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THE REGIONAL ASPECTS OF FOOD SECURITY: THE CASE OF GANJA-GAZAKH REGION OF AZERBAIJAN

The Ph.D. dissertation

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TABLE OF CONTENTS

List of Tables

List of Figures

1. INTRODUCTION

1.1. The Study Problem

In the present era, food insecurity has been taken as one of the leading issues over the last few decades. One of the key factors for creating food insecurity is the outcome of population increases in urban areas. It has been projected that human population will reach 8 billion by the end of 2025, an expansion of around 2 billion people was recorded in just 25 years (UN,1999). While the growth of food production remains constant, the rapid rise in human population will have a tremendous effect on the status of global food security and food supply. The recent nature of the food insecurity problem is associated with various country's inability to grow and produce staple food for its populace, inefficient system of distribution of food with in the country or for few important food items, and barriers of trade between counties due to geopolitical reasons (Robison, 1983). Increasing urbanized life standard in the modern world also put more stress on the demand for food. These transformations in people's lifestyles along with dietary preferences and population growth, greatly control changes in food demand (Bender and Smith, 1997). Azerbaijan is considered a food secured country due to staple food availability and its import of food produce in order to meet the domestic demand of the country (FAO, 2015; ROA, 2016). In contrast, FAO, (2015b) reported that at the household level, achieving food security is still a major challenge. household food security is a multidimensional phenomenon and may be studied in three broad dimensions such as food availability, food accessibility and food utilization Jafarova, (2016). The issue of food insecurity is not only as a result of food supply shortage, but also due to lack of affordability or accessibility to food at household and individual level (Vasa, 2005). Similarly, growing urbanization coupled with increased incidence of climate change and global warming has expedited the stress on the present food supply system and has loomed national and household food security in most of the less developed countries.

In Azerbaijan, food insecurity a major issue facing the country is the problem of climate change, rapid urbanization, limited productivity, and natural resource degradation. Increase in urban population requires increase in food supply in order to achieve a stable food security status requires more food to achieve food security. Azerbaijan has been facing food insecurity in various parts of the country every year (IFRC, 2008). The physical and social

access to food is faced with challenges or poor infrastructural development such as poor storage and processing facilities, poor transportation means and road networks for timely transportation of the farm produce from rural to urban markets especially perishable farm produce (FAO,2003). The study of Murgai et al. (2001), showed that in Azerbaijan, factors such as low rural income level relative to increasing cost of living, household dependent ratio, and extensive unemployment contribute to household food insecurity. Therefore, individuals need to a satisfactory level of income or other modes to be able to purchase goods and services. Further low-income earnings in addition to unemployment has been associated to Azerbaijan's rural household's food insecurity status. (FAO, 2003) highlighted that since independence, achieving food security has been admitted as an imperative priority in Azerbaijan.

However, of recent, the agricultural and food sector has been prioritized by the government for targeting economic growth and improvement of living status of rural individuals. For this reason, loans have been made available through easily accessible to the farmers through the National Fund for agricultural venture. Document released by IFAD (2008) revealed that since Agriculture is a major tool for growth, job creation and food security, there is need to launch several programmes targeted at resuscitating the entire agricultural sector which will intensify crop and livestock production and household income in both rural and urban regions. Another study by (Schmitz and Kennedy, 2016) established that food utilization was still a prime issue in the poorest areas of Azerbaijan. Despite efforts made so far, food security among rural households is still a complex issue in some areas of Azerbaijan. While a sustainable food security situation in its totality at the national level remains a great challenge (Barrett, 1996). Although, the Azerbaijan government has introduced many programs and policies on intervention, aimed at attaining food security all these efforts have not produced the required objectives (Chaaban, et al., 2018). The main reasons for this were the element that food availability and accessibility in Azerbaijan has not increased that can meet up the demand for socioeconomic circumstances at household and individual level. The domestic gap between the food supply and demand has led to increased food and livestock product importation, as well as increased inflation and currency deprecation thereby making it thornier for the middle and lower-middle-class people to meet their dietary needs (Chabot and Tondel, 2011). The available information and data on household and national food security situation in Azerbaijan has remained a problem for both

the policymakers and government as well. The government program implementers and policymakers are gradually seeking food security measurement tools that are reliable and easy and reliable to use (Clapp, 2017). The analysis of national food security determinants and its status is, therefore, useful not only for policymaking but also for better policy implementation (FAO, 2015b). In most of the rural areas poverty rates remains high in which Azerbaijan's food items are cultivated under an outdated rain-fed agriculture system. In rural areas, many households depend on agriculture in meeting their socio-economic needs and due to high rural poverty, it expedites additional to maintain food production who are mainly relying on agriculture activities (FAO,2002).

1.2. Research Scope

The agricultural sector has been considered as one of the key sectors which has a massive potential to develop and boost Azerbaijan economy significantly (ROA, 2008) and there are more prospects for achieving a significant reduction in household income and resource inequality and poverty. The agricultural sector plays a pivotal role in the economy of Azerbaijan. The major area of the country is used for agricultural activities. About 58% area of Azerbaijan was used for growing the different crops and farming of different animals. The major crops which are grown in 2010 were wheat and tomatoes. These two crops provide the maximum amount of production which was the highest value of the ever production. The peoples of Azerbaijan also take interest in cattle breeding, fishing, and forestry. They earn a lot of money by adopting such type of profession which directly affects the economy of the country. The country made progress through an investment of money in the field of Agriculture. Poultry farming and buffalo breeding are also done for obtaining the highest monetary return. These two fields play a great role in developing the economy of the country. Meat is used by people and indirectly provides great money to the country and in return boosting the country’s economy (GOA,2016). FAO, (2010) shows that rural households and small farmers have inadequate access to significant agricultural inputs and resources. The postharvest losses and farming contribution of small farmers are remains uncertain and they have not dynamically contributed to the structured value chain of food. Increasing agricultural mechanization and use of technologically advanced tools utilized in livestock and crop production is key to providing a lasting solution to food insecurity in Azerbaijan. The agricultural sector can help both urban and rural populations by supplying raw materials for

industries, creating more employment and meeting the nation’s demand for and in turn lead to an increase in economic growth and development. and food items economic development. It has the potential to play a vital role to fight against poverty and food insecurity in Azerbaijan. Supplementing local farmer’s income is also necessary in tackling the issue of food insecurity and poverty (Kerton, and Sinclair, 2010). The small farmer's income level can be increased in several ways such as reduce the pre and postharvest losses. This method can improve food availability and food access. The small farmers are facing a great challenge of minimization of these losses of perishable goods like vegetables and fruits. In Azerbaijan, despite massive investment in macro-economic programs, improvements in gross domestic product growth, and trade between 2010 to 2015, rural households and individual’s food insecurity is still a great challenge (FAO,2015). The main causes of rural food insecurity in Azerbaijan are numerous, including environmental, structural, political, social and economic policy failures (Schmitz and Kennedy, 2016). Thus, the food availability dimension involves economic factors on demand and supply side. On the supply side of the economy, food availability and food stability dimension of food security characterize economic factors, relating foreign trade and macroeconomic production levels. On the other side, food access and food utilization dimension denote the demand side of the economy such as income and price level. Therefore, economic factors have a significant role for the national, household and individual level food security status. To understand the deeper the dynamics of national food security, it is important to examine the impact of multidimensional factors. This study aims to explore the size of the dynamics of multidimensional factors on food security status, which gives deeper understandings to decision and policymakers. It will give a rational choice for food security policymaking for any country (Vasa, 2011). The basic and foremost step to address with food insecurity issue is to examine its performance and to appraise the available policy choices (Vasa, 2010). The framework of food security can be examined as a multi-dimensional and complex concept (Gartaula et al. 2012). According to Maxwell et al., (1999) food security analysis is too complex phenomena to be ever examined by using a single component. Therefore, to measure the regional, national and household food security dynamics in a steadfast method remains a critical challenge, while the cost-effective, well-reprehensive components are essential (Maxwell et al., 1999). Analysing regional and local food security perspectives can provide deep knowledge of how common people perceive and value food security. Such type of study may be used to understand how food choices and preferences have changed the people's demands for agricultural goods and services. This

study can then be used to understand the comprehensive phenomenon of multi-dimensional food security and to guide policy at regional, national and household level.

1.3. The Importance of the Study

This research study will be useful for policy making, investors and non-governmental organizations to implement a significant and sustainable role to achieve food security at regional, national and household levels in Azerbaijan. It will also support and contribute to empirical evidence and the existing body of literature in the area of food security and open up further avenues for future research in the allied fields. This study aims to expand the understanding of the most critical issue of food security to support and improve the policy targeting marginal and food insecure segments of Azerbaijan population.

1.4. Background of the Study

The issue of food insecurity and not to eat one's fill has been sought after since the beginning. In such a manner, nourishment security was related to populace living at various levels and conditions. British financial specialist, Thomas Robert Malthus (1766-1834), "As far as he can tell in the Population Law" in 1798, demonstrated that the number of individuals expanded by multiple times (in geometric range) in like clockwork. Therefore, he believed the shortfall of staples to be characteristic. As to populace development, Malthus thought about sicknesses, imperfections, and wars as authentic because of nourishment deficiencies. While Malthus' thoughts didn't express completely regardless, to the utilization of characteristic assets judiciously, changing the framework of agribusiness, leading changes, presenting new arrangements on populace development in certain nations and expanded duty regarding such issues. The issue of nourishment security at various levels: worldwide, national, territorial and family unit, and its answer is confused by the arrangement of monetary and social issues. (Ibrahimov and Aghakishiyeva, 2018).

Root causes of insufficient nutrition is more complicated and includes, environmental, political, cultural and physical broader socioeconomic. From this point of view, dealing with non-nutritional problems requiring a combination of activities and additional interventions in agriculture and food systems, natural resources management, health, and public education. (Ibrahimov and Aghakishiyeva, 2018). Most of the population of developing countries

engaged in the agricultural sector, that's why this problem existed in rural areas. In most developing countries, the land is not fully well utilized. And majority of land is privately owned by the latter, who are not interested in the issue of their agricultural development. The situation once again proves the need for major social change, including land reform is truly democratic. It is no coincidence that in more than 50 developing countries with a combined population of 1.4 billion, there was an absolute decline in the food supply. On a world scale, 244 million people have migrated in 2015. Since the 1960s, the green revolution is considered a key turning point to the agriculture sector in developing counties. As a result, it has rapidly expanded the level of growth and productivity of agro-crops. Hence the food security problems during this regime began to decline in all those countries which were suffering from it. From the world experience, it can be overserved that it is important to upgrade the overall food production system to maintain the sustainable supply of nutritious food in all countries. It suggests a five main global governance mechanisms to upgrade the food production system: first, the formulation of the overall objectives and compulsory to sign contracts binding international level and obtain voluntary agreements, the establishment of organizations globally, and the adoption of new standard operating system in the sector of food production at present. Therefore, food security is the main part of economic security that is representing the national security dynamics of each nation. Consequently, the overall world's food security demands a comprehensive multi-indicators approach. The prices of food were increased in 2007/08 and at that time they were under debate for a long period and it creates a great challenge for the ASEAN and its member countries. Lateran, the prices of food become volatile due to some critical issues and at that time was also a great threat to food security. So, food security is a necessity of time and if it was not properly handled, it can create great threats to population growth and health of peoples. The food security can be controlled by not only ASEAN. It should be controlled by the co-operation of different nations and it is very important for regional stability. (Chandra and Lontoh, 2010).

Agriculture is very sensitive to climate because when climate changes there is a great effect on the production of crops because specific crops grow with specific temperature, specific day length, specific photoperiod, and specific water requirements. When any one of these factors changes then the crops are automatically affected and finally the production of such crops is decreased. If crops are grown under favourable conditions, there tends to be a spontaneous increment in their growth with an increase in the overall production. With the

incidence of climate change, the climate in Azerbaijan is also changing and the sector of agriculture is being affected. The agriculture facing drought, water scarcity, salinity and soil degradation in Azerbaijan (Chaaban, et al., 2018). About 47% of the population of Azerbaijan is currently living in rural areas and they depend on agriculture, so their lifestyle is affected due to changes in climate. Around 39% of employers are working in the agriculture sector so their living habits and living styles are also affected. Currently, the peoples of Azerbaijan are working to address climate change. Many other environmental issues in Azerbaijan are pollution if water resources with wastewater including transboundary pollution, insufficient quality of water and the soil of Azerbaijan are degraded due to soil erosion and salinity, etc. It is stated that 39km water is present in Azerbaijan and out of it, 29.3 km is surface water and 8.8 km of water is underground. The agriculture sector in the country is facing the problems of water shortage due to the uneven distribution of water in the country and wastage of water regularly without considering its importance. The main reason for the shortage of water is due to reliance on irrigated lands. Azerbaijan produces a huge amount of waste which is polluting the water and lands are irrigated with this polluted water, so the crops grown are not healthy and beneficial (Clapp, 2017). The other major problem in Azerbaijan is the problem of soil erosion. Erosion is caused in soil due to poor management, dropped irrigation and drainage infrastructure. The chemicals are applied in the soil to increase productivity in the form of fertilizers and pesticides, this also causes the erosion of soil (FAO, 2015). The pastures are being degraded due to overgrazing and which also leads to soil erosion. 96% of soil erosion is due to agricultural activities in Azerbaijan. About 3.7 million ha of land in Azerbaijan is eroded and 0.7 million ha of that area is intended for agriculture. The soil in Azerbaijan is eroded due to heavy winds, gullies, due to improper land management, water, and irrigation. Some factors which also because soil erosion includes poor cultivation practices, overgrazing, and soil salinization. The reduction of forests grown in Azerbaijan and reduction in vegetation is also caused by soil erosion. Flooding also causes major damage to Azerbaijan. About 1 million ha of soil is damaged due to floods. This was a huge loss to the economy of the country in the year. Similarly, in different years the loss occurred due to flooding. Due to these challenges, the production of different crops was affected, and the production of cereal was reduced from 3% to 14% in 2005 and 2009, all due to flooding and other environmental issues (Djuric, et al., 2017).

