant of household food security for expropriated , to analyze the determinant of household food security for non-expropriated and to analyze the determinant of household food security for expropriated and non-expropriated smallholder farmers. For this study, analytical model selected is binary logit model, which significantly identifies the food security situation of households.

Binary choice models are appropriate when the decision making choice between two alternatives (food secure and food insecure). Household food security is a dependent variable, which takes a value of zero or one depending on whether or not a household was food secure or not (i.e. Food secure=1 and Food insecure=0).

Following Gujarati (1995) ,the logistic distribution for the food security situation can be specify as:

$$P_i = \frac{e^{Z_i}}{1+e^{Z_i}} \dots\dots\dots 1$$

Where  $p_i$  =was the probability that an individual is being food secure for the  $i$ th household and ranges from 0 to 1.  $e$  = represents the base of natural logarithms and  $Z_i$ = is the function of a vector of  $n$ - explanatory variables( $x$ ) and expressed as

$$Z_i = \beta_0 + \sum \beta_i X_i + u_i \dots\dots\dots 2$$

Where  $\beta_0$ = is the intercept  $\beta_i$  = is regression coefficients to be estimated,

$X_i$ = is Variables and  $u_i$  = is a disturbance term

$1 - P_i$  was represents the probability of not being food secured group and can be written as:

$$1 - P_i = \frac{1}{1+e^{Z_i}} \dots\dots\dots 3$$

Then odds ratio can be written as:

$$\frac{P_i}{1-P_i} = \frac{1+e^{-Z_i}}{1+e^{Z_i}} = e^{Z_i} \dots\dots\dots 4$$

Equation (4) indicates simply the odds ratio. It was the ratio of the probability that the household was food secure ( $P_i$ ) to the probability that he/she was food insecure. Finally, by taking the natural logarithms of equation (4) the log of odds ratio could be written as:

$$Z_i = \ln\left(\frac{P_i}{1-P_i}\right) = \ln\left(e^{\beta_0 + \sum_{j=1}^n \beta_j X_{ij}}\right) = Z_i = \beta_0 + \sum_{j=1}^n \beta_j X_{ij} + u_i \dots \dots \dots 5$$

Where  $Z_i$  was log of the odds ratio, which was not only linear in  $X_{ij}$  but also linear in the parameters.

### 3.7.2 Propensity Score Matching Technique

Propensity score matching is often used in a program evaluation setting, where the objective is to compare participant outcome with and without treatment. The method was initially proposed as a technique to reduce bias in estimation of treatment effects with observational data in the seminal work by (Rosenbaum and Rubin 1983). The households were then divided into two groups, those who expropriated and those who do not expropriated, and was ranked according to their propensity score. After that the households were matched with comparable households from the other group. In this way households in the treatment group matched and were compared with households from the control group, that have similar characteristics in every aspect except that they do not expropriated stallholder farmers.

In equation form, our goal is to estimate the causal treatment effect following (Andersson 2012).

$$t_i = Y_{i1} - Y_{i0} \dots \dots \dots (1)$$

Where

$Y_{i1}$  and  $Y_{i0}$  is the outcome treatment and without treatment group respectively for household  $i$ .

Consider  $D = \{0,1\}$  to be a binary indicator where 1 equals being assigned into treatment and 0 means not being assigned treatment. The Average Treatment Effects (ATE) was estimated through:

$$ATE = [E(Y_i | d_i=1)] - E[Y_i | d_i=0] \dots \dots \dots (2)$$

ATE is hence the average difference between the treated households (in our context treated households are households who are expropriated) and the non-treated households are not expropriated.

A preferred parameter to use instead of ATE is the Average Treatment Effect on the Treated (ATT), defined by:

$$ATT = [Y^1 |D=1] - E[Y^0 |D=1] \dots\dots\dots (3)$$

Where  $[Y^1 |D=1]$  is never observed. Replacing  $[Y^0 |D=1]$  by the expected value of  $[Y^0 |D=0]$ , which is observable in ATE, Would not give an accurate estimate as long as  $Y^0$  for the treated and comparison group systematically differs. The true parameter was only identified if:

$$[Y^0 |D=1] - E[Y^0 |D=0] = 0 \dots\dots\dots (4)$$

As discussed above, this is not very likely to hold in non-experimental studies. Instead, we rely on a matching approach to derive a counterfactual that enables us to match treated households with non-treated households with as similar characteristics as possible in order to reduce the bias from self-selection. The matching was made based on an index, the propensity score, summarizing the pre-treatment characteristics of each household. The propensity score is the probability of assignment into treatment,  $(X)$ , conditional on a set of pre-treatment characteristics,  $X$ , so that

$$(X) = \Pr[D=1|X] = E[D|X] \dots\dots\dots(5)$$

A few restrictions should be fulfilled when implementing the propensity score procedure. The conditional independence assumption (CIA) requires that the outcome variable is independent of treatment conditional on the propensity score. The balancing property theorem tells us that two households with the same predicate probability of were treated (i.e. expropriated households) and belonging to two different groups (treated and non-treated) differ when it comes to the error term in the propensity score equation. The error term is furthermore approximately independent of the observed covariates. In other words, for balancing property to be satisfied, households with the same propensity score must have the same distribution of observable and unobservable characteristics irrespective of treatment status. The balancing property can be tested using a covariate imbalance test. Common support implies that analysis was carried out when there are

sufficient data. Hence, there is no extrapolation outside the range of the observed data points. It is therefore advisable to impose a common support restriction when estimating the propensity score in order to improve the quality of matches.

### 3.8 Definition of Variables

It is necessary to identify the potential explanatory variables. Different variables are expected to affect household food security status in the study area. The major variables, which have influence on food, secure or not secure status in the household was presented as follows:

#### 3.8.1 Dependent variable

Household food security status (HHFSS), which is dependent variable for the logit analysis; it is a dichotomous dependent variable in the model taking a value 1 if the household is food secure and 0 otherwise. Households' food security status was determined by computing score was grouped into dummy variable, where the score value average and above was taken as "food secure, coded as ( $Y=1$ )" and the score value below the average was used as "food insecure, coded as (Taruvunga et al. 2013).

#### 3.8.2 Independent variable

Sex of the household head (SEXHH): Female-headed households are more vulnerable to labor shortage situation. They do not actively participate in the animal rearing and crop production activities, which are seen as a backbone for survival of households in the study area. It is dummy variable taking a value of 1 if the household head is female and 0 otherwise. The result of sex of the household head positively influenced on the food security status. Therefore, it is expected that female-headed households have more chance to be food insecure and positive relationship with food insecurity(Mohammed 2016).

Family Size (FSHH): This variable refers to the size of household members who live together under the same roof converted to Adult Equivalent (AE). The expectation is that household with large number of children or economically non-active family members will face food insecurity because of high dependency burden. This is the ratio of children under age 15 and old age of above 64 to family, (total dependency ratio) expressed in terms of AE. Therefore, family size will be expected to have negative relationship with food security of the households(Mohammed 2016).

Size of cultivated farmland: This was measured in hectares and refers to size of the cultivated land. As the cultivated land size increases, provided other associated production factors remain normal, the likelihood that the holder gets more output is high. This variable represents the total cultivated land size of a household in hectare. Therefore; it was hypothesized that farmers who have larger cultivated land are more likely to be food secure than those with smaller area. The result indicates in their study that size of cultivated land and food security status has positive relationship. Therefore; it is hypothesized that size of cultivated land and food security status has positive relationship(Mohammed 2016).

Dependency ratio: dependency ratio is the ratio of dependent household members and able-bodied/economically active household members. Dependency ratio is, therefore, expected to be positively associated with food insecurity i.e. the higher the number of dependent member(s) (higher dependency ratio), the higher will be the chances of being food insecure (Maharjan 2011)

Age of household head: The age of household head in year was expected to have impact on his labor supply for food production. It is also expected to have impact on ability to seek and obtain off-farm jobs and income, which could increase household income young people are stronger and are expected to cultivate larger size farm than old people. However ,the expected effect of age on food security could be positive or negative(Babatunde, Omotesho, and Sholotan 2007).

Educational status of household head: Education is a social capital, which could impact on positively on household ability to take good and well-informed production and nutritional decisions. Some scholars have argued that spouse education could be more important in food security than household head educational status., the expected effect on food security is positive(Babatunde et al. 2007).

Household Income: This refers to the sum total of the earning of the household in year from farm and off-farm sources. The income is expected to boost households food production and also access to more quantity and quality food .the expected effect of this variable on food security is positive(Babatunde et al. 2007).

Farm experience: It is a continuous variable measured in years of production. It is expected that farmers who have adequate experience in rice production and its rate are more likely to adopt the

technologies than those who lack it. This indicated that farm experience affects adoption of improved varieties. It is hypothesized that farm experience will positively affect the food security status of the household(Lensa 2019).

Marital status of household head (HHMS): Marriage is biological and social engagement to support each other both socially and economically. Marriage was established with a view of helping each other and married people pool their resources and reduce cost that would have been spent separately. Moreover, married households put aside some of resources for unforeseen circumstances to smoothen their life. In this study marriage and food security are hypothesized to be related positively(Abdela 2020).

Table 3.2: Description of Variables and hypothesis

Dependent variable: food security status of the household					
S.No	Explanatory variables		Definition and measurement	Hypot.	Some sources
1	SEX	SEX	1= Male 0=Female	+	(Mohammed 2016)
2	EDUC	Education level of HH head	1=illiterate 2=Traditional/religious /Adult 3=Primary Complete 4=Secondary Complete 5=Technical /vocational 6=Diploma Graduate 7=Degree and above	+	(Babatunde et al. 2007).
3	FSZHH	Family Size of the household	Continuous	-	(Mohammed 2016)
4	SCFARML	Size of cultivated farmland	Continuous	+	(Mohammed 2016)
5	DPR	Dependency ratio	Continuous	-	(Maharjan 2011)
6	AGHH	Age of household head	Continuous	+/-	(Babatunde et al. 2007)
7	HHI	Household Income	Continuous	+	(Babatunde et al. 2007)
8	FEX	Farm experience	Continuous	+	(Lensa 2019)
9	HHMS	Marital status of household head	1=Single 2=Married 3=Divorced 4=Widowed	+	(Abdela 2020)

10	CF	Compensation fee of the household	Continuous	+	Own regression output
11	FLOS	Farmland ownership of the household	1 = rent 2 = crop sharing 3 = Gift for free 4= own land	-	Own regression output
12	EH	Environmental harm of the household	1=yes 0= no	+	Own regression output
13	BFIP	Benefit from industry park	1=yes 0=no	+	Own regression output

## Chapter Four

### Finding and Discussion

This study investigated the implication of farmland conversion to Industrial park whether bring negative impact on the residences livelihood. This means, it further looked at the household food security status visa vise the socio economic and environmental impact. The results were basically indicator using cross-sectional data with respective with descriptive statistics such as percentage and chart, and econometric model in logit model.

#### 4.1 Demographics Characteristics of Respondents

As indicated by table 4.1 below from the total 335 valid respondents 47.46 % were expropriated farmers, 52.54 % are non- expropriated farmers. From the total sample more than 99.9 % of household head provided useful information. All the household head respondents are live in Debre Berhan city administration and the sample is composed of expropriated and non-expropriated farmers'. The majority 75.52 % respondent are male headed. However, out of this respondent 34.93 % are expropriated farmers and 40.60 % non-expropriated farmers. From the total sample, 24.48 % are female-headed respondents. Out of these respondents, 12.54 % were expropriated farmers and 11.94 % are non-expropriated farmers. In terms of marital status, from the total sample, 80 % of the respondents are married, 3.58 % of the respondents are single, 11.94 % of the respondents are divorced and 4.48 % of the respondents are widowed. Table 4.1 reveals that the average age of the household head 45.62 is nearly similar to both expropriated and non-expropriated farmers. In addition, the minimum age of the respondent, head are 18 years and the maximum age of the respondent, head are 84 years. Similarly, table 4.1 also shows that education background of the household head to both expropriated and non-expropriated farmers are mostly educated. Among the educated. 30.2 percent followed religious schools. This was followed by primary school (30 percent) and secondary (8 percent) school attainment. The remaining highest school attainments covered by other category. All head of the respondents were Orthodox Christian followers.

Table 4.1: Demographics Characteristics of respondents

Variable	Category	Total		Expropriated		Non-Expropriated	
		N	%	N	%	N	%
Sex	Male	253	75.52	117	34.93	136	40.60
	Female	82	24.48	42	12.54	40	11.94
	Total	335	100	159	47.46	176	52.54
Marital status	Single	12	3.58	5	1.49	7	2.09
	Married	268	80.00	124	37.01	144	42.99
	Divorced	40	11.94	23	6.87	17	5.07
	Widowed	15	4.48	7	2.09	8	2.39
	Total	335	100	159	47.46	176	52.54
Level of Education	Illiterate	87	25.97	40	11.94	47	14.03
	traditional/religious	101	30.15	45	13.43	56	16.72
	Primary Complete	99	29.55	48	14.33	51	15.22
	Secondary complete	28	8.36	13	3.88	15	4.48
	Technical/Vocational	19	5.67	13	3.88	6	1.79
	Diploma Graduate	1	0.30	0	0.00	1	0.30
	Total	335	100.00	159	47.46	176	52.54
Religion	Orthodox	335	100	159	47.46	176	52.54
	Islam	0	0.00	0	0.00	0	0.00
	Catholic	0	0.00	0	0.00	0	0.00
	Protestant	0	0.00	0	0.00	0	0.00
	Total	335	100.00	159	47.46	176	52.54

Source: survey summery, 2021

## 4.2 Socio-economic and environmental implication of farmland conversion to industrial park

### 4.2.1 Socio-economic implication of farmland conversion to industrial park

Table 4.2 shows that, from the total 335 valid respondents 47.46 % were expropriated farmers, 52.54 % are non- expropriated farmers. From 159 households, 77.75-hectare farmland was expropriated from the year 2016-2020. On average for each household 0.5 hectare farmland expropriated. This means that before expropriated 159 smallholder farmers have been 255.25 hectare. After expropriated 159 smallholder farmers, have 177.5 in total. Each individual farmer had average hectare of 1.98 decrease to 1.1 hectare. From the data, after 2018 expropriated smallholder farmers' increase rapidly.

Table 4.2: The association between food security versus expropriation

Food security status	Expropriation		
	Yes	No	Total
Food insecure	123 ( 36.72)	75 ( 22.39)	198 (59.10)
Food secure	36 (10.75)	101 (30.15)	137 (40.90)
Total	159 (47.46)	176 (52.54)	335 (100)
Pearson chi2(1) = 41.7205		Pr = 0.000	

Source: survey summery, 2021

Note: at 5 % level of significance

#### 4.2.1.1 Independent t-test

The independent t-test, also referred to as an independent-samples t-test, independent-measures t-test or unpaired t-test, is used to determine whether the mean of a dependent variable (e.g., Income, Food security and family size). Specifically, you use an independent t-test to determine whether the mean difference between two groups or variables are statistically and significantly different to zero.

Table 4.3: Independent t-test for expropriation versus total income

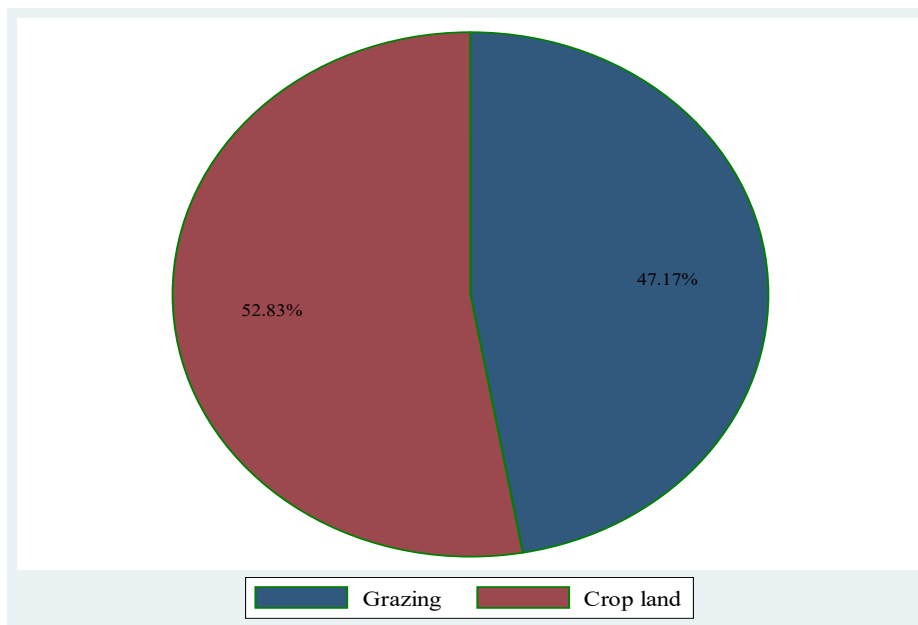
Variable	Obs	Mean	Std. Err	Std. Dev.
Expropriation	335	1.525373	.0273235	.5001028
Total income	335	43425.91	1560.062	28553.83
combined	670	21713.72	1145.514	29650.89
diff		-43424.39	(1560.062)***	

Source: survey summary, 2021

Note: at 5 % level of significance

The above table shows, the mean difference between expropriation and total income is -43424.4, p-value is 0.000. We reject the null hypothesis since P-value is significance ( $< 0.05$ ) Therefore, we accept the alternative hypothesis (HA) which state that there is mean difference between the two variables expropriation and Total income. So the mean of expropriation is smaller than that of total income by 43424.4 score after expropriation and it was statistically significant.

Figure 4.1: Major purpose farmland before expropriated smallholder farmers

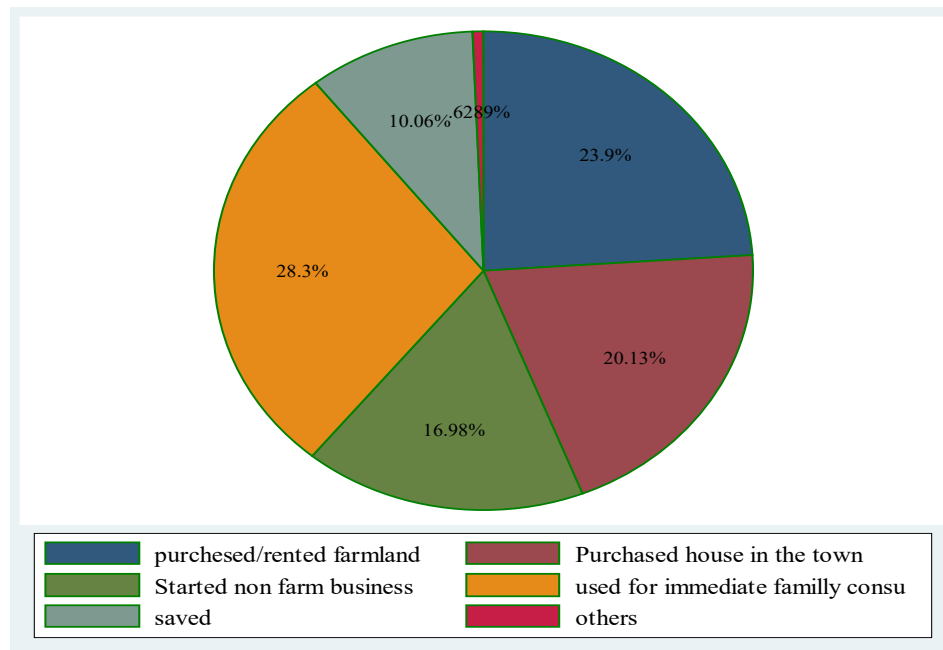


Source: survey summary, 2021

The graph 4.2 shows, farmland utilization before expropriated smallholder farmers. From the graph, the farmland were used many purposes, like grassland, cropland, grazing, source of firewood and source water. Most of the respondents used as 47.17 % of the farmers used grazing purposes and 52.83 % of the farmers used cropland purposes.