Essential policies: expanding trade system especially expand imports to increase investment and industrial development. developing policies; provide facilities like a loan for small stockholders and local businesses. Supporting policies: increase research and development, develop infrastructure system, the welfare of society and decrease food wastage. Empowering policies: communication with each other, promote government coordination, monitoring; development planning, market performance indicators, establish fiscal policy (Tortajada and Zhang, 2017). The issues created around these pillars are a great challenge which should be resolved. In this study, a systematic study was done to analyse future problems with agriculture and food. These are affected by climate change and many other socioeconomic factors. Political interference is also a major issue in some countries due to which food departments are not properly established and no improvement in the self-sufficiency of wheat and other staple foods. To get maximum results, certain steps needs to be considered by governments of different countries (Calicioglu et al., 2019).

1.5. Experience of Azerbaijan

Azerbaijan has been confronting great food security challenges since its independence. Food distribution and trade relations problems not only led to reducing the food availability and food utilization but also to a great reliance on food import from the world and debt ever-increasing foreign trade. Thus, the provision of sustainable food security requires complete implementation of socio-economic, technical, scientific and political information and other measures over time. FAO (2002), presents three pathways to achieve the food security, to protect the domestic market: 1) Increase the real income level and improve the life standard of the population; 2) develop and strengthen the agro-based economy; 3) Develop the value chain of agriculture products for the indigenous market. Hence, we can say that food security demands food independence of the country is a factor important economic, social and political independence of the nations.

Relevant criteria were considered for food security assessment, and GIS multi-criteria analysis was applied for producing food security maps. In the food security map, 905 villages (57% of the rural area) considered insecure zones and 544 villages (22.15% of the rural area) considered insecure zones. The results from this research important for government departments of East Azerbaijan province of Iran such as the Ministry of Water Resource

Management, Ministry of Agriculture, and the Ministry of Natural Resources (Feizizadeh *et al*., 2015).

It is difficult to measure food security in the situation of higher prices in demand side, a lower-income group not able to afford sufficient food while in supply-side due to increases in prices increase address food security and farmers may be got profit from higher agricultural production secondly due to increases in food self-efficiency as resulted increase food security. Food security not depended on the food balance of trade and countries' ability to maintain food consumption through the production of food and maintain finance for imported food. Hunger increased in the short-run due to social policies which food aid and in medium run hunger maintain due to the higher income of people. Higher trade prices of food good for development in agriculture but should not be expected, higher trade food prices will direct effect/increase agriculture growth. Two factors involved: firstly, change in trade prices and response secondly, agriculture production rise (Herrmann, 2009).

During the 20th century level of expenditure on food much lower than in recent decades when production increases. Food variety effected by life expectations. There was determine a significant relationship between the quality of food and income level and resulted in healthier food was more expensive than cereal and fat. Consumer attitude about food change due to change in income level. Consumer preference for choosing food was different when it had a lower income. Per capita income level higher in developed regions and lower in less develop regions and spend more money on better quality, healthier food. People who belonged to the higher-income group were spending more on healthier food than the lower-income group. In the consumer basket, foodstuff accounts for approximately one-third of the overall expenditure. Finding from this research was that food annual expenditure and per capita quantity of food consumed annually in regional level between 2010 and 2013 (Godor, 2016).

For improvement, the food security system makes a food policy council and promotes locally determined work. Work may relate to growth and development in the food system. Food policy defined many goals and planning, food retail, waste management, urban agriculture, food retail, community health for economic development. Findings range that in addressing food security determine the role of regional government (Stevenson, 2013).

Vulnerability analysis suggests two fundamental intervention options: 1. Reduce the diploma of publicity to the hazard; 2. Increase the capability to cope. By accounting for vulnerability, meals safety insurance policies and packages expand their efforts from addressing contemporary constraints to food consumption, to consist of actions that also tackle future threats to food security. Hunger is typically understood as an uncomfortable or painful sensation precipitated with the aid of inadequate food strength consumption. Scientifically, hunger is referred to as meals deprivation. Simply put, all hungry humans are food insecure, however not all food-insecure humans are hungry, as there are other causes of meals insecurity, along with those due to poor consumption of micro-nutrients. Malnutrition results from deficiencies, excesses or imbalances in the consumption of macro- and/or micronutrients. Malnutrition might also be an effect of meal insecurity, or it may relate to non-food factors, such as inadequate care practices for children, inadequate health services; and an unhealthy environment. While poverty is, without doubt, a motive of hunger, lack of enough and the desirable diet itself is an underlying purpose of poverty (FAO, 2008). This study main purpose is to conduct an objective examination into the factors that affect the regional, national and household food security in Azerbaijan.

1.6. The Study Objectives

This study aims to examine the determinants of household's and national food security in Azerbaijan generally and household food security in the Ganja-Gazakh region of Azerbaijan particularly. Besides, this study seeks to assess the link between the agriculture sector and food security in the light of various challenges.

The specific objectives of the study are given as:

1. What is the impact of food determinants on participants?
2. How do the participants perceive the different food security programs in the Ganja-Gazakh region of Azerbaijan?
3. Perceptions of participants about on their food security?
4. To examine the multi-dimensional determinants of food security in Azerbaijan.
5. What are the implications of the perceptions of the participants for policy and practice?

1.7. The Study Hypothesis

The study hypothesises are given as follow:

H1: Does the food security determinant have a significant influence on the Ganja-Gazakh region or not?

H2: Does the Azerbaijan food security program have a significant impact on the participant or not?

H3: Does regional food have significance impact on regional economics or not?

H4: Do multi-dimensional determinants have a significant impact on the dynamics of national food security in Azerbaijan or not?

2. LITERATURE REVIEW

This chapter is organized as follow: Section 2.1 describes the mapping the food security studies in Azerbaijan and reviewing the research priorities and gaps, and section 2.2 unfolding the food security studies in other countries. The section 2.3 reviews the present challenges of food insecurity in Azerbaijan. In the last section 2.4 explores the sustainable food security approach in Azerbaijan.

2.1. Mapping of Food Security Studies in Azerbaijan

Asian countries become increasingly populated and urbanized, attaining the food security of rural households is a decisive errand. Globally, more than half of world's population depends of agriculture and same proportion living in rural areas (52% of total population in 2013), these nations are enduring the high population growth, mainly in Asian region (World Bank, 2014). The rural inhabitants, who are mostly the poor in these countries are most vulnerable to food and nutritional insecurity. These rural households don't have access to food in the right quality and quantity at safe and affordable situations, almost no access to good healthcare, transport, shelter and mechanized agricultural facilities and equipment's which further destabilize the affordability and utilization of safe and sufficient food (Cohen and Garrett, 2010). Recent numbers of international food security showed that although food insecurity is decreasing from 804 million people to 790 million in 2012 to 2014, access and affordability to food remains a critical issue under relevant food security issues, mainly in poor countries (FAO, 2014). Agricultural sector has a very great role in improving food security in various ways and at various levels. First, when rural households cultivate their own food and vegetables, they have direct availability and access to nutritious food, which may provide a range of micro and macro nutrients. As a result, rural household's monthly expenditures may also decrease, freeing up money on other needs such as health, education and clothing. Rural agriculture system may supply a more sustainable food chain and reduce the adverse impact of inflation and variable wages. It may also provide distinct support to rural women, who normally face more employment constraints and challenges as compare to men in developing countries. Further, the agricultural sector has high tendency of causing a shift in the rural community's food security by developing the quality, quantity and diversity of foods. Despite the massive potential advantages, researchers and policymakers are still

sceptical about the contribution of agricultural sector towards rural food security, especially given the well-established problems faced by rural growers such as water scarcity, insecure land tenure, limited access to support services and recognitions by government (Webb, 2011).

The aim of this review is to carefully examine the available documented information for agriculture sector's impact on food security in Azerbaijan and Hungary. To achieve this objective, such existing evidences that presented data on various food security indicators such as food availability, access, dietary diversity, food utilization and nutritional status. Recognizing the importance of other endogenous factor like climate change, this critical review also includes an appraisal of direct or indirect impact of these factors on food security. This study used critical review guidelines in order review the existing evidence on the role of agricultural sector on the food security of Azerbaijan and Hungary. This study searched peer reviewed journal articles that fulfil the eligibility criteria and qualitatively summarized the findings across studies.

2.1.1. Results and Discussion of Systematic mapping

This review identified abstracts and titles as hypothetically related for the following critical review. These methods yielded potentially relevant papers for a full-text critical review. The qualitative tabulated synthesis is given bellow.

Ten articles from Azerbaijan explicitly explored the relationship among several polices and food security. The output of these selected studies included the following measures of copping striges such as climate change, nutritional status, food diversity, access and utilization. (Mammadov, 2017) explains that the problems related to agriculture system like irrigation, soil, water. Solution of these problems in Azerbaijan. Another research from (Polat, 2015) explores that forming education impact on farmers and level of production. These trainings have positive impact of farming education training on food availability. The study of Humbatova and Hajiyev, (2016) examined the impact of microfinancing and loan for agriculture. This review indirectly targeted food security by agricultural production system. The study of Tyczewska et al., (2018) examined the impact of population and climate change on agricultural production and food security. This research directly targeted food security by using secondary data from 1960 to 2015. They found that the use of agro biotechnology in agriculture was useful for attaining food security. (Oglu, 2018) explored the issues related to

climate change, irrigation system and problem of soil and salinity. In this research indirectly targeted food security by problems regarding from agriculture. Quantitative study was designed, and secondary data was used from 1978 to 2016. These problems were directly linked to food insecurity and poverty Aliyev, (2017) found that the problems of land cover with mountainous surface and Agriculture area in Azerbaijan and solution of these problems.

Quantitative study was designed. Secondary data was used from 1997 to 2017. Major findings from this research were that low-intensity irrigation underneath conditions of acute shortage of water resources in mountain and hill areas of the republic. A recent study by (Ibrahimov and Aghakishiyeva, 2018) depicts the food security and the directions of agrarian policy in Azerbaijan. Secondary data was used from 2010 to 2016. Major findings from this research were that active restrictive policy ought to be enforced in several sectors of the economy, and may be used a lot of flexibly in terms of finance, access to credit, tax, price control, investment, insurance and alternative means in order to ensure food security in Azerbaijan Republic.

Several articles demonstrated the impact of different policy measures to national, household and individual's food security of Hungary. Nemes, G. and High, C. (2013) highlighted new challenges and improvement techniques and knowledge in agricultural sector. Alternatively, a study by Godor, (2016) showed that food consumption and income of people are related in such a way that that differences in higher income and consumer behaviour were more than the lower income group. Another study by Feher and Fejos, (2006) examined the food security policy, and the efficiency of food security and agricultural production. Findings from this research were that in last 12 years' agricultural production was increased to 2 billion dollars. Local market was fully opened, and products compete with other EU (European Union) products. Also, Szucs et al., (2017) shows that agricultural and forestry sector not only plays an important role in food security but also has tremendous impact on biodiversity. The study of Jefferson, (2015) and Gólya, (2017) examined the main problems of agriculture, food safety and trade. The study of Drexler and Dezseny, (2013) reveals that organic agriculture and research in Hungary is at a very lagging state and this might give fascinating potential market opportunities for organic food process corporations. A study of Popp, (2007) analysed the development of agricultural and food trade in Hungary

after EU enlargement. Quantitative study was designed and indirectly targeted food security. Secondary data was used from 1990 to 2006.

Table 2-1 Literture Review Table

Author	Location	Study Design	Data/ Sample Size	Targeted FS	Nature & Length	Aims/Objectives	Findings
Mammadov, (2017)	Azerbaijan	Quantitative	380	Indirectly	Primary	Analysed the problems related to agriculture system	Needed attention on underground mineral of soil, surface and ecosystem.
Polat, (2015)	Azerbaijan	Quantitative	1991-2013	Indirectly	Secondary	Education impact on farmers and level of production	Positive impact of farming education training on agriculture production
Humbatova and Hajiyev, (2016)	Azerbaijan	Quantitative	2001-2015	Indirectly	Secondary	Impact of microfinancing and loan for agriculture	Oil share depended on loans especially state finance support
Tyczewska et al. (2018)	Azerbaijan	Quantitative	1960-2015	Directly	Secondary	Impact of agriculture production on food security	Used of agro biotechnology in agriculture was a solution for food security problem.
Oglu, (2018)	Azerbaijan	Quantitative	1978-2016	Indirectly	Secondary	Issues of climate change and problem of soil and salinity.	Problems in agriculture directly link with food security and development of country. issues.
Aliyev, (2018)	Azerbaijan	Quantitative	1959-2020	Indirectly	Secondary	Problems related to soil and water resource and food security.	Agro systems surface improving everyday grasslands and fields was to enhance water, air and nourishment modes.
FAO. (2012)	Azerbaijan	Quantitative	1990-2012	Indirectly	Secondary	Assessment of agriculture and rural development	Agriculture and rural development positively affected food security.
Aliyev, (2017)	Azerbaijan	Quantitative	1997-2017	Indirectly	Secondary	Problem of land cover with Mountain.	These problems negatively related with food security.
Drexler and Dezseny, (2013)	Azerbaijan	Quantitative	1988-2012	Indirectly	Secondary	Organic agriculture and research	There was a major lack of organic process capability and market opportunities
Ibrahimov and Aghakishiyev, (2018)	Azerbaijan	Quantitative	2010-2016	Directly	Secondary	Food security and directions of agrarian policy	Active restrictive policy ought to be enforced in several sectors of the economy,

Findings from this research were that excess stocks of cereals, the possibilities for the primary feed grain consuming sectors (i.e. dairy, pig meat and broiler meat production) to expand seem as an alternative slim in the mid-term. Meat and dairy producers will face the burdens of adjustment in the livestock sectors and the anticipated growth of biofuel manufacturing in Hungary. Another study by Burger, (2009) analysed effects of agricultural system and its influences on food security. Food security studies were largely correlated with food availability, trade and agricultural growth. Although food availability supplies a numerous pathway to short run food security, such as availability of nutritious food, fruits and vegetables. Our analysis disclosed that existing evidence in selected countries has widely focused on only food availability and overlooked the other aspects of food security such as access, affordability, utilization and stability. These existing evidences was largely interconnected with food availability, trade and agricultural growth. Although food availability and trade supply a numerous pathway to short run food security, such as availability of nutritious food, fruits and vegetables. Our review identified that most studies related to Azerbaijan's and Hungary's food security situation has been focused on only food availability at national level and overlooked the other aspects of food security such as access, affordability, utilization and stability. Thus, this implies that there is need to take into consideration some other indicators of food security research. Such indicators in a good food security evaluation should include access to food in terms of both rural and urban populations, food diversity and quality and quantity of available food at individual, household and national level. Additionally, the food security studies should assess the role of agriculture on intra-household distribution of food (e.g., to vulnerable groups of rural households like children and women) especially in scenarios with strong policies where food security issues have been prioritized by the government in order to explain these relationships.

2.2. Unfolding of Food Security Studies in other Countries

In developing countries, the rural poor population are the most vulnerable when it comes to access to food and nutrition in terms of timeliness, quantity, and quality. These rural households have limited or no access to basic amenities such as healthcare, transport, shelter and agricultural mechanization (Cohen and Garrett, 2010). Recent numbers of international food security display that although food insecurity is decreasing from 804

million people to 790 million between periods of 2012 and 2014, food access and affordability remains a critical issue to food security, mainly in poor countries (FAO, 2014). Although, progress is observed to achieve the Millennium Development Goal (MDGs) to reduce the global food insecure people by 2015, upcoming hazards to food security such as climate change, resource depletion, population growth and biodiversity loss present major challenges to dealing with issues related to food insecurity in developing nations (Godfray et al., 2010). Agricultural sector may provide a key source of income and food for rural households and help lessen the developing risks to food security. Agricultural sector can be explained by large area within the villages, such agriculture land, gardens, fruits and vegetables farms, and livestock that are used for cultivation and producing milk and livestock for home consumption and sale in market (FAO, 1999). Furthermore, rural farming reportedly supplies a large share of poultry and produce goods consumed in same region of Asia (Maxwell, 2001). The main intent of this review is to examine the available evidence for agriculture sector's impact on food security in Singapore, Georgia and Austria. To achieve this objective, this study conducted a critical review of existing evidences that are presented in a tabulated data on various food security indicators such as food availability, access, dietary diversity, food utilization and nutritional statuses.

Table 2-2 Literature Review Table

Author	Location	Study Design	Data/Sample Size	Targeted FS	Nature	Aims/Objectives
Tarasuk and Vogt, (2009)	Ontario	Quantitative	10517	Directly	Primary	To identify socio-demographic factors related to unit food insecurity within the Ontario population.
Stevens et al. (2017)	Bangladesh	Quantitative	850	Directly	Primary	To investigate the association of seasonality with dietary diversity, unit food security and organic process standing of pregnant girls in an exceedingly rural district of northern Asian country.
Hillbruner and Egan, (2008)	Bangladesh	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Becquey et al. (2012)	Burkina Faso	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Segall-Corrêa et al. (2014)	Brazil	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Mavengahama et al. (2013)	South Africa	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Skinner et al. (2014)	Sub- arctic	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Pérez-Escamilla, (2012)	Brazil	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Frongillo and Nanama, (2006)	Burkina Faso	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
da Silva Guerra et al. (2013)	Brazil	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.

Melgar-Quinonez, (2006)	Bolivia	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Coates et al. (2006)	Bangladesh	Qualitative and quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Coates et al. (2006)	Bolivia	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Saediman et al. (2019)	Indonesia	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Hackett et al. (2008)	Colombia	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Hackett et al., (2008)	Brazil	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Marques et al., (2015)	Brazil	Quantitative	850	Directly	Primary	To investigate the role of seasonality in determinant the food security and organic process standing of low-income urban households and to isolate specific pathways through that seasonality has its impact.
Interlenghi et al., (2017)	Brazil	Quantitative	850	Directly	Primary	Comprehend the degree of nourishment uncertainty among road merchants as far as their entrance to nourishment, the nature of nourishment devoured and the procedures they used to adapt to nourishment lack.
Tabrizi et al., (2018)	Iran	Quantitative	850	Directly	Primary	Assess the family unit nourishment security status and related factors in east-Azerbaijan, Iran
Gholami and Foroozanfar, (2015)	Iran	Quantitative	850	Directly	Primary	Survey the family unit nourishment security status and related components among various rustic areas of Neyshabur (a city in upper east of Iran).
Sharafkhani et al. (2010)	Iran	Quantitative	850	Directly	Primary	Decide the job of family unit creation on the family unit nourishment uncertainty.

2.2.1. Process of Systematic Review Analysis

This study used critical review guidelines and presented main reviews in the existing evidence on the role of agricultural sector on the food security of Singapore, Georgia and Austria. This study searched the peer reviewed journal articles that fulfil the eligibility criteria and qualitatively summarized the findings across studies. Our study identified the eligible studies using three electronic search databases: Google scholar, Science direct and J store. In each database used following primary keywords ("agriculture") along with its synonyms and secondary keywords ("food security", "food insecurity", "rural income" and "nutritional security"). This study identified abstracts and titles as hypothetically related for the following critical review. These methods yielded the potentially relevant paper for a full-text critical review. The qualitative tabulated synthesis is given bellow.

2.2.1.1. Review of food security studies in Singapore

The study of Bhaskaran, (2018) analysed that economic challenges and how to meet them policy. Quantitative study was designed and indirectly targeted food security. Findings from this research were that Singapore confronts the increasing burdens of ageing inflation weak innovation capability, and declining productivity growth. A report of NCCS, (2012), examined the climate trade consequences on food security and recommended policy. Similarly, Ward *et al.,* (2019) analysed food by directly targeting food security. Major findings from this research were that Total business output worth in 2018 was nearly $8 billion USD. The most merchandise made by the Singaporean food processing sector covers products such as flavourings, sauces, ready-to-eat meals, noodles, deli meat, sausage, confectionary, chocolates, snacks and beverages (including beer). High prospective U.S. food processing ingredient merchandise for the Singaporean market embody beef, farm merchandise, contemporary fruit, processed vegetables and vegetable oils. A report of FAO. (2016) reveals that agricultural sector issues and food safety, food security Primary data for this study was used and collected from 550 respondents. Major findings from this research were that established Fostering regional cooperation and the food retail sector for the supply of safe and healthy food at lower prices. Singapore joins the APO Programmer and Advancing food safety program. Similarly, Ward *et al.,* (2015)

explains that trade issues and country agriculture production and directly targeted food security in quantitative terms. The study of Yong, (2017) analysed issue of food security problems with healthier economy structureand also directly targeted food security using quantitative study. Secondary data was used from 2016 to 2017. Major findings from this research were that trade policy impact positive on economy and food security. Islam and Wong, (2017) studied the climate change and its effects on living standard, food production and food security. In this research they directly targeted food security. Major findings from this research were that provide a balanced view for understanding relationship between food security and climate change. Tortajada and zhang, (2017) explains toward Policy about improvement in food security.

2.2.1.2. Review of food security studies in Georgia

The study of Meskhia, (2016) scrutinized the endogenous and exogenous factors or problems effected food security. In this research directly targeted food security. Major findings from this research were that increase local food production effected food security in country level. Similarly, the study of Asatiani, (2009) reveals that current situation of food security and relationship between food production and economic determinants, undernourishment. Quantitative study was designed. Primary data was used and collected from 860 respondents. Major findings from this research were that moderate level of undernourished people. A recent study of McKay *et al*., (2019) explored the measures of food insecurity, food availability. In this research directly targeted food security. Primary data was used and collected from 700 respondents. Major findings from this research were that there were needed consideration to measure food insecurity. The study of Lekashvili and Gvelesiani, (2012) examined the evaluation of the contemporary state of affairs in meals safety coverage and the analysis of the legal, political and demographic factors affecting it. two Identification of the problems in meals satisfactory and safety. Making guidelines for meals safety method of Georgia. In this research directly targeted food security. The study of Natsvaladze, (2015) considered the sustainable agriculture development troubles in the context of providing food security. In this research indirectly targeted food security. Primary data was used and collected from 650 respondents. Major findings from this research were that agricultural politics of presidency compete a big role in development of the market. The foremost necessary directions include. Aswalw, (2015)

explored the trends of agriculture share in GDP of economy and its impact on food security. To examine the public expenditure incurred via the government before and after reform period. In this research indirectly targeted food security. Quantitative study was designed. Secondary data was used from 1980 to 2011. The results concluded that there was wanting to incur more expenditure in agriculture and allied sectors to enlarge the share of agriculture in GDP of our country. The study of Tvalchrelidze, (2011) depicts that agriculture manufacturing effects on food security. In this research directly targeted food security. A report of FAO. (2008) considered the effects of local weather exchange on meals security. Food structures will additionally be affected through possible inner and global migration, resource- based conflicts and civil unrest triggered through climate alternate and its impacts. Agriculture, forestry and fisheries will no longer solely be affected by using climate change, contribute to it via emitting greenhouse gases. Another study of USDA, (2013) examined the main vegetables of Georgia and food safety situation. The study of Sellers et al. (2007) reveals the home food security for Georgia.

2.2.1.3. Review of food security studies in Austria

A recent study by Schneider et al, (2019) investigated the role food wastes and losses along with total value chain on food security dynamics in Austria and many European countries. They used the both qualitative and quantitative data, especially on food wastes that were collected during the harvesting seasons. For this purpose, they examined the single crop (potato) analysis for Austria and Germany. They found that 1% to 9% potential food waste and post-harvest losses in the case of single crop. This study suggests that to control the food waste and post-harvest losses are important measure for ensuring the food security. Another study by Pinter and Kirner, (2013) examined the impact of numbers of farms as one of crucial dimension of food security and agricultural development. They found dairy farms were facing a lot of profound challenges for maintaining the stabilize supply chain and food security of Austrian households. Empirical findings reveal that typology provides a comprehensive framework for ensuring the food security and agricultural structural change. Similarly, Winkler et al, (2016) examined role of pork as a staple food for nutritional security of Austrian population. This study identifies three impact categories by using the life cycle assessment method. The empirical findings are expressed in term of food, environmental

and nutritional security. They found that pork production played a significant role for food and nutritional security of Austrian population. A study of Mitter and Schmid, (2019) examined the water stress management for agriculture production and food security. They found the impact of multi seasonal climate variation on food production and economic growth. They used the integrated climatic modelling framework by employing the crop rotation and portfolio optimization model in Austria. The empirical results show that climatic variation had adverse consequences for the food security. A recent study of Lueckl et al, (2018) evaluates the national food control plan in Austria. They identified six high risk food products and found that rate of non-compliances among the availability and demand of meat increased from the year 2010 to 2016. On the other hand, other food business demand was showing a significant decline over the same period. They found that food safety was the main issue in all food categories. This study suggests the importance of improving the food safety and food stability. Another recent study of Darnhofer et al, (2019) proposed a conceptual framework which gives a food security situation understanding at national level. They involved the role of organic sector and examined its impact on food chain in Austria France and Italy. The dynamic results show that organic food system enables social practices and opening some new pathways for ensuring food and nutritional security at household and national level. Similarly, Biebar et al (2019) mapped the local livestock sector in Austria and other countries. They performed the nation-wise comparison and average food milk and meat production in Austria was substantially lower as compare to other countries. They suggest that to control the average milk and meat production gap, Austria can improve its short as well as long term food security. The prevalence of undernourishment in young children, the micro and macro nutrients deficiency in particularly infants and women are critical in the less developed countries (Stevens *et al.*, 2015). Many international institutions place more emphasis on food security problems, especially in developing countries, where a huge amount of people suffers from such with main aim of combating and tackle the problems of malnutrition and malnourishment (Asatiani, 2009). Asia for instance is faced with two major challenges: food insecurity and climate change. The prices of food increased in 2007/2008 and has become volatile due to some critical issues and a great threat to food security. Nevertheless, it should be controlled by the cooperation of nations since it is an important factor in preserving regional stability (Chandra and Lontoh, 2010). Food represents the basic need of humans that provides