In the total sample 335 households, 159 were expropriated and all farmers received compensation fee from city administration. The minimum compensation fee per square meter was 1 birr and maximum compensation fee per square meter was 73 birr. Minimum total compensation fee received was 25000 birr and maximum total compensation fee received was 750000 birr.

Figure 4.2: Utilization of compensation fee in household level



Source: survey summery, 2021

From the graph ,Out of expropriated smallholder farmers based on compensation fee utilization 28.30 % of farmers used for immediate family consumption, 20.13 % of farmers purchased house in the town,23.90 % farmers purchased /rented farmland ,16.98 % of farmers started non-farm business and 10.06 % of farmers saved.

Table 4.4: Compare the amount of compensation money with your farmland

Category	Total n=159	Percent (%)
Higher than	27	16.98
Equivalent too	21	13.21
Lower than	90	56.60
Very much lower than	20	12.58
others	1	0.63
Total	159	100.00

Source: - survey summary, 2021

As result, out of the sample, 159 smallholder farmers were expropriated and paid compensation fee. 16.98 % of smallholder farmers' compensation money was higher than aggregate value of own land and properties on it, 13.21 % of smallholder farmers compensation money was equivalent to the value of own land and properties on it , 56.60 % of smallholder farmers compensation money was lower than the aggregate value own land and properties on it. And also 12.58 % of smallholder farmers compensation money was very much lower than the aggregate value of own land and properties on it.

Table 4.5: Major type of livelihood in expropriated smallholder farmers

Variable	Category	Total n=159	Percent %
Major type of Livelihood before farmland expropriation	Crop production	118	74.21
	Livestock	3	1.89
	Crop production and Livestock	37	23.27
	Own Business	1	0.63
	Total	159	100.00

Major type of Livelihood after farmland expropriation	Crop production	92	57.86
	Livestock	22	13.84
	Crop production and Livestock	34	21.38
	Own Business	7	4.40
	Causal Labor	3	1.89
	Others	1	0.63
	Total	159	100.00

Source; survey summary, 2021

As table 4.3 shows, major type of livelihood before and after farmland expropriation of smallholder farmers, 74.21 % of farmers' livelihood before farmland expropriation were crop production. After farmland expropriation, that farmers' livelihood were decreased from 74.21 % to 57.86 %. 1.89 % farmers livelihood before farmland expropriation were livestock and after farmland expropriation ,the farmers livelihood in livestock were increased from 1.89 % to 13.84 % ,i.e. in number 3 farmers to 22 farmers.

From the above table, 23.27 % of farmers' livelihood before farmland expropriation were mixed (crop production and livestock). After farmland expropriation, those farmers were decreased from 23.27 % to 21.38 %. 0.63 % of farmers livelihood before farmland expropriation were own business and after farmland expropriation the farmers livelihood in own business were increased from 0.63 5% to 4.4 %.

As we see the other category, none of farmers' livelihood before farmland expropriation were causal labor and after farmland expropriation the farmers' livelihood in causal labor were increased from 0 % to 1.89 %. In general, farmland conversion to industrial area or other purpose has its own implication to livelihood of expropriated smallholder farmers in Debre Berhan city administration.

Table 4.6: Major type of livelihood /source of income for non-expropriated smallholder farmers

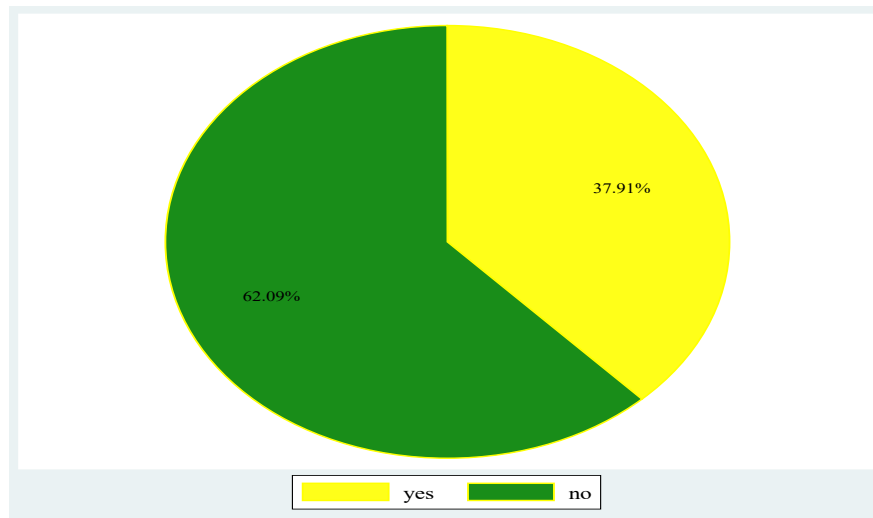
Variable	Category	Total n=176	Percent %
Major type of Livelihood/source of income	Farming/Crop production	171	97.16
	Business Such as petty trade	1	0.57
	Temporary employment	2	1.14
	Remittance	2	1.14
	Total	176	100.00

Source; survey summary, 2021

The result shows, out of the sample 176 respondents were non-expropriated smallholder farmers. The major type of livelihood /source of income of farmers i.e. 97.16 % of farmers' livelihood /source of income was farming activities like crop production and livestock. 0.57 % of farmers' livelihood /source of income was business activity, 0.14 % of farmers' livelihood /source of income was temporary employment and 1.14 % of farmers' livelihood /source of income was Remittance.

Farmland conversion to industrial park or other purposes has its own socio economic implication on expropriated stallholder farmers as compared to non-expropriated smallholder farmers. We see one of socio economic variables like type of livelihood /source of income in expropriated smallholder farmers, the sample of 159 farmers, 93 % of farmer livelihood /source of income were farming activities. On the other way, in the non-expropriated smallholder farmers, the sample of 176 farmers 97.16 % of farmer livelihood /source of income was farming activity. This difference shows farmland conversion to industrial park has its implication on socio economically in expropriated smallholder farmers.

Figure 4.3: Benefit from industrial park establishment



Source; survey summary, 2021

From the graph, the total sample of 335 smallholder farmers, 62.09 % of farmer have not gotten any benefit from industry park establishment. The remaining 37.91 % of the farmer have gotten benefit from industry park establishment. Under benefited farmers, 18.21 % of expropriated smallholder farmers and 19.70 % of non-expropriated smallholder farmers. Under not benefited farmer, 29.25 % of expropriated smallholder farmers and 32.84 % of non-expropriated smallholder farmers.

Table 4.7: Type of benefit gotten from industry park establishment

Variable	Category	Total n=127	Percent %
Type of benefit	good compensation	28	22.05
	Brought farm technology	9	7.09
	Employment opportunity	48	37.80
	Accessed as clean water	20	15.75
	Created market access	13	10.24
	Other	9	7.09
	Total		

Source: survey summary, 2021

From the above table, of the total sample of 335 farmers, 127 farmers were benefited from industry park establishment. The farmers have gotten much type of benefits. Out of this 22.05 % have gotten good compensation, 7.09 % have gotten brought farm technology, 37.80 % have gotten employment opportunity, 15.75 % have gotten accessed as clean water and 10.24 % of smallholder farmers have gotten created market access.

Table 4.8: Total income annually and cultivated area in hectare

Variable	Obs	Mean	Std.	Min	Max
Total income annually	335	43425.91	28553.83	5500	280000
Total cultivated area	335	1.315672	.679975	0.25	4

Source: survey summary, 2021

From the data set, mean of total income annually was 43425.91 birr and mean of total cultivated area was 1.315672 hectare.

In the summary statistics given above each variable has its own minimum and maximum value. From the table, the minimum of total annual income was 5500 birr and maximum of annual income 280000 birr. The minimum of cultivated area 0.25 hectare and maximum of 4 hectare.

From the table, the standard deviation of total annual income was 28553.83. This implies high variation between a data set. The standard deviation of total cultivated area was 0 .679975. This implies there was not high variation between a data set.

Table 4.9: Obtained cultivated farmland

Variable	Category	Total n=335	Percent %
Obtained cultivated farmland	Rent	93	27.76
	Crop sharing	75	22.39
		68	20.30
	Gifts	99	29.55
	own land		
Total	335	100.00	

Source: survey summary, 2021

Most of the farmers obtained cultivated farmland as follows , 27.76 % of farmers obtained as rent, 22.39 % of farmers obtained as crop sharing, 20.30 % of farmers obtained as gift from relatives /friends /neighborhoods, 29.55 % of farmers obtained as own land.

#### 4.2.2 Environmental implication of farmland conversion to industrial park

Environmental implication of farmland conversion to industrial park was environmental pollution, anticipated health and safety problems. The other major negative implication are those related to potential pollution of the biophysical environment, health and safety of workers as well as residents near and around the industry park. This is mainly due to potential release of solid, liquid and gaseous waste manifested in pollution of water resources, air and potential contamination of land and soil resources. Noise pollution as well as potential accidents and injuries to human beings that can happen during the construction and operation phases of the industry park are also problems that need too mitigated. All these have negative implication on the health and safety of human beings and other living organisms in and around the industry park. Some of the implication may be even of a wider scale especially in relation to the anticipated surface water pollution. Especially worth mentioning is the potential influencing that the release of uncontrolled solid and liquid waste from the industrial activities in the industry park. The result indicated 31.64 % of sampled farmers were environmentally harmed and 68.36 % of sampled farmers were not environmentally harmed in case of industrial park.

Table 4.10: Type of Harm happened

Variable	Category	Total n=10	Percent %
Type harm	Polluted rivers and streams	6	5.66
	polluted farmland	19	17.92
	make as landless	6	5.66
	make as poor	1	0.94
	affected our livestock	69	65.09
	brought sniffing	4	3.77
	others	1	0.94
	Total	106	100.00

Source: survey summary, 2021

The result indicates, 5.66 % of farmers harmed in polluted rivers and streams, 17.92 % farmers harmed in polluted farmland, 5.66 % of farmers harmed in make as landless, 0.94 % of farmers harmed in make as poor, 65.09 % of farmers harmed in their livestock and 3.77 % of farmers harmed in brought sniffing.

Table 4.11: Source of water to environmentally harmed farmers

Variable	Category	Total n=106	Percent %
Major Source of water to household consumption	Rivers and stream water	2	1.89
	Spring water	49	46.23
	tab water potable	55	51.89
	Total	106	100.00

Source: survey summary, 2021

The table indicates the source of water to household consumption in environmentally harmed. Out of those farmers 1.89 % of farmers source of water were river and stream water, 46.23 % of farmers source of water were spring water and 51.89 % of farmers source of water were tab water potable.

Table 4.12: Quality of water

Variable	Category	Total n=106	Percent %
Quality of river /stream water after industry establishment	Excellent	4	3.77
	Very Good	17	16.04
	Good	79	74.53
	bad/unclean/polluted	6	5.66
	Total	106	100.00

Source: survey summary, 2021

The above table shows, the quality of river /stream water after the process of industrial establishment measured in farmers' local experience. From this, 3.77 % of farmers were excellent, 16.04 % of farmers were very good, 74.53 % of farmers were good and 5.66 % of farmers were bad /unclean/polluted.

Table 4.13: most common disease in case environmental implication

Variable	Category	Total n=100	Percent %
Most common disease	STD	3	3.00
	TB	3	3.00
	Diarrhea	3	3.00
	Typhoid fever	1	1.00
	Intestinal Parasites	1	1.00
	Ameba	2	2.00
	Eye disease	1	1.00
	Tonsillitis	6	6.00
	Do not know	80	80.00
	Total	100	100.00

Source; survey summary, 2021

From the above table, most common disease prevailing in the area over last five years shows , out of 100 respondents ,80 % of respondents were do not know, 6 % of respondents were tonsillitis, 3 % of respondents were TB and 3 % of respondents were Diarrhea.

Table 4.14: Compare the life of expropriated with non-expropriated smallholder farmers

Variable	Category	Expropriated		Non-Expropriated		Total	
		N	%	N	%	N	%
Family life	Improved	66	19.70	94	28.06	160	47.76
	Worsened	58	17.31	23	6.87	81	24.18
	Indifferent	34	10.15	58	17.31	92	27.46
	other	1	0.3	1	0.3	2	0.6
	Total	159	47.46	176	52.54	335	100.00

Source; survey summary, 2021

As table 4.12 indicates, out of the total sample 47.76 % of the respondents or smallholder farmers' family life were improved. Out of the improved respondents 19.70 % of expropriated farmers, where as 28.06 % were non-expropriated farmer.24.18 % of the respondents' family life were worsened .out this 17.31 % of expropriated farmers and 6.87 % of non –expropriated farmers. In addition, out of the total sample 27.46 % of the respondents' family life were indifferent. Out of this 10.15 % of expropriated farmers and 17.31 % of non-expropriated farmer.

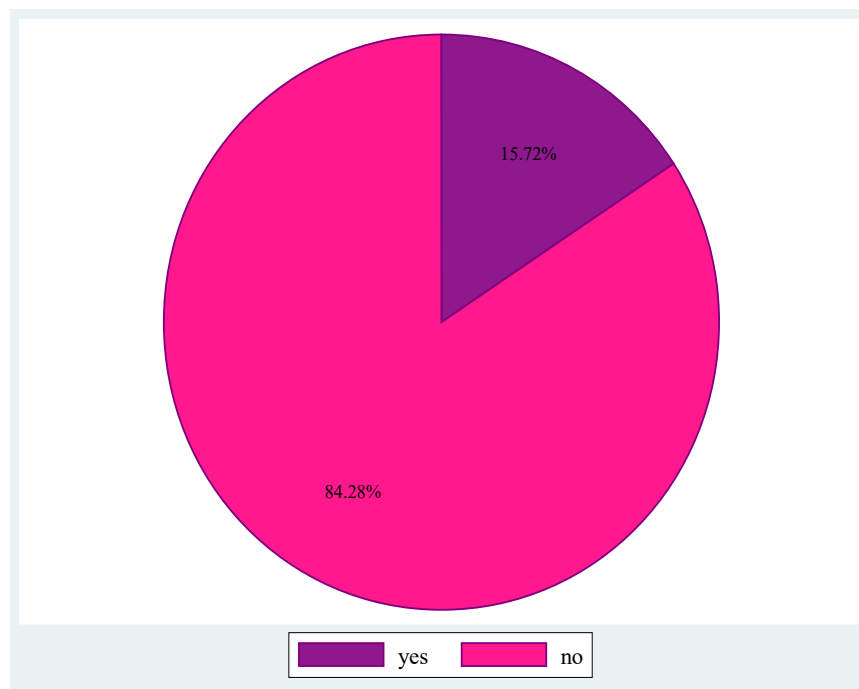
#### 4.2.3 Measuring food security status of the sampled household

There are different type of food security measurements including food consumption score (FCS) , Household Food Insecurity and Access Scale (HFIAS),Calorie intake , Coping Strategies Index (CSI), The Household Hunger Scale (HHS) and Household Dietary Diversity Score (HDDS). We used HDDS, which is a commonly applied tool and recommended by the FAO as a proxy for food access. Moreover, it is a low-cost tool, fast and easy to manage.

Accordingly, data on 12 food groups consumed over 24 hours prior to the survey period was collected from smallholder farmers to guide the computation of the score, which ranges between zero being a minimum score and 12 as the maximum score. The computed score was grouped

into dummy variable, where the score value above average was taken as “food secure, coded as ( Y =1) and the score value below the average was used as “food insecure, coded as ( Y =0).

Figure 4.4: Household Feeding status after farmland expropriated was reduced



Source; survey summary, 2021

The graph indicated, 15.72 % of expropriated smallholder farmers’ household feeding status were reduced and 84.28 % of expropriated smallholder farmers’ household feeding status not reduced after farmland expropriated.

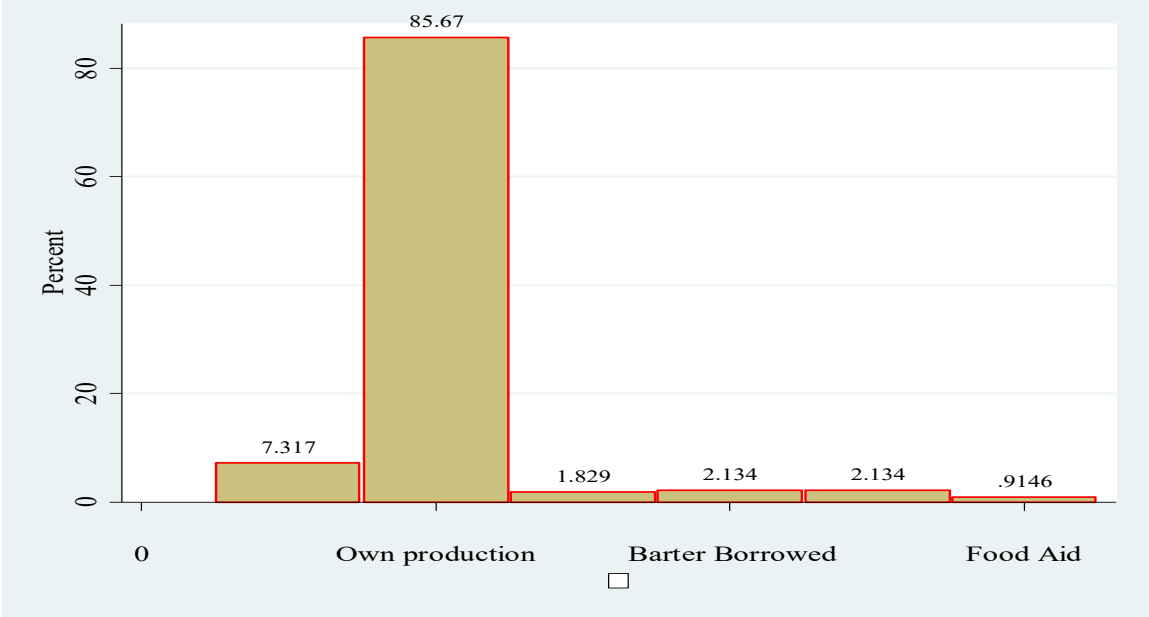
Table 4.15: food security status of HH (HDDS)

Variable	Category	Total and percentage	
		N	%
Food security status	Food insecure	198	59.10
	Food secure	137	40.90
	Total	335	100.00

Source; survey summary, 2021

The above table indicates, in the sample of 335 Households 80 % of food insecure and 20 % of food secure. Out of food insecure households 34.93 % of expropriated smallholder farmers and 45.07 % of non-expropriated smallholder farmers. In addition, out of food secure household, 12.54 % of expropriated smallholder farmers and 7.46 % of non-expropriated smallholder farmers.

Figure 4.5: Common source of food items in sampled households



Source: survey summary, 2021

The above figures shows that, 85 .67 % of common source of food items in the households were own production, 7.32 % of were Purchased, 1.83 % Traded goods /Services, 2.13 % Barter Borrowed, 2.13 % Received as Gift and 0.91 % Food Aid.

Table 4.16: Food security status of expropriated and non –expropriated smallholder farmers (own self-assessment)

Variable	Category	Expropriated		Non-Expropriated		Total	
		N	%	N	%	N	%
Food security status	Food secure	90	26.87	98	29.25	188	56.12
	Food insecure	22	6.57	20	5.97	42	12.54
	Varies (not stable)	41	12.24	44	13.13	85	25.37
	Do not know	6	1.79	14	4.18	20	5.97
	Total	159	47.46	176	52.54	335	100.00

Source: survey summary, 2021, Pearson chi2 (3) = 2.8863 Pr = 0.409

Note, Significant at p-value < 0.05

The above table indicates ,based on the respondents own self-assessment ,56.12 % of household were food secure ,12.54 % of households food insecure and 25.37 % of households varied from one year to another year . Out of food, secure households 26.87 % of expropriated household and 29.25 % of non-expropriated household. In food insecure household, 6.57 % of expropriated household and 5.97 % of non-expropriated household. In addition, out of not stable status of 12.24 % of expropriated households and 13.13 % of non-expropriated households. We test the association between food security status and expropriation, in these result, the Pearson Chi-Square Statistic is 2.8863 and the p-value =0.409 .there for, at 5% level of significance, we conclude that the association between the variables was statically insignificance .means that there is no association between them.