nutrition for the living. In the meantime, Asian countries are facing several other challenges as well, such as high and rapid growth in population, adverse environmental conditions, rural poverty with very little growth in agricultural development (Marzęda-Młynarska, 2017). Problems related to food insecurity arose frequently, their number showed a sharp increase between 2007 and 2012 (Utter *et al*., 2018). The main reason for food insecurity could be looked at as the inequality of the society where the poor, due to insufficiently available food or not affordable healthy food, suffered from many diseases (Schlichting *et al*., 2019). Human development is valuable due to its comparability across regions however, it may not be the best indicator for food security (Maxwell et al., 2008). Regional food security has become a major challenge and a primary focus of sustainable developmental goals in the past few decades (ADB, 2006). A country is said to be food secured when all its people always have enough economic and physical economic access to nutritious and safe food to meet their nutritional requirements, in order to keep on an active and healthy lifestyle (FAO, 2003). Therefore, that has become a primary focus in the millennium development goals (MDGs). And as such, food security is observed and examined in the different countries, thus it is measured through the progress of any government, and as part of social well-being (Carter *et al*., 2010). However, achieving regional and country-level sustainability of food is still a great challenge (Smith, 2011). While many countries have presented social development programs and policy interventions for it, none of these efforts led to reaching the desired goals (Chaaban, *et al*,.2018). Particularly, food security in Asian countries did not increase enough to meet the regional demand. The gap between the national food supply and demand has led to an increase in the import of food and livestock (Zahrnt, 2011). Furthermore, there is lack of adequate publications and data on regional and national food security in the Asian region, which raised a problem for sustainable policymaking and implementation. The policymakers and implementers of the regional food security program have been gradually seeking for the tools of measuring food security, which are reliable, easy to use and help to interpret the dynamics of food security (Feizizadeh *et al*., 2015; Godor, 2016). The analysis of regional and national food security determinants and their status is, therefore, useful for not only policymaking but implementation as well (FAO, 2015b). Hence, its suggested that there is need to look at some key areas and several factors to be examined empirically that directly or indirectly impacted food security in some regions (Islam and Wrong, 2017). However, according to the literature review, no study applied

macro-level or large-scale data to estimate the regional dynamics of the food security situation and its key determinants from a macro prospective recently. Studies having a target population or a micro perspective while investigating the determinants of food security could not only mislead policymakers but also could give a spurious situation analysis on countries under analysis (Oglu, 2018). Food import in these economics was an effective policy that improved food security at national level and regional level. However, for achieving the sustainable food security goals, trade liberalisation and more economic integration is required, which could bring mutual benefits. These types of trade policies will contribute immensely to the improvement of national and regional food security. Moreover, achieving the GDG 2 (sustainable development goals) that targets the eradicating hunger and malnourishment and the attainment of sustainable food security in such countries like Azerbaijan, Singapore, Austria, Georgia and Hungary by the end of 2030.

This analysis was carried out to unfold the food security studies in Singapore, Georgia and Austria. Food security studies were largely correlated with food availability and agriculture growth. Although food availability supplies a numerous pathway to short run food security, such as availability of nutritious food, fruits and vegetables. Further, upcoming food security research should also be extended to focus on food availability, diversity and quality more specifically, with a prime emphasis on household and individual food security situations in individual countries. Additionally, e food security studies should assess the role of agriculture on intra-household distribution of food.

2.3. Review of current food security challenges and prospects of Azerbaijan

Food and nutritional security are a major development issue facing many developing countries, as well as many Asian countries. In Azerbaijan, despite massive investment in macro-economic programs, improvements in gross domestic product growth, and trade between 2010 to 2015, rural households and individual's food insecurity is still a great challenge (FAO,2015). The agricultural sector plays an important role in the economy of Azerbaijan. Majority of its total land area is used for agricultural activities. About 58% area of Azerbaijan is utilized for growing different crops and farming of different animals. In 2013 to 2018 production of wheat does not increase because some problem in agriculture system like unstable irrigation system, scarcity of land for agriculture, soil

issues, lack of water, inferior seed quality, climate changes issue (FAO, 2018). The people of Azerbaijan also take interest in cattle breeding, fishing, and forestry. They earn a lot of money by adopting such a type of profession which directly affects the economy of the country in a positive way. The country made progress by investing in the field of Agriculture. Poultry farming and buffalo breeding are done for obtaining the highest amount of money. These two fields played and still playing a great role in developing the economy of the country. Demand for meat is a major source of internally generated revenue to the country. Most of the meats produced are being exported to Turkey, Russia, and Georgia and has contributed greatly to the growth and development of the country's economy (GOA, 2016). The main causes of rural food insecurity in Azerbaijan are numerous, including environmental, structural, political, social and economic policy failures (Schmitz and Kennedy, 2016). The GDP of Azerbaijan is increasing substantially over the past few years. It is all due to outstripping growth in the agricultural sector. In 2006 the per capita GDP of the country was 2487 USD and in 2010, the GDP is increased to 5713 USD. There was a decline in agricultural share and in a resultant reduction in the growth of the economy of Azerbaijan and instead of this 39.7% of people were employed in the field of agriculture. The prices of food commodity are increasing in the sector of food and mostly people spend about 50-60% of their income on food. The price of wheat was increased by about 82% in 2010. The prices of beef were also increased, and this was due to a drop in the supply of beef. To address such problems, the government takes many steps including the exemption of wheat and rye flour from VAT between December 2010 and August 2010. As a result of this decline in growth in agricultural sector, Azerbaijan imported 45% portions of cereal from different countries. The importation was increased due to the factor of decline in the growth of the economy. This costs about $270 million about 44% increase in cost from the previous years. Azerbaijan established a closer and keen relationship with the European Union based on importation, as a result, Azerbaijan increased its importation of cereals by 45% relative to 2009, costing the country $270 million, a 44% increase in cost from the previous year. Many studies emphasize agro-economic and environmental factors such as deforestation and an increase in urbanization due to rapid population growth and climate change (Willer and Lernoud, 2015). In 2005 it was examined that about 9.5% of gas emission comes from agriculture which is pointed to ponder upon it. Later on, major problems can be generated due to various issues. There should be great work on gas emission so that problems can be dissolved. In 2005, about

9.5% of total greenhouse gas emissions from Azerbaijan were derived from agriculture, compared to 8.9% in Europe overall.

In this study, we looked at the major challenges of the food security of Azerbaijan. The study reviews the present issues of the Azerbaijan agricultural sector, focusing on various aspects of agriculture from production to food security and examining whether substantial transformations exist in this sector. This study also reviews how access to advice on crucial issues related to GDP growth, population growth, gross food production index, national, household and individual food availability-along these pathways affects prospects of food security.

2.3.1. Present challenges in ensuring Azerbaijan's food security

The agriculture sector in Azerbaijan is facing many challenges. Agriculture is very sensitive to climate because when climate changes then there is a resultant effect on the production of crops because specific crops grow with specific temperature, specific day length, specific photoperiod, and specific water requirements. When any one of these factors changes then the crops are automatically affected and finally the production of such crops is decreased. If crops are grown under favourable conditions, then the production increased. As we know that the climate is changing globally so also the climate of Azerbaijan is also changing and the agricultural sector is being affected due to incidence of drought, water scarcity, salinity and soil degradation (Chaaban, et al., 2018). About 47% of the population of Azerbaijan is currently living in rural areas and they depend on agriculture, so their lifestyle is affected due to changes in climate. Around 39% of employers are working in the agricultural sector so their living habits and living styles are also affected. Currently, the people of Azerbaijan are working to address climate change. Many other environmental issues in Azerbaijan are pollution of water resources with wastewater including transboundary pollution, insufficient quality of water and the soil of Azerbaijan are degraded due to soil erosion and salinity, etc. It is stated that 39km water is present in Azerbaijan and out of it, 29.3 km is surface water and 8.8 km of water is underground. The agriculture sector in the country is facing the problems of water shortage due to the uneven distribution of water in the country and wastage of water regularly without considering its importance. The main reason for the shortage of water is due to reliance on irrigated lands. Azerbaijan produces a huge amount of waste which is polluting

the water and lands are irrigated with this polluted water, so the crops grown are not healthy and beneficial (Clapp, 2017).

The other major problem in Azerbaijan is the problem of soil erosion. Erosion is caused in soil due to poor management, dropped irrigation and drainage infrastructure. The chemicals are applied in the soil to increase productivity in the form of fertilizers and pesticides, this also causes the erosion of soil (FAO, 2015). The pastures are being degraded due to overgrazing and which also leads to soil erosion. 96% of soil erosion is due to agricultural activities in Azerbaijan. About 3.7 million ha of land in Azerbaijan is eroded and 0.7 million ha of that area is intended for agriculture. The soil in Azerbaijan is eroded due to heavy winds, gullies, due to improper land management, water, and irrigation. Some factors which also lead to soil erosion includes poor cultivation practices, flooding, overgrazing, and soil salinization. Deforestation and reduction in vegetation problems associated with soil erosion. Flooding led to a huge loss to the economy of the country. Due to these challenges, the production of different crops was affected, and the production of cereal was reduced from 3% to 14% in 2005 and 2009 respectively (Djuric, et al, 2017).

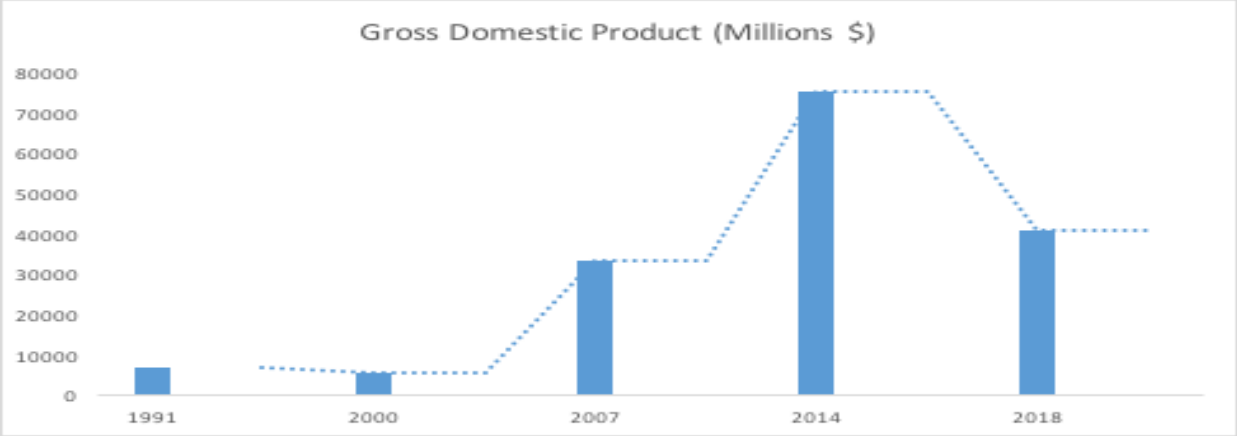
Secondary data was employed for this review study which include national, household, individual and focus group surveys. This study used the trend analysis approach in which annual data are undertaken to examine the past, present and future challenges faced by Azerbaijan agricultural sector towards food security. This method allows for quantitative and qualitative reasoning to deal with the demands of respective challenges while still affecting the prospects. The annual time series data is taken from the food and agricultural organization (FAOSTAT), which was published by the united nation. The household and individual-level data are taken from focus group servery conducted by FAO between May and June 2006. This survey covers 12678 random respondents from each district of Azerbaijan.

2.3.1.1. Relationship between economic growth and food security

Figure 2.1 explains that GDP growth from 1991 to 2018. Horizontal line show years and vertical line show dollar in millions. From 1991 to 2000 GDP trend shows lower than $10000 million. 1991 more than in 2000. Next decade some years still the same level of

GDP then increases rapidly from 2005 to 2007. In 2007 GDP growth was more than $30000 million than some years the same level of GDP. From 2012 to 2014 GDP grows rapidly from $35000 million to $70000 million and this was the highest level of GDP in the past decades. GDP Still the same in the next some years then start to decrease rapidly till 2018 than the same level start. In Azerbaijan, many important crops are grown commercially and some of them are cereals, fruits, vegetables, potatoes, melons, and sunflowers, etc.