For food in secured households its own reasons .Most of the respondents were inability to produce sufficient grains, inadequate income from non-farm activities and failure to properly utilize own production and other earnings.

### 4.3 The effect of expropriation on food security of smallholder farmers

#### 4.3.1 Estimation of propensity score matching

The binary logistic regression model was used to estimate propensity scores for matching the treated with untreated households. In this study expropriation households are the dependent variable and has taken value 1 and 0 if the respondents are non-expropriated. For estimating propensity scores, the study has used different observable characteristics, both from expropriated households and non-expropriated households. Ages, age dependency ratio, education level, cultivated farmland size, farmland ownership, Total family size, farming experience, Total income annually and environmental harm was taken to estimate.

Table 4.17: Results of Estimated Propensity Score

Propensity score variables	Coef.	(Std.Err)
Age	-.0159422	(.020)
Age dependency ratio	.0002025	(.002)
Total family size	.1181608	(.086)*
Farming experience	.07937171	(.021)***
Total income annually	-7.08e-06	(4.40)*
Current cultivated land size in hea.	-1.035404	(.225)***
Educational level of HH Head	.3124663	(.125)**
Environmental harm	-.6153139	(.281)**
Farmland ownership	.0028842	(.109)
Constant		
Number of obs = 335	LR chi2(9) = 54.64	
Prob > chi2 = 0.0000	Pseudo R2 = 0.1179	
Log likelihood = -204.45515		

Source: survey summary, 2021 , Standard errors in brackets

Note: \*\*\*, \*\* and \* significant at 1%, 5% and 10%, probability level of significance

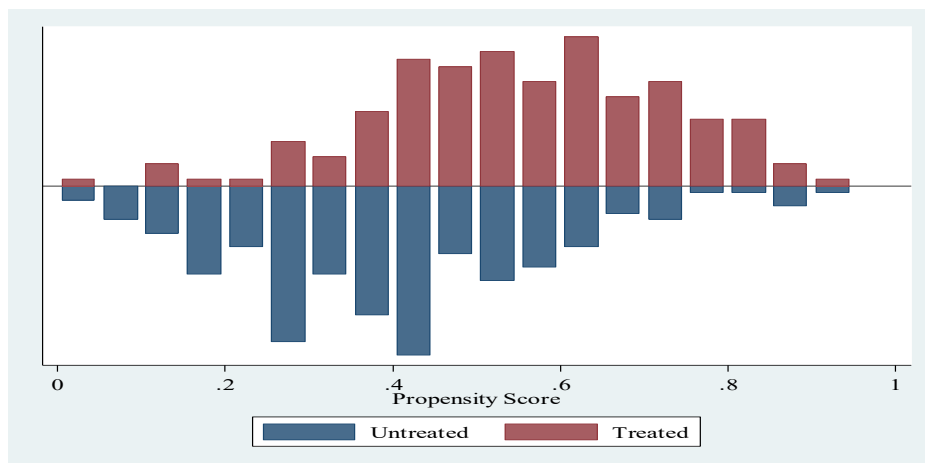
Table 4.18: Common support region

psmatch2: Treatment assignment	psmatch2: Common support		Total
	On support	Off support	
Untreated	176	0	176
Treated	159	0	159
Total	335	0	335

Source: survey Summary, 2021

The above table show, describes the common support of the untreated and treated group for the outcome variables. From the total sampled household 335 observations (100 %) are on support from both the treated and untreated group. This result presents the off support observation was discarded from the both from treated and control group.

Figure 4.6: propensity scores with common support regions



Source: survey summary, 2021

The above figure tells between the regions of common support using color codes. The upper red color shows the treated on support observations. The lower blue color indicates the untreated on support. Therefore, all of the observation is in the common support region of the region. This confirmed that there is adequate intersection in the features of treated and untreated components to find sufficient matches.

#### 4.3.2 Matching Treatment and Control Groups

After finding of common support region, different matching algorithm was applied to match expropriated households with non-expropriated households' in common support region. Khandker et al. (2010), explain that benefit and disadvantage of every algorithm are clear in theoretical and simulation studies, but practically there is always uncertainty about which one is the best method for matching.

The final choice of a matching estimator was guided by different criteria such as equal means test referred to as the balancing test pseudo-R2 and matched sample size. Specifically, a matching estimator which balances all explanatory variables (i.e., results in insignificant mean differences between the two groups), bears a low R2 value and results in large matched sample size is preferable (Dehejia and Wahba 1999).

This study has used nearest neighbor matching to estimate the average treatment effect of expropriation. After analyze the outcomes it has been found that nearest neighbored matching with large matched sample size is the best estimator for the data at hand.

#### 4.3.3 Testing the Balance of Propensity Score and Covariates

This was to perform a balancing test, which tests the significance of the mean difference between all covariates used for the matching purpose before and after matching. The objective of the balancing test is to verify that treatment is independent of unit characteristics after conditioning on observed characteristics (as estimated in the propensity score model),  $D \perp X / P(X)$  where  $X$  is the set of characteristics' that are believed to satisfy the conditional independence assumption. In other words, after conditioning on  $P(X)$  there should be no other variable that could be added to the conditioning set of the propensity score model that would improve the estimation and after the application of matching there should be no statistically significant differences between covariates mean of the treatment and comparison units. After matching tests, any difference in the covariates means between the two groups in the matched sampled has been eliminated because it should increase the likelihood of unbiased treatment effects. The main purpose of the propensity score estimation is not to obtain a precise prediction of selection into treatment, but rather to balance the distributions of relevant variables in both groups.

Table 4.19: Propensity score and covariates balancing

Variable	Sample	Mean		% of bias	t-test	
		Treatment	Control		T	p> t
Age	Unmatched	46.226	45.438	7.2	0.66	0.512
	Matched	46.226	46.686	-4.2	-0.38	0.702
Age dependency ratio	Unmatched	53.87	51.074	5.2	0.48	0.633
	Matched	53.87	62.434	-16.1	-1.37	0.173
Level of education	Unmatched	2.4591	2.3125	12.9	1.18	0.238
	Matched	2.4591	2.3082	13.3	1.19	0.234
Total family size	Unmatched	5.2956	5.0114	17.8	1.62*	0.106
	Matched	5.2956	5.5975	-18.9	-1.79*	0.075
Farming experience	Unmatched	23.585	20.915	26.1	2.38 *	0.018
	Matched	23.585	24.585	-9.8	-0.85	0.395
Total income annually	Unmatched	44315	54796	-21.8	-1.96 *	0.051
	Matched	44315	45108	-1.6	-0.26	0.796
Farmland ownership	Unmatched	2.6667	2.4205	20.8	1.90*	0.058
	Matched	2.6667	2.6164	4.2	0.37	0.708
Current cultivated land size	Unmatched	1.1557	1.4602	-46.0	-4.19 ***	0.000
	Matched	1.1557	1.1431	1.9	0.18	0.856
Environmental harm	Unmatched	1.6289	1.733	-22.4	-2.05 **	0.041
	Matched	1.6289	1.7421	-24.4	-2.18**	0.030

Source: survey summary, 2021

Note: \*\*\*, \*\* and \* significant at 1%, 5% and 10%, probability level of significance

According to Table 4.19, before matching, some variables were significantly different for the two groups of respondents. But after matching most of significant covariates were conditioned to be insignificant which indicates that the differences in covariates mean between the treated and control groups eliminated after matching and were balanced.

Table 4.20: Chi square test for joint significance

Sample	Ps R2	LR chi2	p>chi2
Matched	0.023	10.17	0.337

Source: survey summary, 2021

In this context Chi square test is a combined test for the equality of means between expropriated and non-expropriated for all the covariates. The result signifies that there is low pseudo R2 value and insignificant likelihood ratio (LR) test, hence after matching; there is insignificant mean difference between the treatment groups and control groups.

#### 4.3.4 Estimating Treatment Effect on the Treated

This section presents and discusses the results of the PSM technique to assess the effect of expropriation on household food security status. It explains the estimation of propensity scores, matching methods, common support region and balancing test of covariates. It also explains the treatment effect of the intervention across the expropriated households. To attain the main and the specific stated objectives of this study, this section evaluated the effects on the outcome variable for their significant effect on expropriated households. The specific effect indicator that was considered as outcome variable was food security status measured in HDDS.

Table 4.21: The average treatment effect on the treated.

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Food security	Unmatched	.226415094	.573863636	-.34744854	.050481737	-6.88
	ATT	.226415094	.471698113	-.24528301	.07911029	-3.10
	ATE	.	.	-.22089552	.	.

Source: survey summary, 2021, significant at 1 % probability level of significance

As above Table 8 showed that negative and statistically significant mean difference between expropriated and non-expropriated households of food security status. A negative value of ATT confirmed that food security status of the households were insecure due to expropriated in the study area. This expropriated household's food security mean is less than by the mean 25 % comparing with non-expropriated households. The statics is significant at 1 % significant level.

## 4.4 Determinants of food security

### 4.4.1. Logistic regression

One of the very important roles of econometrics is to provide the tools for modeling based on the given data. The logistic regression modeling technique helps a lot in this task. The regression models can be either linear or non-linear based on which we have linear regression analysis and non-linear regression analysis. For this Analysis researcher used three models were created based on logit model.

1. Determinant of food security for expropriated smallholder farmers
2. Determinant of food security for non-expropriated smallholder farmers
3. Determinant of food security for expropriated and non-expropriated smallholder farmers

### 4.4.2 Model diagnosis test results

Multi-co linearity is a statistical phenomenon in which there exists a perfect or exact relationship between the predictor variables. When there is a perfect or exact relationship between the predictor variables, it is difficult to arise with reliable estimate of their individual coefficients. This finally results in incorrect conclusions about the relationship between outcome variable and predictor variables. There are several ways of diagnosing the presence of multi-collinearity: Examination of Correlation Matrix, link test, goodness of fit test, Variance Inflation Factor (VIF) and Eigen system Analysis of Correlation Matrix. In this study, we used goodness of fit and variance inflation factor.