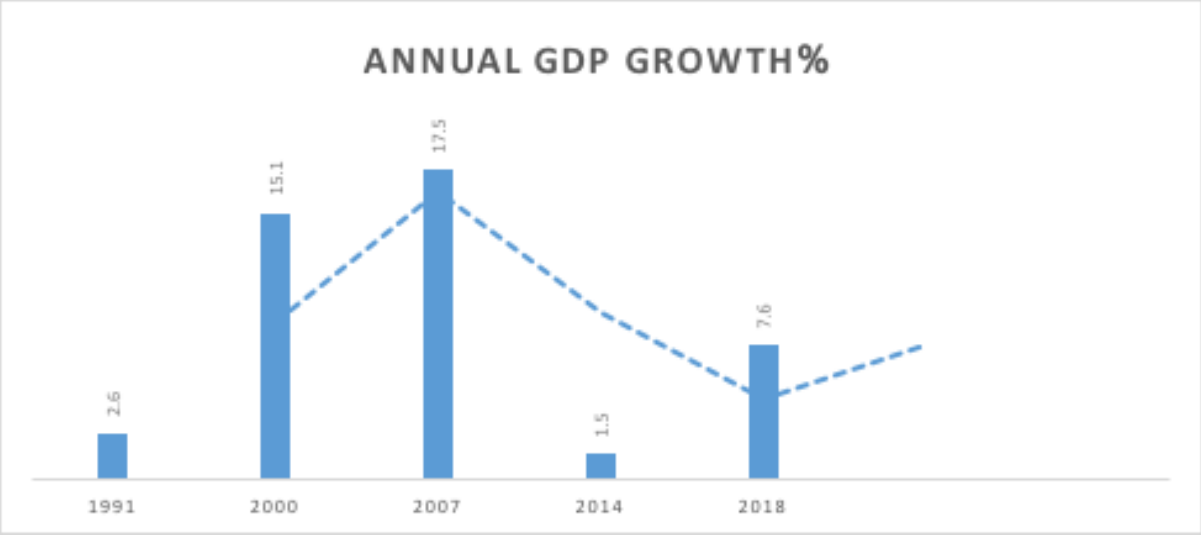
Figure 2-1 Trend of GDP (1992-2018)



Source: FAOSTAT published by United Nations

About 90% of the cultivated area is under cereal cultivation and wheat is grown as a major crop in the country. The country is also working on improving the production of vegetables and fruits and hence 58% production of fruits has been increased. About 35% of the production of vegetables is also increased. Many other important crops are also grown in Azerbaijan extensively such as cotton, berries, and grapes, etc. Agriculture plays an important role in the economy of the country, so agriculture has a great and efficient effect on the GDP of the country. In 2018 GDP decreases rapidly because of goods production level lower, the population grows rapidly, unemployment, lower per capita income, and expenditure. Lower GDP growth shows food insecurity situation because production level was lower and lack of enough food available for people

Figure 2-2 Trend of Annual GDP growth (1992-2018)



Source: FAOSTAT published by United Nations

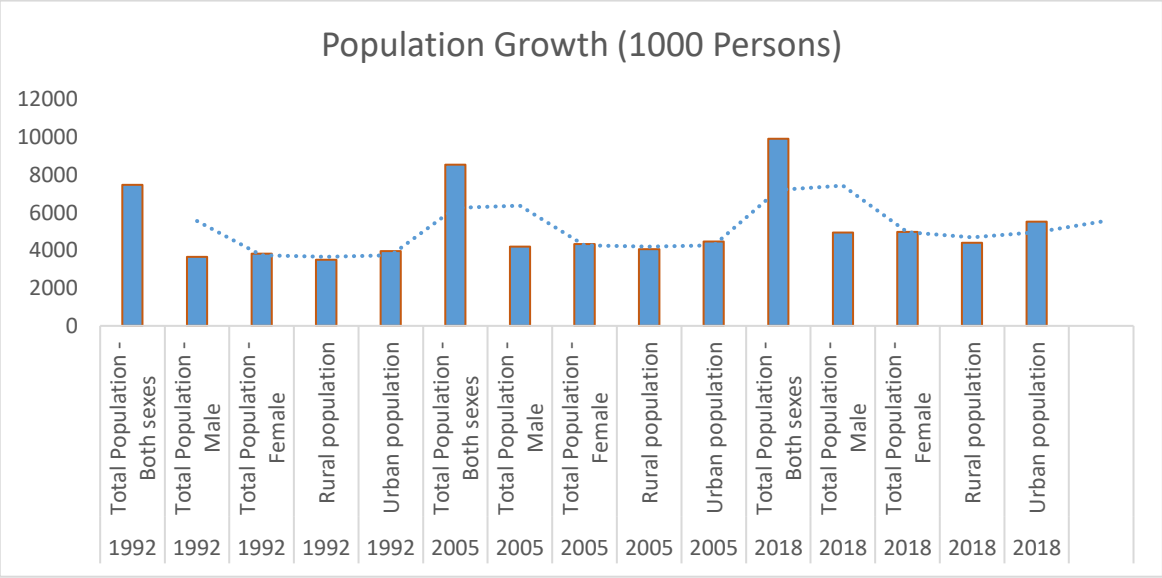
Figure 2.2 indicates that annual GDP growth percentages data from 1991 to 2018. In 1991 GDP annual growth 2.6 percent then increase in 2000 from 2.6 percent to 15.1 percent. From 2000 to 2007 the GDP increase from 15.1 percent to 17.5 percent reached the highest level. In 2014 a decreased level of GDP growth percentage at 1.5 percent then again increase at 7.6 percent in 2018. After 2018 GDP growth shows an increase in the next years. Annual GDP growth decrease in 2014 and lower level in 2018 than previous decades the main reason for the decline was that goods production level lower, population grow rapidly, unemployment, lower-income, and expenditure of people. Lower GDP growth proved there is food insecurity situation because production level is lower as well as food availability.

2.3.1.2. Relationship between population growth and food security

Figure 2.3 reveals population growth from 1992 to 2018. Population growth increases rapidly day by day. In 1992 the population was 7000k which females more than males and peoples belong from the urban area more than a rural area. In 2005 the population was 9000k which females more than males and peoples belong from urban areas more than a rural area. In 2018 the population was around about 10000k which females more than males and peoples belong from the urban area more than a rural area. Rapidly growth in population creates a situation of food insecurity in the country. Increases in population

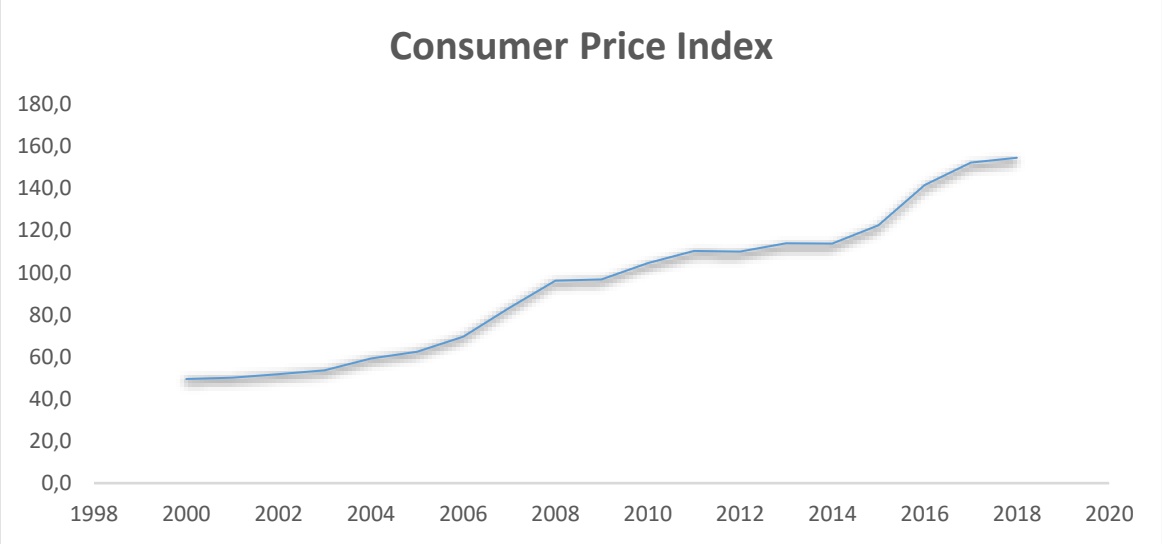
growth negatively affected food security because when population increase then demand of food increase, but the production of food does not increase as well thus limited food available for people.

Figure 2-3 Trend of the population in Azerbaijan (1992-2018)



Source: FAOSTAT published by United Nations

Figure 2-4 Trend of a consumer price index (1992-2018)

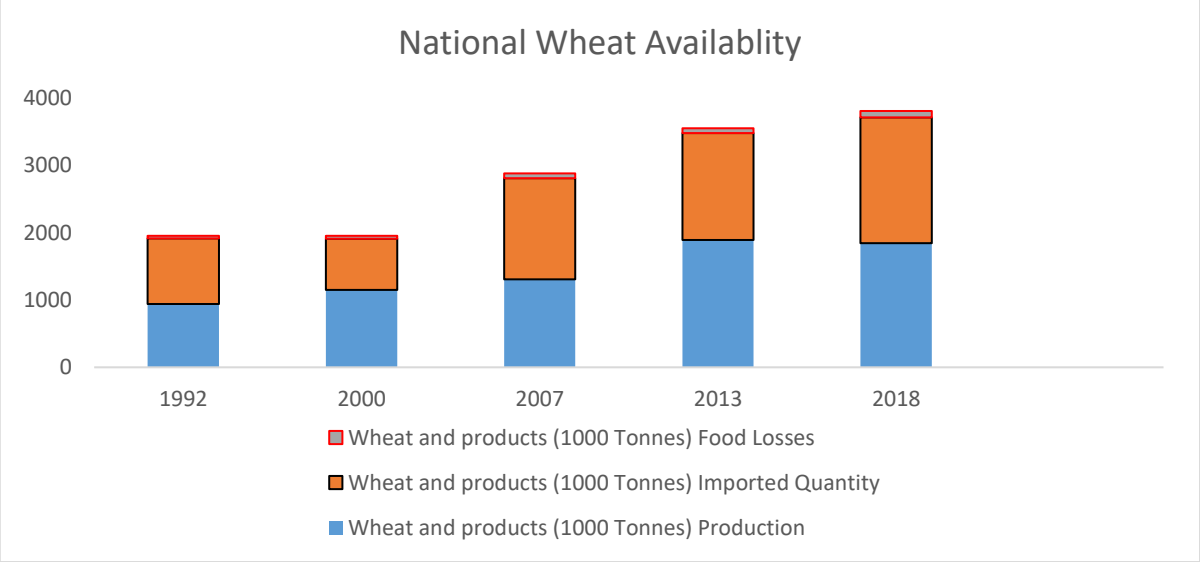


Source: FAOSTAT published by United Nations

2.3.1.3. Agricultural output and Household and Individual food security

Figure 2.5 reveals that wheat availability data at a national level from 1992 to 2018. In 1992 wheat production at home is 1000k tonnes, the imported quantity of wheat was 1999k tonnes and wheat losses were very low this year. In the year 2000 wheat home production increased from 1000k to 1200k while the imported quantity of wheat smaller than the imported quantity of wheat 1992 and minor losses of wheat during this year. In 2007 1300k tonnes increase the home production of wheat than 1992 production while also increasing the imported quantity of wheat very rapidly at 2900k tonnes and minor losses during the year. In 2013 2000k tonnes increase the home production of wheat than 2007 production while also increasing the imported quantity of wheat very rapidly at 3400k tonnes and minor losses during the year.

Figure 2-5 National food availability



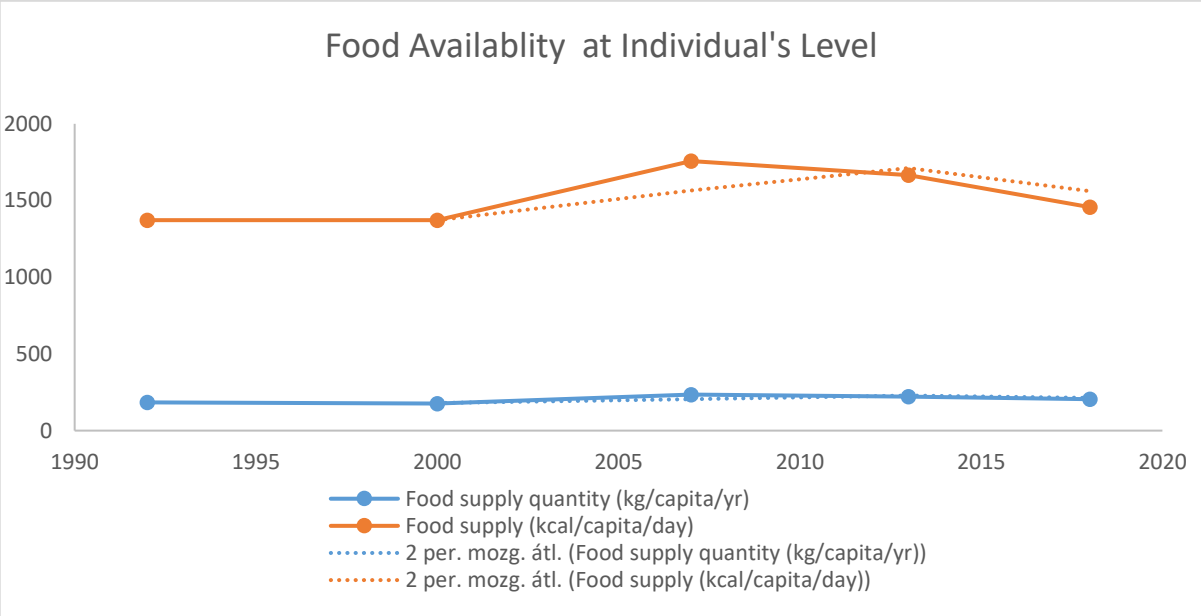
Source: FAOSTAT published by United Nations

In 2018 2000k tonnes stable level of home products as well as 2013 while increasing the imported quantity of wheat very rapidly at 3900k tonnes and 100k losses during the year. In 2013 to 2018 production of wheat not increase and losses in wheat because some problem in agriculture system like unstable irrigation system, lack of land for agriculture, soil issues, lack of water, not improvement in seed quality, climate changes issue that's why wheat production did not increase than population growth increase, not enough

quantity available. Lower wheat production also had a negative effect on food security or creates food insecurity.

Figure 2.6 shows that food availability at the individual level from 1990 to 2020. Food availability was very lower than the population. Land privatization was done in Azerbaijan which plays a great role in the improvement of the economy of the country. Production was increased and indirectly it impacts the economy. Lands were privatized by three different methods which include agricultural enterprises, registered as legal entities, include agro-industrial enterprises, joint ventures, and agricultural cooperatives that employ people; peasant farms, a type of individual enterprise where the farmer is directly involved in production; or household or private farms, very small plots or gardens for personal or household use. This privatization and land reforms bring revolution in agriculture and production was increased which improve the economy of the country.

Figure 2-6 Per capita food availability (1992-2018)

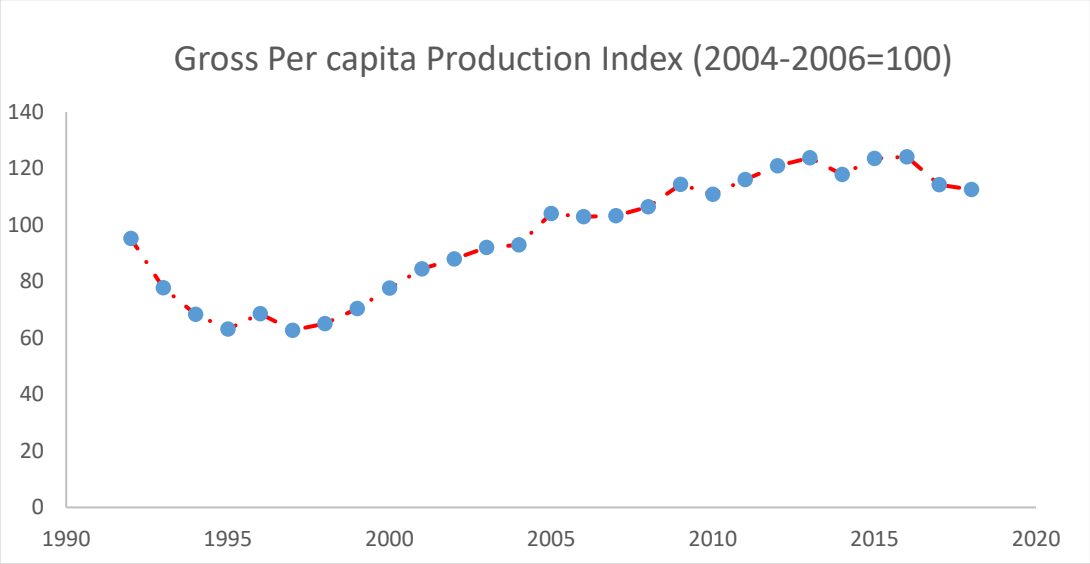


Source: FAOSTAT published by United Nations

Figure 2.7 reveals that Gross Per capita Production Index data from 1990 to 2020. Firstly, in 1990 a decrease trend shows then 1993 to 1995 decrease tend. While in 1999 to 2005 increase trend then 2006 to 2008 decrease trend then 2010 to 2013 increase per

capita GPI. In 2014 there is decrease per capita GPI while in 2015-2016 increase per capita GPI at the highest level was recorded compared to 2017-2018.

Figure 2-77 Per Capita gross production index (1992-2018)



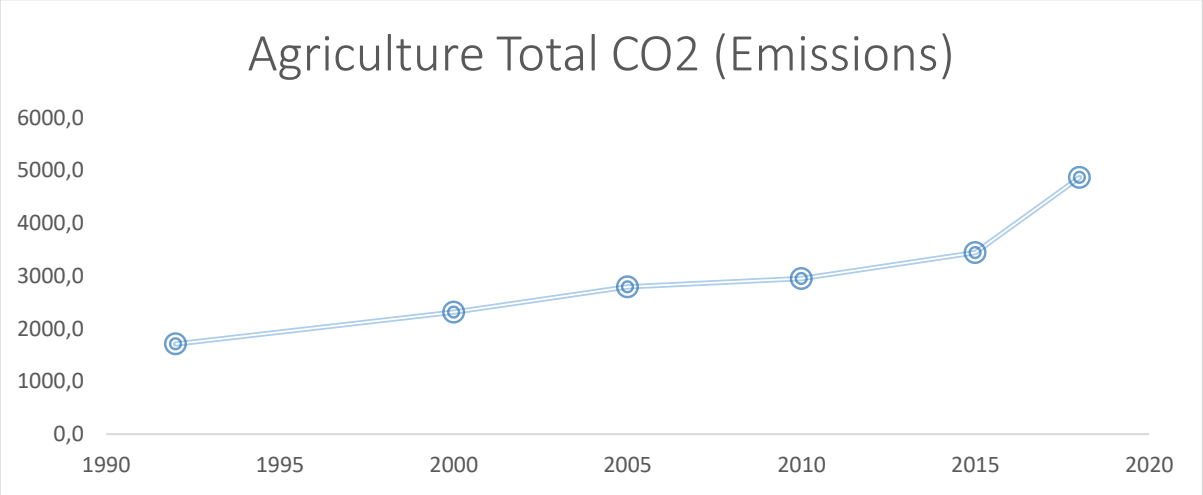
Source: FAOSTAT published by United Nations

2.3.1.4. Climate change and food security

Figure 2.8 shows that agriculture total CO2 (Emissions) data from 1990 to 2020. Due to CO2 emission pollution increases day by day food production lower. It was dangerous for agriculture production that's why production level did not increase insufficiently, and the country faces the situation of food insecurity. This study considered carbon emission CO2 as a proxy of climate change in Azerbaijan. The increase in carbon emission leads to climate change vulnerabilities, but its impact is ambiguous in Azerbaijan. Climate change creates volatility and insecurity in domestic food supply thus slow down the rate of agricultural growth in Azerbaijan. The low agricultural growth rate does create food insecurity and malnutrition particularly for poor and thus adversely impact the sustainable development (see FAO, 2010; FAO2013) our empirical finding is consistent with Swart, et al, (2003) and Chaaban et al, (2018). Climate change has an adverse and significant impact on national food security. For Azerbaijan, a 1% change in the current state of climate leads to deterioration of long-term food security dynamics at national and household as well.

Similarly, UPG urban population growth also has a negative and significant impact on the national food security dynamics of Azerbaijan.

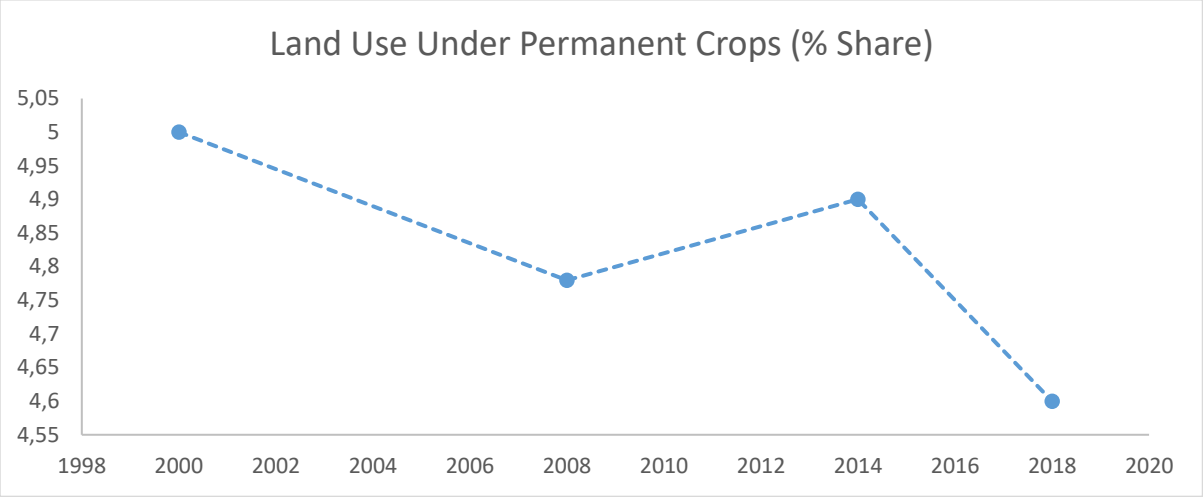
Figure 2-88 Total CO2 emissions of agriculture in Azerbaijan (1992-2018)



Source: FAOSTAT published by United Nations

Figure 2.9. reveals the percentages of land use under permanent crops from 1998 to 2020. From 2000 to 2008 the land percentage decrease from 5 percent to 4.8 percent. From 2008 to 2014 increase in percentage (4.8 percent to 4.9 percent) of land uses for major crops. Then from 2014 to 2018 land uses percentage decrease rapidly from 4.9 percent to 4.6 percent. The period of 2014 to 2018 the percentage of land uses decreases because the area of agriculture is very small for production while majority of the area containing residents of people while most, areas contain mountains and forest where major crops cannot grow. Some lands are characterised with soil related issues which leads to reduced production, and the country is faced with the situation of food insecurity. Empirical evidence suggests that if Azerbaijan adopts more in-ward looking policies to develop the agricultural sector, it will improve the sustainable food supply and security as well as better economic growth and terms of trade. In order to overcome the issue of rural food insecurity for sustainable agriculture combining the lesion from the past with the adaptation of modern climate-smart agricultural practices should be implemented.

Figure 2-9 Trend of Agriculture land utilization (1992-2018)



Source: FAOSTAT published by United Nations

Sustainable transformation and intensification of the agriculture sector can be explaining as a change or process in which production or output is increased without harming climate and environment. This idea specifically focuses on stated aims instead of methodology. It does not need a special technology or modern mechanization or a different range or set of tools that should be implemented. Sustainable transformation or intensification seeks to attain multiple aims, not only expand in output or agricultural yield, and therefore must include social, environmental and economic perspectives. Normally, in less developed countries like Azerbaijan, limited adaptive and innovation capacity to develop agriculture poses a limitation on small farmer's agricultural production, creation of income and investment. Food import in Azerbaijan is seen as an effective short-term policy with improving food insecurity at the national level.

From the findings of this study, food production and agricultural activities over the last twenty-eight years focused on the need to accelerate t production yield without mitigating issues related to environment and climate and this has contributed to a loss of soil erosion and health, deforestation and salinization, and water depletion. This review highlights the key challenges facing sustainable development of Azerbaijan's economy and the outcome suggests that farmers must radically change their practices or approach to grow agricultural goods and consumer behaviour as well as processing to control the post and pre-harvest losses. Therefore, to attain sustainable food security objective in Azerbaijan,

In-ward looking policies needs to develop and agriculture research and development should be expanded for uplifting agriculture growth and rural farmer's livelihood, no doubt, these type of policies will contribute immensely to improve the national and household food security level. Therefore, policymakers should develop a set of sustainable policies to mitigate against climate change and food insecurity. This review proposes that

2.4. Exploring the sustainable household food security approach in Azerbaijan

At present, several studies revealed that 'household's food insecurity' is one of the most complex and panicking problems confronting the Asian region as well as the world (McDonald, 2010). This comprehensive review study posits that the consequences and root causes of regional and global food insecurity are interconnected, multidimensional and cannot be effectively tackled solely on a regional and national level with domestic policy targeting, but instead demands a multi-levels approach such as national, household and individual approach to food security. The international food price spike in 2007-08 triggered critical concern among many rural and urban households of Asian economies like Azerbaijan about the potential unfavourable socioeconomic and socio-political impacts in the region. To achieve household and national food security, normally food stocks and imports have been exercised as policy instruments to offset the short-term difference in domestic production gaps. Much existing empirical evidence confirm the inter-changeability between food import and domestic storage (Makki et al., 1996), but mainly hubs the casual of nations' dependence on imports. As a result, such types of policies increased national dependence on imports to offset the impact of variability in domestic supply and prices (Gouel and Jean, 2013). Instead of openly overruling in the agro market system to control the domestic prices, many nations adopt policies that offset the adverse impact of food inflation on common masses. On the demand side, social safety net policies adopt such as food subsidies, cash transfer programs and food for work programs. On the supply side, the key aims to stabilize the domestic agricultural supply with the help of input or output support price polices. This short review paper aims at briefly highlight the research gaps and the right policy options for attaining the Azerbaijan household food security considering. existing household food security studies of Azerbaijan and some regional countries to learn the experiences of regional economies.

2.4.1. Protocols of Systematic Review Analysis

This short review compares the existing evidence in order to find the scope, priorities and gaps related to Azerbaijan food security issues over time. Our study used review guidelines and a tabulated review of the existing evidence on Azerbaijan and regional economies household's food security studies. This study searched the peer-reviewed journal articles that fulfil the eligibility criteria and qualitatively summarized the findings across studies. Our study identified the eligible studies using three electronic search databases: Google Scholar, Science direct and J store. In each database using the following primary keywords ("agriculture") along with its synonyms and secondary keywords ("food security", "food insecurity", "rural income" and "nutritional security"). The ISI Web of Science (WoS), issued by Thomson Reuters, was chosen as the martial source for review. To find the relevant studies, the researchers explored the electronic sources and reviewed the abstracts that previously synthesized food security analyses. Afterwards, criterion of the year of publication (2000 to 2018) was used for review analysis which was not applied by Villar-Compte *et al*. (2017).