The model goodness of fit test of the logistic regression justify that the model is robust enough to explain the dependent variable. The Pseudo R<sup>2</sup> statistic of the model is 0.2934, which lies between zero and one an evidence that the variable is well fit for the model and the independent variable could explain the dependent variable.

Table 4.22: Hosmer and Lemeshow goodness of fit

No obs	No of group	Hosmer-Lemeshow chi2(8)	Prob > chi2
334	10	13.06	0.1097

Source: survey summary, 2021

The output returns a chi-square value (a Hosmer-Lemeshow chi-squared) and p-value (e.g. Pr>ChiSq) Small p-value mean that the model is a poor fit. Like most goodness of fit tests, these small p-values (usually under 5 %) mean that your model is not a good fit. From the result, p-value of Hosmer –Lemeshow test is 0.3470. This value is greater than at 5% .Then the model is a good fit.

Multi-collinearity test: The VIF measures how much the variance of an estimated regression coefficient increases if your predictors were correlated. A VIF around 1 is very good. There are some guidelines we can use to determine whether our VIF are in an acceptable range. A rule of thumb commonly used in practice is if a VIF is > 10, you have high multi co-linearity. In this case, the values around 1, are in good shape, and can proceed with regression. We see the above result, out of twelve variables ten variables VIF value around 1 and mean of VIF was 1.88. This result implies a good shape and low multi collinearity.

Table 4.23: Logistic regression model based on expropriated and non-expropriated smallholder farmers

Explanatory variables	Food security status of Expropriated households		Food security status of Non-expropriated households	
	Coef. (Std.Err)	Odds Ratio	Coef. (Std.Err)	Odds Ratio
Age	-0.1361766** (0.083)	0.8726885	-0.46139 (0.061)	0.9548615
Age dependency ratio	-0.0079846 (0.008)	0.9920472	-0.0181082** (0.008)	0.9820548
Total family size	-0.1265752 (0.365)	0.8811079	-0.4075752 (0.252)	0.6652614
Farming experience	0.2228** (0.086)	1.249579	0.23359 (0.056)	1.023634
Total Compensation fee in birr	2.39e-06 (2.65)	1.000002		
Total income annually	-0.000044** (0.00002)	0.9999562	0.0000487** (0.001)	0.9999513
Current cultivated land size in hea.	4.512369 *** (1.125)	91.13749	2.445857 * (0.705)	11.54044
Sex of HH Head				
Male	-1.023778 (1.012)	0.3592353	0.7275319 (0.896)	2.069965
Educational level				
Traditional/Religious/Adult	1.759238 (1.281)	5.808011	2.133367 (1.041)	8.443248
Primary Complete	6.442845 *** (1.802)	628.1912	2.847576 ** (1.126)	17.24592
Secondary Complete	4.236239 * (2.258)	69.14733	2.685759 (1.376)	14.66932

Technical/Vocational	4.832066** (2.094)	125.47	2.210189 (1.692)	9.117435
Marital status of HH Head				
Married	-2.193272 (2.141)	0.1115512	1.720669 (1.536)	5.588266
Divorced	-6.865704 ** (2.976)	0.0010429	2.054091 (1.638)	7.799745
Widowed	0.857962 (5.176)	2.358349		
Farmland ownership				
Crop sharing	-1.976101 * (1.089)	0.1386086	-0.4131661 (0.810)	0.6615524
Gift for free	-2.05091 (1.285)	0.1286178	0.22163 (0.891)	1.248109
Own land	-3.51127 *** (1.189)	0.029859	-0.2674065 (0.893)	0.7653619
Environmental harm				
No	2.840624 ** (1.021)	17.12646	0.6466136 (0.779)	1.909065
Benefit from industry park				
No	0.6224452 (0.778)	1.863479	0.3101397 (0.645)	1.363616
Constant	-4.8112 (3.633)	0.0081381	-4.291639 (2.312)	0.0136825
Number of obs =159      LR chi2(20) =113.78 Prob >chi2 =0.0000      Pseudo R2 =0.6197 Log likelihood =-34.908523		Number of obs =167      LR chi2 (18) =44.62 Prob > chi2 =0.0005      Pseudo R2 =0.3165 Log likelihood =-48.193752		

Source: survey summary, 2021,      Standard errors in brackets

Note: \*\*\*, \*\* and \* significant at 1%, 5% and 10%, probability level of significance

Before the analysis of significance variables to check the heterogeneity of each significance variables. The chi-squared ( $\chi^2$ , or  $\text{Chi}^2$ ) test in Cochrane reviews. It assesses whether observed differences in results are compatible with chance alone. A low P value (or a large chi-squared statistic relative to its degree of freedom) provides evidence of heterogeneity. From this the above result shows, P-value is less than 0.05 and large Chi-square statistic with degree of freedom. This means heterogeneity presents.

#### A. Analysis of the significant explanatory variables for expropriated farmers

From the above output, logistic regression model was presented and discussed. Different socio economic variables and others influence food security status of the households. Different variables are important across different space and over time in explaining food secure farmers. Many factors were hypothesized to influence the food security status based on theoretical models and empirical evidences. The eight explanatory variables, which have been found to significantly influence the food security status by the sample, farm households with regard to expropriated smallholder farmers. Because the p-value of those variables are at 1%, 5 % and 10 % level of significance. This implies age, level of education, farming experience; marital status; Farmland ownership, total income, environmental harm and cultivated farmland size are statically significant. This means those variables are affect the dependent variable food security status of the household.

Age of the household head: this variable was found to be negative and significant at equal to 10 % level of significance. The negative sign is an indicative of its influence in the food security status of the smallholder farmer households. This means that, an increase in the age of the household head increased the likelihood for the household to be food insecure. One possible reason may be that older household heads have larger number of family size as polygamy is a common practice. This opens up a chance for bearing children even at latter ages. The other possible reason is that a household, which headed by older aged head face a family labor shortage since old children become independent having their own household. In addition, due to this the household would be composed of young aged children with large family size. Analysis

of logistic regression predicts household which headed by productive aged is more likely to be food secure than households headed by non-productive age (Odds=.8726885) .The prediction here indicates household headed be higher aged (nonproductive aged); household has more chance to be food insecure in the study area. Other study reveals that age of household head is negatively significant to food security.

Educational Status of Household head: The model revealed that education of household head was significant at 5 % significance level and positively related with food security status of the households in the study area. This means that, an increase in the literate of the household head increased the likelihood for the household to be food secure. The odds ratio for the household head whose level of education is primary complete is 628.1912. Since the odds ratio is greater than one ,it is in favors of the particular category primary complete The household head level of education is primary complete is about 628.1912 times more likely his/her food security status is secured as compared to illiterate household heads. The possible justification for this finding was that literate farming household heads are more willing to implement agricultural extension advice, to accept and use modern agricultural technologies, and to diversify their source of income than the illiterate ones. In addition, household head education largely contributed on working efficiency, competency, diversify income and becoming visionary in creating conducive environment to educate dependents with long term target to ensure better living condition than illiterate ones. As a result, literate households reduce the probability of becoming food insecure in the sample households. This is due to educated household head plays a significant role in shaping household members to participate in to different income generating activities. Previous study reveals that level of education of household head is positive relationship and statically significant to food security.

Farming Experience: this variable had a positive relationship and significant at 1 % probability level with regard to food security status of the respondent households. This implies that the household who had low farming experience would be in a position to cope with food insecurity, this means households with high experience produce more for household consumption and for sale and have better chance to be food secure. The odds ratio of the households farming experience is 1.249579. This indicates a household whose farming experience is about 1.249579 times more likely his or her food security status is food secure as compared to non-experience

farming households. According (Lensa 2019), Farming experience to food security status were positively relationship and statically significant.

Total income: This variable was found to be negative and significant at less than 5 % level of significance. The negative sign is an indicative of its influence in the food security status of the smallholder farmer households. Total income means farm income and non- farm income in smallholder farmers.. The odds ratio of the household's total income is 0.9999562. This indicates a household whose total income is about 0.9999562 times more likely his or her food security status is food secure as compared to less annual total income of households. According to (Babatunde et al. 2007) results, total income is one factor of food security status .for this result income were positive relationship and statically significance .Our result is different from the privacy result.

Current cultivated land size in Ha: this variable had a positive relationship and significant at less than 1% level of significance with regard to food security status of the respondent households. This implies that the household who got more hectares of cropping land would be in a position to cope with food insecurity, this means households with large cultivated land produce more for household consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land. The odds ratio of the households total cultivated land size is 91.13749. This indicates a household whose total cultivated land size is about 91.13749 times more likely his or her food security status is food secure as compared to less or not cultivated land size of households. The previous study says, total cultivated land size is one factor of food security status. For this result total cultivated land size were positive relationship and statically significance (Mohammed 2016) .

Marital status of household head: This variable had a negative relationship and significant at less than 5 % level of significance. Marriage is biological and social engagement to support each other both socially and economically. Marriage was established with a view of helping each other and married people pool their resources and reduce cost that would have been spent separately. The odds ratio for the household head whose marital status is Divorced is 0.0010429. Since the odds ratio is less than one, it is not in favors of the particular category Divorced. The household head marital status is divorced is about 0.0010429 times less likely his/her food

security status was not secured as compared to single household heads. Previous study says, in this study marriage and food security are hypothesized to be related positively (Abdela 2020).

**Farmland ownership:** This variable had a negative relationship and significant at less than 1 % level of significance. Farmland is one of the main source income in many ways .farmland ownership gotten may be in sharecropping, by gift, rent and by government (own). The odds ratio for the household whose farmland ownership is own land is 0.029859. Since the odds ratio is less than one, it is in favors of the reference category rented land. The expropriated households farmland ownership is rent land is about 33.49 times more likely his/her food security status is secure as compared to own land expropriated households.