2.4.2.1. Synthesis of Azerbaijan household's food security studies

Mammadov, (2017) highlighted the problems related to agriculture systems like irrigation, soil, water. A solution to these problems in Azerbaijan. The quantitative study was designed which indirectly targeted food security. Primary data was collected from 380 respondents. To attain food security, there is a need to explore and utilize the underground mineral of soil, surface, and ecosystem. Another research of Polat, (2015) explored the relationship between farming and agricultural education, farmer's income and level of production. The quantitative study was designed by employing secondary data from the year 1991 to 2013. The major findings from this research were that positive impact of farming education training on agriculture production. A recent study by Humbatova and Hajiyev, (2016) analysed the impact of microfinancing and loan on agriculture and food production. For this purpose, this study employed a secondary dataset from 2001 to 2015. Major findings from this research were that microfinancing and loan have positive impacts on the food and nutritional security of Azerbaijan. On the other side Tyczewska et al., (2018) examined the impact of population and climate change on agriculture production and productivity. In this research, they directly targeted food security problems. Secondary

data was used from 1960 to 2015. Major findings from this research were that the used of agro-biotechnology in agriculture was a solution to the food security problem. Similarly, Oglu, (2018) explored that issues related to climate change, irrigation system and the problem of soil and salinity. Major findings from this research were that situations or problems in agriculture directly

link with food security and development of the country. Negatively affected food security from these agriculture issues. Food security has garnered great attention from researchers and policymakers since the food price shock in 2007-08, because of the dependence of many countries on imported food (such as in Azerbaijan). Empirical evidence from this period suggests that middle and lower-middle-class households (largely from rural areas in Azerbaijan) are especially hard hit during such catastrophes because prices of food and staple cereals increase sharply beyond their purchasing power (Schmitz and Kennedy, 2016). Although the poverty rate has decreased from 49% in 2004 to 10% in 2016, data show massive disparities between urban and rural areas. Most poor people live in rural areas, where social and economic conditions remain a prime issue of concern, and a great number of rural households remain vulnerable to food insecurity. Despite the improvements made through domestic and global efforts to eradicate poverty, people in Azerbaijan, particularly in rural areas, still have critical challenges of food access and affordability (FAO,2015a). The massive rate of malnourishment and undernourishment among this segment of society suggests that food and nutritional insecurity will persist as a core issue to be tackled by policymakers and the research community (Sutton, et al, 2013). Most of the existing studies have shown that lack of yield-enhancement, low adoption capacity, dysfunctional output and input markets, poor access to extension services and declining soil fertility are the main drivers of national and household food insecurity in developing countries (Willer and Lernoud, 2015). Climatic variability in the form of increased carbon emission and temperature variability and expiated in-season and mid-season droughts also worsen the situation. (Clapp, 2017). A recent study by Watson (2017) shows that unless substantial investments are made to accelerate per-capita food availability in Azerbaijan, the great number of rural people facing undernourishment and hunger will increase considerably. National food security is a multi-dimensional and complex phenomenon, like poverty, with a variety of indicators and definitions. The significance of a nation's food security has become an issue of sustainable governance

globally during the past few decades (ADB, 2006). A nation is food secure when all people at all time have enough economic and physical access to nutritious and safe food for meeting their food requirements, and to achieve an active and healthy lifestyle (FAO,2003). It is also a prime focus of millennium development goals and mainly observed as a helpful measure for examining the progress of a government in term of social and economic well-being (Akramov,2012).

Achieving sustainable food security at the national level remains a great challenge not only for less developed countries but also for developed nations (Barrett, 1996). Although the Azerbaijan government has introduced many programs and policy interventions aimed at attaining national food security, all these efforts have not produced the required objectives (Chaaban, et al,.2018). The main reason for this is that food availability and accessibility in Azerbaijan has not increased enough to meet the demand for the socioeconomic circumstances at household and individual levels. The gap between food supply and demand has led to increasing import of food and livestock products, as well as food inflation and currency depreciation, which make it more difficult for the middle and lower middle-classes to meet their dietary needs (Chabot and Tondel, 2011). The inability to provide reliable data on the household and national food security situation in Azerbaijan has remained a problem for policymakers. Agencies that implement government programs, as well as policymakers, are gradually seeking food security measurement tools that are reliable and easy to use and that can help interpret the dynamics of the national food situation (Clapp, 2017). The analysis of national food security determinants and its status is, therefore, useful not only for policy making but also for better policy implementation (FAO,2015b). There are numerous factors affecting food security – both directly and indirectly – that have been examined empirically in Azerbaijan at the micro level or using targeted group approaches at the household or farm level (Djuric, et al, 2017). However, to the author's best knowledge, none of the recent studies on food security have employed macro or large-scale data to estimate the national dynamics of the food security situation and its key determinants like the present study. Target population or micro studies of determinants of food security will not only mislead policymakers but give a misleading situation analysis for Azerbaijan and other less developed countries (Ilyasov, 2016). The study of (Zh, 2018) reveals that agricultural issues related to soil and water resource, problems solving techniques and their impact on food security. In this research, secondary

data was used from the period 1959 to 2020. They found that these factors have a significant impact on food supply and food security. A report given by FAO, (2012) specifies the various challenges of climate change and growing threats of soil degradation. This FAO report also combined numerous agricultures as well as crops, fruits, vegetables, and livestock growth challenges. They found that agriculture and rural development have a positive role in attaining food and nutritional security. One recent study of Aliyev, (2017) depicted that problems of land cover with mountain surface and agriculture areas in Azerbaijan and solution to these problems. This research indirectly targeted food security by using secondary data from the period 1997 to 2017. This research found the low-intensity irrigation capacity and shortage of water resources in mountain and hill areas which harmed food production. It is important to control the existing water shortage and low intensity of irrigational issues which may enhance the crop production area. These problems were negatively related to food security. Another study of Drexler and Dezseny, (2013) shows the importance of organic agriculture and food security. In this research, they indirectly targeted food security by employing secondary data from the period 1988 to 2012. Some estimates recommend that there was a major lack of organic food processing capability, therefore the government should enhance the fascinating potential market opportunities for organic food processing units. Another research of Ibrahimov and Aghakishiyeva, (2018) depicts the directions of agriculture policy and food security policy in Azerbaijan. In this research, they directly focused on food security by using secondary data from 2010 to 2016. Major findings from this research were that active restrictive policy ought to be enforced in several sectors of the economy in Azerbaijan at the macro and micro levels.

2.4.2.2. Synthesis of global economies household's food security studies

The study of Tarasuk and Vogt, (2009) explains the socioeconomic and demographic factors related to food and nutritional security within the Ontario population. This study used primary data and collected from 10,517 respondents. This research found that 379,100 households were suffering from food insecurity in Ontario during 2004. Prevalence of food insecurity was found among the tenant households and single-parent and single-person households. Another research by Stevens et al., (2017) investigates the role of seasonality with dietary diversity and food security. Primary data was used and

collected from 850 respondents. They come up with results that seasonality had a direct correlation with food security. Similarly, the study of Hillbruner and Egan, (2008) investigated the role of seasonality in determinant the food security and organic process standing of low-income urban households. A quantitative study was designed and directly targeted household food security. Primary data was used and collected from 600 respondents. Findings from this research were that prevalence rates of food insecurity, wasting, and inadequate growth were all considerably higher throughout the monsoon season as compared with the season. Dietary diversity and lost work thanks to the weather were known as specific pathways through that season affected home food security. The study of Becquey *et al*., (2012) analysed the seasonality of the dietary dimension of unit food security in Ouagadougou. For this purpose, the quantitative study was designed and directly targeted the issue of household food security. Primary data was used and collected from 1056 respondents. Results showed that intakes of energy and 10 micronutrients were considerably lower throughout the lean season than during the post-harvest season. That was associated with less frequent consumption of smaller amounts of vegetables. Food security relied heavily on food expenses and the worth of meat and fish. Households with economically dependent adults and bigger households were the foremost vulnerable, whereas education and the social network had a positive impact on food security. The study of Segall-Corrêa et al., (2014) reveals that to review and refine the Brazilian Unit Food Insecurity (BUFI) measuring Scale structure. A quantitative study was designed and directly targeted household food security. Primary data was used and collected from 112,665 respondents. They found that people were eating less than the recommended criteria. Similarly, Mavengahama *et al*., (2013) show the role of untamed vegetable species in-unit food security in maize primarily based subsistence cropping systems. A quantitative study was designed and directly targeted household food security. Secondary data was used and from 2003-2008. Findings from this research were that for some poor families WV is substituted for a few food crops. The seasonal prevalence of those vegetables leaves several families while not a food supply throughout the off-season. Wild vegetables increase agrobiodiversity at the home level. Another study of Coleman-Jensen et al., (2014) examined the household food availability in the United States of America. A quantitative study was designed and directly targeted household food security. Secondary data was used from 1995-2013. Findings from this research were that state-level prevalence rates of food insecurity and extremely low food security for 2011-13 are

compared with 3-year average rates for 2008-10 and 2001-03. Likewise, Frongillo and Nanama, (2006) studied the agencies measure household food insecurity for application layout, planning, concentrated on, implementation, tracking, and assessment, however current measures frequently are insufficient. A quantitative study was designed and directly targeted household food security. Primary data was used and collected from 126 respondents. Findings from this research were that the outcomes supplied sturdy evidence that the meals insecurity score, calculated from experience-primarily based questionnaire items, became valid for figuring out seasonal variations in household meals insecurity, variations among families in food lack of confidence at a given time, and modifications in family food insecurity over the years in northern rural Burkina Faso. Another study of Da Silva Guerra et al. (2013) explored the household's food availability in the Brazilian Amazon. A quantitative study was designed and directly targeted household food security. Primary data was used and collected from 363 respondents. The results showed that 23.1% prevalence of mild to intense meals lacks confidence, suggesting affiliation with the following: low earnings, negative sanitation. The study of Melgar-Quinonez, (2006) examined the relationship between per capita food intake and household income. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 330 respondents. Findings from this research were that food-comfortable families had extensively higher (P, zero.05) total DPC food costs in addition to expenses on animal supply foods, greens, and fat and oils than fairly and severely meals-insecure households. The consequences provide evidence that America HFSSM can discriminate among families at exceptional ranges of meals lack of confidence reputation in numerous developing international settings. Similarly, the study of Coates et al. (2006) indicated that the evaluation of a qualitative and quantitative method for developing a household food insecurity scale for Bangladesh. Quantitative and Qualitative study was designed and directly targeted household food security. Secondary data was used from 2001-2003. Findings from this research were that inadequate food quantity was the major challenge for food security at the regional and household level. A recent study of Saediman *et al*., (2019) evaluated the nourishment status of poor families. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 64 respondents. Results indicated that an extraordinary lion's share (81.3%) of family units was nourishment secure. Likewise, the study of Bikombo, (2014) comprehends the degree of nourishment uncertainty among road

merchants as far as their entrance to nourishment, the nature of nourishment devoured and the procedures they used to adapt to nourishment lack. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 120 respondents. Major findings from this research that semi-educated individuals who produced RS 2000 every month which was to be imparted to a normal of 4 individuals from their separate family units. Subsequently, most of road brokers' families lived beneath the destitution line, along with these lines' nourishment unreliable. Constrained pay traded off the nature of nourishment expended: vitality thick nourishment overwhelmed their nourishment; thus 59.2% experienced a transmittable way of life sicknesses. Another study by Ndhleve et al., (2012) examined the household nourishment status in a seaside country network of South Africa. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 159 respondents. This analysis exhibited that 9% of the family units' experience extreme deficient access to nourishment, while 78% have moderate access to nourishment and 13% approach sufficient nourishment. A recent study of Tabrizi et al., (2018) measured the family unit nourishment security status and related factors in East-Azerbaijan, Iran. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 1385 respondents. Major findings from this research that pervasiveness of nourishment frailty was 58.4%. The pace of nourishment weakness in the inhabitants of a capital city (59.7%) was higher than those of occupants of territorial urban communities (57.18%), in any case, this distinction was not factually critical (P=0.36). The respondents with family size more than 3 (P=0.01), jobless (0.001) and wedded (0.01) respondents and the ones with lower instruction levels (P<0.001) were altogether more nourishment uncertain than different respondents. In the wake of modifying for depending factors, the conjugal status, family size, instructive level and the work status of the leader of the family had a noteworthy relationship with nourishment security. The study of Gholami and Foroozanfar, (2015) examined the family unit nourishment security status and related components among various rustic areas of Nishapur (A city in the upper east of Iran). The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 2747 respondents. Major findings from this research that Altogether, 2747 family units (59.1%) were distinguished as nourishment secure. The most elevated predominance of nourishment security was seen in the Central region (62.3%) and the least was in the Miyanjolgeh region (52.9%). In reverse various

strategic relapse uncovered that vehicle possession, nearness of constant sickness in a family unit and family pay (every month) were fundamentally connected with nourishment security in all the studied regions ($p< 0.05$). Similarly, the study of Sharafkhani et al., (2010) analysed the impact of decision about the job of family unit creation on the family unit nourishment status. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 2503 respondents. Major findings from this research that 2503 family units, 1012 (40.4%) were distinguished as nourishment secure and the staying 1492 (59.6%) were nourishment shaky. There was a noteworthy connection between family structure and size and family unit nourishment security status ($p<0.005$). There was, be that as it may, no noteworthy relationship between family unit nourishment uncertainty and the number of youngsters (under five) and the number of older people living at home. The study of Knueppel et al., (2010) examined the Household Food Insecurity Access Scale (HFIAS) in Tanzania. The quantitative study was designed and directly targeted household food security. Primary data was used and collected from 2503 respondents. Major findings from this research that about 20 % of the families were ordered as nourishment secure, 8.4 % as gently nourishment shaky, 22.8 % as modest nourishment secure and 48.1 % as seriously nourishment unreliable. Food insecurity generally happens when people don't have physical, economic or social access to safe and healthy food, and chronic food insecurity occurs whenever they are incapable of diminishing or absorbing the adverse impact of food price shocks (FAO,2003). Food insecurity is interrelated yet separate from other social issues such as malnutrition and poverty. Primarily, the failure of efforts to control food insecurity is possibly the result of overemphasis on ensuring food availability at the national and household level (IFAD,2010). While a sustainable food security situation hangs on total food production and agricultural performance, it also is contingent on food access, utilization and stability (Jafarova, 2016). Therefore, looking only at the food availability component is a weak estimator of food security, as such analysis only conveys one aspect of the entire population (FAO,2015a). Most of the existing literature empirically observes the food availability component for national food security. However, food availability and accessibility cannot be explicitly distinguished at the national level, where constraints of data availability fail to disclose the extent to which food is physically and economically available in the domestic market. In addition, people's attitudes towards food acquisition don't always reflect food accessibility (Khalilov, et al, 2015). So, the food availability

approach to food security might not relate to its latent benefits, consequences, and causes. This study gives a marginally different framework to explain how food security dynamics are examined and managed at the national level. The paper asserts there to be three main components of national food security analysis: food availability; food accessibility; and food utilization. This framework is very suitable for our analysis, subject to data and time constraints. While a reliable approximation of food security dynamics is a prerequisite for well-targeted policies and effective program implementations, there is no unique procedure for food security measurement. And despite the FAO's strong theoretical foundation, there exists no uniform tool that apprehends all dimensions of food security (FAO, 2003). The unattainability of such a gold standard makes it ineffective to employ a single benchmark as an accurate assessment of food security. Due to its multidimensional nature, it is typically agreed that a group of indicators is required for the accurate study of food security (IFAD,2010).