**Environmental harm:** This variable had a negative relationship and significant at less than 1 % level of significance. Environment is to main in living human being. Environment in basic for human, livestock and cropping purpose. The odds ratio for the household whose environmental harm is not environmental harmed is 17.12646. Since the odds ratio is greater than one, it is in favors of the particular category was not environmental harmed. The expropriated households is environmental harm is not environmental harm is about 17.12646 times more likely his/her food security status is secure as compared to environmentally harmed expropriated households.

## **B. Analysis of the significant explanatory variables for Non-expropriated farmers**

From the above table, the four explanatory variables, which have been found to significantly influence the food security status by the sample, farm households with regard to non-expropriated smallholder farmers. Because the p-value of those variables are at 1%, 5 % and 10 % level of significance. This implies age dependency ratio, level of education, total income and cultivated farmland size are statically significant. This means those variables are affect the dependent variable food security status of the household.

**Age dependency Ratio:** This variable have negative relationship and it is significant at less than five percent probability level. It is found that dependence ratio and food insecurity have positive relationship. The positive sign shows that the probability of becoming food insecure is high for households where productive members are less than unproductive members are. The odds ratio of the households' age dependency ratio is .9820548. This indicates a households age dependency ratio is increased food security status of the household is food insecure whereas age

dependency ratio decreased the food security status of the household are food secure. The previous study says, result in that the variable have negative relationship and it is significant at less than five percent probability level (Mohammed 2016).

Total income: This variable was found to be negative and significant at less than 5 % level of significance. The negative sign is an indicative of its influence in the food security status of the non-expropriated smallholder households. The odds ratio of the household's total income is .9999513. This indicates a household whose total income is about 0.9999513 times more likely his or her food security status is food secure as compared to less annual total income of households. According to (Babatunde et al. 2007) results, total income is one factor of food security status .for this result income were positive relationship and statically significance .Our result is different from the previous result.

Current cultivated land size in Ha: this variable had a positive relationship and significant at less than 1% level of significance with regard to food security status of the respondent households. This implies that the household who got more hectares of cropping land would be in a position to cope with food insecurity, this means households with large cultivated land produce more for household consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land. The odds ratio of the households total cultivated land size is 11.54044. This indicates a household whose total cultivated land size is about 11.54044 times more likely his or her food security status is food secure as compared to less or not cultivated land size of households. The previous study says, total cultivated land size is one factor of food security status. For this result total cultivated land size were positive relationship and statically significance (Mohammed 2016) .

Educational Status of Household head: The model revealed that education of household head was significant at 5 % significance level and positively related with food security status of the households in the study area. This means that, an increase in the literate of the household head increased the likelihood for the household to be food secure. The odds ratio for the household head whose level of education is primary complete is 17.24592. Since the odds ratio is greater than one, it is in favors of the particular category primary complete. The household head level of education is primary complete is about 17.24592 times more likely his/her food security status is

secured as compared to illiterate household heads. Previous study reveals that level of education of household head is positive relationship and statically significant to food security (Babatunde et al. 2007).

Table 4.24: Logistic regression model based on all sampled households

Explanatory variables	Food security status of for all sampled household	
	Coef. (Std.Err)	Odds Ratio
Age	-.0365579 (.027)	.9641023
Total family size	-.3417526*** (.115)	.710524
Farming experience	.0815627*** (.027)	1.084981
Total income annually	.0000138** (5.85)	1.000014
Current cultivated land size in hea.	1.010935*** (.240)	2.748169
Educational level of HH Head		
Traditional/Religious/Adult	-.1828604 (.398)	.8328844
Primary Complete	.6409341 (.412)	1.898253
Secondary Complete	1.1903** (.577)	3.288067
Technical/Vocational	1.363998* (.737)	3.911802
Marital status of HH Head		
Married	.7357602	2.087068



are at 1%, 5 % and 10 % level of significance. This implies Family size, Farming experience level of education; total income, Farmland ownership, cultivated farmland size, marital status and expropriation are statically significant. This means those variables are affect the dependent variable food security status of the household.

Family size the household: The result showed that the family size was negatively relationship and statistically significant in determining the probability of household's food security status of expropriated and non –expropriated smallholder farmers. The odds ratio of the households' family size is .710524. This indicates a household family size is increased food security status of the household is food insecure whereas family size decreased the food security status of the household are food secure. The previous study found out the same result in that the variable have negative relationship and it is significant at less than ten percent probability level. Rural households with large family size, having children of non-productive age, could face the probability of food insecurity because of high dependency ratio than farm households with small family size(Mohammed 2016). Therefore, this agrees with the expected that household size with high dependency ratio had role to play in affecting the probability of households to become food insecure. The reaming variables are interpreted to the above two models. Because the same sig and significance level.

Expropriation households: Expropriation households' means, the households expropriated their farmland. Farmland is one of the main source of income .Due to this reason expropriated farmland household had on implication of food security status. The result showed that the expropriation was negatively relationship and statistically significant in determining the probability of household's food security status of expropriated and non –expropriated smallholder farmers. This implies to increase exploration households' food security status was decreased .The odds ratio of the households' not expropriation is 6.964789. Since the odds ratio is greater than one, not expropriation households is about 6.964789 times more likely his/her food security status is secure as compared to expropriation households. This implies other variables interpret to the above variables.

#### D. Compare the significance variables of the three models

Age of the household head: this variable was found to be negative and significant at equal to 10 % level of significance to food security status of expropriated households and negative relationship with significant at 1 % level of significant to food security status of all sampled households. Whereas age of the household head had negative and not significant at 1 %, 5 % and 10 % level of significant to food security status of non –expropriated households. Age dependency ratio only significant to food security status of non –expropriated households. Family size of the households were significant to all sampled households but not expropriated and non-expropriated models. Farming experience were significance for expropriated households and all sampled households but not non-expropriated models. Total income level of education and current cultivated farmland of the households were significance at 1%, 5 % and 10 % level of significance to all models.

#### 4.5 Coping strategies of expropriated smallholder farmers

The CS enumerates various consumption-related coping strategies commonly used by a population. CS applied for shortage of various consumptions. Four general categories of coping were measured, with individual strategies defined specifically according to location and culture:

1. Dietary change (e.g. eating less preferred but less expensive food etc.);
2. Increasing short-term food access (borrowing; gifts; wild foods; consuming seed stock);
3. Decreasing numbers of people to feed (short-term migration);
4. Rationing strategies (mothers prioritizing children/men; limiting portion size; skipping meals; skipping eating for whole days).

This study land problems solved in copying of share cropping and land rent, for food shortage problem solved were used consume less preferred food ,borrowing grain from relatives /neighbors ,work in other farms ,diet change (type, quantity and quality ) and livestock sale.

## Chapter Five

### Conclusion and Recommendations

#### 5.1 Conclusion

This study was undertaken in Debre Berhan city administration, in north Showa of, Amhara region with the objectives to measure the food security status of smallholder households. This means the study wanted to identify the socio-economic implication caused by the farmland conversation to industrial park. It also needed to identify the environmental impacts caused by the farmland conversation to industrial park and pattern of coping strategies used by households in the study area. To achieve these objectives the study relied more on primary data, which were collected by conducting household survey from 335 randomly selected households in five selected kebeles of the district. Households' demographic characteristics, socioeconomic and environmental situation of households' consumption status were collected, organized, analyzed and interpreted to come up with the results.

Data were analyzed using both descriptive statistics and econometric method. The descriptive statistics were used to study the demographic, socio-economic, Environmental implication, household consumption and coping strategy in relation to food security status of households. The econometric method in which logit model was specified and estimated was used to analyze the food security status in the study area.

The sampled households were classified into food secure and food insecure groups based on Household Deity Diversity score (HDDS) actually consumed by the households during the previous 24 hours of survey data either through purchase, gift or other means. The sample of 335 Households 59 % of food insecure and 41 % of food secure. Out of food insecure households, 36.72 % of expropriated and 22.39 % of non-expropriated smallholder farmers. In addition, out of food secure household, 10.75 % of expropriated and 30.15 % of non-expropriated smallholder farmers.

Logistic regression with logit and propensity score matching model was employed to study the effect of expropriation on food security and relations between the probability of households being food security status and household's socio-economic characteristic. Many factors were hypothesized to influence the food security status based on theoretical models and empirical

evidences. In propensity, score matching, expropriated household's food security mean is less than by the mean 25 % comparing with non-expropriated households. Based on the determinant of food security in the first model, food security status for expropriated smallholder farmers. For this model the eight explanatory variables, which have been found to significantly influence the food security status by the sample, farm households with regard to expropriated farmers. Because the p-value of those variables are less than 0.01, 0.05 and 0.1. This implies age, level of education,; farming experience; total income and cultivated farmland size , Marital status ,Farmland ownership and environmental harm are statically significant. This means those variables are affect the dependent variable food security status of the household. Out of the hypothesized variables. Age, total income, marital status and farmland ownership were statically significant and negatively related with food security status. In addition level education, framing experience, cultivated farmland size and environmental harm were statistically significant and positively related with food security status. In second model, food security status for non-expropriated smallholder farmers, in this some variables affect the food security status .Those variables are age dependency ratio and total income are statistically significant and negatively relationship to the dependent variable. Whereas Current cultivated land and level of education are statistically significant and positively relationship. In the third model shows, Family size and farmland ownership are statistically significance and negatively relationship to food security status of expropriated and non-expropriated smallholder farmers. Whereas; total income, Farming experience, expropriation, marital status, current cultivated land and level of education are statistically significance and positively relationship to dependent variable.

In addition to this, the coping strategies practices by most of the households in the study area. This land problems solve /copying of share cropping and land rent, food shortage problem solved were used consume less preferred food ,borrowing grain from relatives /neighbors ,work in other farms, diet change (type, quantity and quality ) and livestock sale.

## 5.2 Recommendations

Based on the findings of this study, the following points are forwarded as recommendations,

- Farmland conversion to industrial park or area increase from year to year. Due to this, many smallholder farmers go to landless. To solve this problem, giving skill training and make small size farmland more productive to secure their food security.
- The government should pay fair compensation fee.
- Prior to any proposed land transfer for industrial area, the Government should consult local communities. Both the Government and investors should be accountable to local communities and it should involve them in all stages of the land transfer processes. This done to ensure that either local people benefit from investment projects or the negative consequences are minimized. Lack of adequate consultation leads to lack of public confidence on the project. Prior consultation with the local communities will give them the opportunity to assess how they will benefit and/or be affected by the project and to be prepared for such outcomes.
- The government should Strong regulatory requirements should be included in both social and environmental impact assessments (EIA), by incorporating strict requirements that stakeholders should be properly informed of the contents of the reports before any agreement so that they receive independent and objective advice on legal, economic and social issues. In this regard, the Government should strengthen its institutional capacity to monitor and regulate the activities of investors so that they will be held accountable in cases of harm to the local people.
- To bring a sense of ownership, the small holders be employed with in the industrial parks. This helps to keep the IP safe.
- The IPs have to use environmental friendly technologies.
- Finally, the government must also conduct periodic inspection of the industrial project site to evaluate the environmental effects of the project. Although the Environmental Protection Authority (EPA) was tasked with ensuring investment, projects do no harm to the surrounding environment.

### 5.3 Suggested future study

The author suggests further researchers to conduct study on the impact of expropriation on the food security of smallholder farmers. To measure food security of smallholder farmers, like using calorie intake of per day per household, food consumption score, Household Food Insecurity and Access Scale and using well-established econometric models such as endogenous switching regression or any other relevant models.

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## Appendix I

Dear Respondent,

In your area of Debre berhan , I conducting a research on the socio-economic and environmental impact of farm land conversion to Debre Berhan Industrial park/area on your living status. The objective of the study is to assess the food security status of expropriated households. Hence, your response is highly valuable and I kindly request you to provide me the accurate information. Your answer will apply only for academically purposes and your personal information will not transferred to others. So be confidential for your genuine information's and your participation is crucial for the success of this academically study.

Thank you for your participations!

- 1, Name of Interviewer/enumerator \_\_\_\_\_
- 2, Interview Date \_\_\_\_\_ Time from \_\_\_\_\_ to \_\_\_\_\_
- 3, Respondents Keble (village) \_\_\_\_\_
- 4, Household serial number \_\_\_\_\_

**Section one: Demographic Characteristics of head of household**

No.	Question	Response option	Answer
1	Sex?	1= Male 0 = Female	<input type="text"/>
2	What is your age in complete year?		_____
3	Your completed level of education	1 = illiterate 2 = traditional/religious/adult 3 = Primary Complete 4 = Secondary Complete 5 = Technical/vocational 6 = Diploma Graduate 7= Degree and above Graduate	<input type="text"/>
4	What is your religion?	1 = Orthodox Tewahido 2 = Islam 3 = Protestant 4 = Catholic 5 = other	<input type="text"/>
5	What is your Marital status?	1 = Single 2 = Married 3 = Divorced 4 = Widowed	<input type="text"/>
6	What is your number of family size?	0-14 years ____M____F  15-64 years __M____F  > 65 years ____M____F	_____  _____  _____

**Section Two: Household Economic Activity/ expropriation and impact of industrial park/area**

No	Question	Response option	Code
7	How many years you work on farming?		_____
8	Is your farmland was expropriated in case of Debre Birhan industrial park/other industry?	1 = Yes 0 = No(Skip to Q19 )	<input type="checkbox"/>
9	When was your land expropriated? Specify the year		_____
10	How Much farmland have before expropriation? in timad		_____
11	Your farm size now? In timad		_____
12	For what purpose did you use the land before expropriated? Multiple answer is possible.	1. Grazing 2. Crop land 3. Grassland 4. Source of firewood 5. Source of water 6.Other, specify _____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
13	Do you receive compensation fee?	1 = Yes 0 = No (Skip to Q 19 )	<input type="checkbox"/>
14	how much birr per m <sup>2</sup>		_____
15	what did you do with the compensation fee?	1= purchased/rented farm land 2= purchased house in the town 3= started non-farm business 4 = used for immediate family consumption 5= saved 6= other	<input type="checkbox"/>
16	How did you rate/compare the amount of compensation money with your land and properties on it if any?	1=Compensation money was: 2= higher than aggregate value of my land and properties on it 3= was equivalent to the value of my land and properties on it 4= lower than the aggregate value of my land and properties	<input type="checkbox"/>

		on it 5= very much lower than the aggregate value of my land and properties on it 6= Other, specify -----	
17	What is the major type of <i>livelihood</i> for your household before your land expropriation?	1 = crop production 2 = livestock 3= mixed crop and livestock 4= Own business 5= Causal labor 6= Remittance 7=Aid 8. Others, please specify:	<input type="checkbox"/>
18	What is the major type of <i>livelihood</i> for your household after your land expropriation?	1 = crop production 2 = livestock 3= mixed crop and livestock 4= Own business 5= Causal labor 6= Remittance 7=Aid 8. Others, please specify: ____	<input type="checkbox"/>
19	<b>For un-expropriated farmers:</b> what are the sources of income for your household? (choose any that are applicable)	1= Farming/crop production 2= Business such as petty trade 3= Temporary employment(migration or neighborhood employment) 4= Remittance 5= other	<input type="checkbox"/>
20	Do you get any benefit because of the industrial park/area establishment?	1 = Yes 0 = No (Skip to Q 22 )	<input type="checkbox"/>
21	Would you mention the benefit?	1 = good compensation 2 = brought farm technology 3 = diversified our income (employment opportunity) 4 = accessed us clean water 5= created market access 6=other	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
22	How much get income in farming activity on average annually ? in birr ,considering with crop, livestock and honeys		_____
23	How much get nonfarm income on average annually ? in birr		_____
24	How do you obtain the land you cultivate?	4 = rent 5 = crop sharing 6 = from relatives,	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

		friends/neighborhood (for free) 4= own land 5= others	<input type="checkbox"/> <input type="checkbox"/>
25	Total Area cultivated in this year 2020/2021 in timad ?		<input type="text"/>

### Section Three: Environmental impact related to industrial park/area

No	Question	Response option	Code
26	Do you get any harm environmentally because of the industrial park establishment?	1 = Yes 0 = No (Skip to Q33 )	<input type="checkbox"/>
27	Would you mention the harms?	1 = polluted rivers and streams 2 = polluted farm land 3 = make us landless 4 = make us poor 5= affected our livestock 6= brought sniffing 7=other_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
28	What are your current major sources of water for household consumption in your locality?	1= River/stream water 2= spring water 3= pond in backyard 4= tap water potable 5= other, specify-----	<input type="checkbox"/>
29	How do you rate the quality of river/stream water in your area for human uses after the processes of industrial establishment based on your local knowledge/experience?	1= excellent 2= very good 3= good 4=bad/unclean/polluted	<input type="checkbox"/>
30	If your answer (bad/unclean/polluted), did you or your family member, get sick of using river/stream water for drinking?	1 = Yes 0 = No (Skip to Q33 )	<input type="checkbox"/>
31	What are the most common diseases prevailing in your area over the last	1= STD 2=TB	<input type="checkbox"/> <input type="checkbox"/>

	five years? (More than one answer is possible)	3= Diarrhea 4= Typhoid Fever 5= Intestinal parasites 6= Gastric 7=Ameba 8= Eye disease 9= Tonsillitis 10= Other (specify) --- -----	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
32	What other impact/s does using river water in your area bring on your family, livestock and agricultural activities? At least three ?	1= Children drop schools due to health problems 2= Farm labor often affected 3=Abortion and maternal health problems 4= Deaths among Children and elder. 5=Other specify ---	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
33	Generally, if you are expropriated, would you compare your life as compared to unappropriated households in your village?	1 = my family life is improved 2 = my family life is worsened 3 = we are indifferent 4=other	<input type="checkbox"/>

#### Section four : Coping Mechanism

No	Questions	Response option	Code
34	Do you think that after your farmland expropriated your household feeding style reduced?	1 = Yes 0 = NO (skip to sec five )	<input type="checkbox"/>
35	If yes, how do you cope with problems of land and food shortages for your household? (multiple answer is possible)	1= share cropping 2=consume less preferred food 3= land rent 4= borrowing grain from relatives/neighbors	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>



			<i>Other (specify)</i> =7
36	Cereals: (1)		
37	Roots and White Tubers(2)		
38	Vegetables (3)		
39	Fruits (4)		
40	Meat, (5)		
41	Eggs (6)		
42	Fish and other sea food (7)		
43	Pulse/ Legumes( 8)		
44	Milk and milk products (9)		
45	Oils and fats (10)		
46	Sugar or Haney (11),		
47	Spices, condiments and beverages (12		

No	Question	Response option	Code
48	According to your own self-assessment, what is the status of your household?	1 = food secure 2= Food insecure 3=Varies from one year to another 4=do not know	<input type="text"/>
49	If food insecure, what is the major reason?	1=Inability to produce sufficient grains and to rear livestock 2=Inadequate income from nonfarm activities 3=Instability due to frequent changes in rural policies 4=Failure to properly utilize own production and other	<input type="text"/>

		earnings 5=Other specify	
--	--	-----------------------------	--

Thank you!

### Annex I: Multi-collinearity test

Variable	VIF	1/VIF
Q2_WHAT_IS~_	4.59	0.217797
Q7FarmingE~e	4.43	0.225513
Q3_YOUR_CO~A	1.72	0.582094
Q1_SEX_OF_~T	1.47	0.681957
Q6Totalfim~e	1.39	0.717902
Q5_WHAT_IS~S	1.39	0.719390
Q26Envarom~n	1.31	0.765895
Agedependa~o	1.30	0.770052
Totalculti~r	1.30	0.771475
Q24OBTAIN~D	1.28	0.782105
Q30_IF_YOU~P	1.24	0.804634
Totalincom~y	1.20	0.836569
Mean VIF	1.88	