This study underlined the research gaps and the right policy options for achieving the Azerbaijan household food security considering existing household food security studies of Azerbaijan and some other countries to learn the experiences of regional economies. We found that household and individual food security is vulnerable due to climate change and exchange rate and international price volatility which requires urgent attention from both domestic as well as international The synthesis of food security studies suggests a different factor that may influence the state of household food security. The best-performing nations in terms of household food security are those with high research and development. It will improve the potential of domestic agriculture food supply for meeting national household and individual's needs. At the household level, every nation, including Azerbaijan, need a database of cross-sectional, time series and penal datasets to study the food availability, accessibility, affordability, utilization, hunger and malnutrition that will provide early warning assistance to policymakers. The structure of social safety nets can mitigate the impact of food inflation on most vulnerable populations. In Azerbaijan at the household level, there is a need for inclusive household food security policy in order to achieve sustainable developmental plans that consider Azerbaijan's household characteristics and specificities and address both food accessibility and utilization dimensions of the country's food security. Household food security strategies should include short- and long-term policies that decrease food inflation and benefiting for both demand and supply side

sectors. Instead of openly overruling in the agro market system to control the domestic prices, many nations adopt policies that offset the adverse impact of food inflation on common masses.

2.5. Lessons for attaining Azerbaijan's Food Security

These are following lessons for achieving Azerbaijan's food security.

1. This review analysis was carried out in order to highlight the implication of food security situation as presented by studies and documented information with focus on Azerbaijan and Hungary. From this study, the existing evidences was largely focused on food availability, trade and agricultural growth. Although food availability and trade offer a promising possibility to short run food security through ensuring availability of nutritious foods such as fruits and vegetables which are mostly perishable if not processed on time. This review highlighted that Azerbaijan and Hungary food security literature has predominantly focused on only food availability at national level and overlooked the other aspects of food security such as access, affordability, utilization and stability. This implies that the food security research should be expanded in order to include and cover major areas of concern and importance to over all food security of the nations. There should be in addition to food availability, a systematic focus on food diversity and quality more specifically, with a prime emphasis on household and individual food security. The food security studies should assess the critical roles that agriculture plays on intra-household distribution of food (e.g., to vulnerable groups of rural households like children and women). More rigorous research on multi-indicators of food security studies in settings where helpful policies have been endorsed would more evidently explain these relationships.

2. This analysis was inspired to critically unfold the food security studies in Singapore, Georgia and Austria. Food security studies were largely correlated with food availability and agricultural growth and rural development. Although food availability offers possibilities to short run food security through accessible nutritious food like fruits and vegetables. Our study disclosed that existing evidence in selected countries has widely focused on only food availability and

overlooked the other aspects of food security such as access, affordability, utilization and stability. Moreover, the results imply that the upcoming food security research should also expand the focus from food availability to food diversity and quality more specifically, with a prime emphasis on household and individual food security. This version of our food security studies considers the role of agriculture on intra-household distribution of food (e.g., to vulnerable groups of rural households like children and women) in Singapore, Georgia and Austria. More rigorous research on multi-indicators of food security studies in settings where helpful policies have been endorsed would explicitly explain these relationships.

3. Agriculture contributes to Azerbaijan's food security, but prospects for the agricultural sector remain unreliable. Using a review analysis approach, this study examines present, past and future trends of food demand and supply in Azerbaijan to underline prospects and challenges of the Agricultural sector's contribution to food and nutritional security. The study highlights the significance of crops to the sustainable development of agriculture in Azerbaijan and discusses potential pathways for attaining food security, while also appraising their socioeconomic acceptance. Alternative pathways which highlight the significance of the stability of agricultural growth for food security. If past trends are maintained, the growth of food and agriculture would be static or slow, resulting in adversely affecting the per capita food availability. This review suggests that comprehensive policies to address the issues of climate change and promote sustainable agriculture, control post, and pre-harvest losses and liberalize regional trade are imperative. The agricultural sector needs more attention to food security policies due to sustainable solutions.

4. Several factors determine the sustainability of a country’s developmental goals for its citizens towards actualizing household food security. Currently, when household and individual food security is vulnerable due to climate change and exchange rate and international price volatility which requires urgent attention from both domestic as well as international. In Azerbaijan at the household level, there is a need for inclusive household food security policy in order to achieve sustainable developmental plans that consider Azerbaijan's household

characteristics and specificities and address both food accessibility and utilization dimensions of the country’s food security. Household food security strategies should include short- and long-term policies that decrease food inflation and benefiting for both demand and supply side sectors. The synthesis of food security studies suggests a different factor that may influence the state of household food security. The best-performing nations in terms of household food security are those with high research and development. It will improve the potential of domestic agriculture food supply for meeting national household and individual's needs. At the household level, every nation, including Azerbaijan, need a database of cross-sectional, time series and penal datasets to study the food availability, accessibility, affordability, utilization, hunger and malnutrition that will provide early warning assistance to policymakers. The structure of social safety nets can mitigate the impact of food inflation on most vulnerable populations.

3. MATERIALS AND METHODS

This chapter is organized as follows: the section 3.1 presents the methodology of the objective-1 and adds relevant information about food security dimensions, study design, and empirical strategy. The section 3.2 presents the methodological setup of the objective-2 of the dissertation. Similarly, section 3.3 presents the empirical methodology of objective 3.

Multidimensional determinants of national food security in Azerbaijan

Food plays a fundamental role for living organisms to achieve a healthy routine. The achievement of food security is a complex and important development priority for all developed and less developed countries (FAO,2015a). Food security is an international concern for every human being; about 805 million people around the globe are food insecure (FAO, 2015b). In Azerbaijan, the situation of food security is more critical due to climate change vulnerability and land degradation (Jafarova, (2016). The agricultural sector is the third leading contributor to the gross domestic product of Azerbaijan, after construction and oil sectors. It contributes around 8% to the national economy (ROA,2016), and employs about 40% of the labor force as compared to 1.5 % in the oil sector. Similarly, agro-based industry plays a vital role in food security by the processing of dairy, meat products and canning of fresh vegetables and fruits. According to a national report on 2015 data, the value of total imported commodities was above $9 billion, out of which 13.5% was food, beverages, and live animals.

Food security has garnered great attention from researchers and policymakers since the food price shock in 2007-08, because of the dependence of many countries on imported food (such as in Azerbaijan). Empirical evidence from this period suggests that middle and lower-middle-class households (largely from rural areas in Azerbaijan) are especially hard hit during such catastrophes because prices of food and staple cereals increase sharply beyond their purchasing power (Schmitz and Kennedy, 2016). Although the poverty rate has decreased from 49% in 2004 to 10% in 2016, data show massive disparities between urban and rural areas. Most poor people live in rural areas, where social and economic conditions remain a prime issue of concern, and a great number of rural households remain vulnerable to food insecurity. Despite the improvements made through domestic and

global efforts to eradicate poverty, people in Azerbaijan, particularly in rural areas, still have critical challenges of food access and affordability (FAO,2015a). The massive rate of malnourishment and undernourishment among this segment of society suggests that food and nutritional insecurity will persist as a core issue to be tackled by policymakers and the research community (Sutton, et al, 2013).

Most of the existing studies have shown that lack of yield-enhancement, low adoption capacity, dysfunctional output and input markets, poor access to extension services and declining soil fertility are the main drivers of national and household food insecurity in developing countries (Willer and Lernoud, 2015). Climatic variability in the form of increased carbon emission and temperature variability and expiated in-season and mid-season droughts also worsen the situation. (Clapp, 2017). A recent study by Watson (2017) shows that unless substantial investments are made to accelerate per-capita food availability in Azerbaijan, the great number of rural people facing undernourishment and hunger will increase considerably. National food security is a multi-dimensional and complex phenomenon, like poverty, with a variety of indicators and definitions. The significance of a nation's food security has become an issue of sustainable governance globally during the past few decades (ADB, 2006). A nation is food secure when all people at all time have sufficient economic and physical access to nutritious and safe food for meeting their food requirements, and to achieve an active and healthy lifestyle (FAO,2003). It is also a prime focus of millennium development goals and mainly observed as a helpful measure for examining the progress of a government in term of social and economic well-being (Akramov,2012).

Achieving sustainable food security at the national level remains a great challenge not only for less developed countries but also for developed nations (Barrett, 1996). Although the Azerbaijan government has introduced many programs and policy interventions aimed at attaining national food security, all these efforts have not produced the required objectives (Chaaban, et al,.2018). The main reason for this is that food availability and accessibility in Azerbaijan has not increased enough to meet the demand for the socioeconomic circumstances at household and individual levels. The gap between food supply and demand has led to increasing import of food and livestock products, as well as food inflation and currency depreciation, which make it more difficult for the middle and

lower middle-classes to meet their dietary needs (Chabot and Tondel, 2011). The inability to provide reliable data on the household and national food security situation in Azerbaijan has remained a problem for policymakers. Agencies that implement government programs, as well as policymakers, are gradually seeking food security measurement tools that are reliable and easy to use and that can help interpret the dynamics of the national food situation (Clapp, 2017). The analysis of national food security determinants and its status is, therefore, useful not only for policy making but also for better policy implementation (FAO,2015b).

There are numerous factors affecting food security – both directly and indirectly – that have been examined empirically in Azerbaijan at the micro level or using targeted group approaches at the household or farm level (Djuric, et al, 2017). However, to the author's best knowledge, none of the recent studies on food security have employed macro or large-scale data to estimate the national dynamics of the food security situation and its key determinants like the present study. Target population or micro studies of determinants of food security will not only mislead policymakers but give a misleading situation analysis for Azerbaijan and other less developed countries (Ilyasov, 2016).

The present study helps fill this gap by incorporating the multidimensional determinants of food security at the national level. The prime objective of this study is to examine the determinants of the national food security situation in Azerbaijan. The specific objectives of the study are to analyze the short-term and long-term dynamics of these determinants on food security status.

3.1.1. Theoretical Background

Food insecurity generally happens when people don't have physical, economic or social access to safe and healthy food, and chronic food insecurity occurs whenever they are incapable of diminishing or absorbing the adverse impact of food price shocks (FAO,2003). Food insecurity is interrelated yet separate from other social issues such as malnutrition and poverty. Primarily, the failure of efforts to control food insecurity is possibly the result of overemphasis on ensuring food availability at the national and household level (IFAD,2010). While a sustainable food security situation hangs on total food production and agricultural performance, it also is contingent on food access,

utilization and stability (Jafarova, 2016). Therefore, looking only at the food availability component is a weak estimator of food security, as such analysis only conveys one aspect of the entire population (FAO,2015a). Most of the existing literature empirically observes the food availability component for national food security. However, food availability and accessibility cannot be explicitely distinguished at the national level, where constraints of data availability fail to disclose the extent to which food is physically and economically available in the domestic market. In addition, people's attitudes towards food acquisition don't always reflect food accessibility (Khalilov, et al, 2015). So, the food availability approach to food security might not relate to its latent benefits, consequences, and causes.

This study gives a marginally different framework to explain how food security dynamics are examined and managed at the national level. The paper asserts there to be three main components of national food security analysis: food availability; food accessibility; and food utilization. This framework is very suitable for our analysis, subject to data and time constraints. While a reliable approximation of food security dynamics is a prerequisite for well-targeted policies and effective program implementations, there is no unique procedure for food security measurement. And despite the FAO's strong theoretical foundation, there exists no uniform tool that apprehends all dimensions of food security (FAO, 2003). The unattainability of such a gold standard makes it ineffective to employ a single benchmark as an accurate assessment of food security. Due to its multidimensional nature, it is typically agreed that a group of indicators is required for the accurate study of food security (IFAD,2010). This study employs the quantitative approach to explore how multidimensional determents affect the food security dynamics in Azerbaijan at the national level. This analysis will be useful for food security policymaking and monitoring analysis.

3.1.2. Agro-ecology and food security of Azerbaijan

Azerbaijan is situated in southwestern Asia. Most of its land falls in the Asian zone, while a small area in the northern range is in Europe. Azerbaijan's total population is around 10 million and its economy is greatly dependent on natural resources and oil production (ROA, 2016). Azerbaijan possesses various climate zones and topographies which allow for agro-based products of a variety of animals, plants, and fisheries. The agricultural sector is the third leading contributor (8%) to Gross National Product but

crucial issues limit agricultural growth, largely because of serious land degradation and fragmented holdings of natural resources. Climate change and mishandling in animal and plant production have led to waterlogging, desertification, soil erosion, reduction of soil fertility and increase in secondary salinization (FAO,2010). All these problems have damaged the food security and agricultural growth rate. In Azerbaijan, the agricultural sector can play an important role in reducing poverty and food insecurity. Even though its contribution to national income is quite low, particular focus is being dedicated to non-oil sectors, mainly agriculture, in order to expand socioeconomic activities and to bring higher levels of food security. However, the climate outlook for Azerbaijan is categorized by increasingly extreme and frequent rainfall and a rise in temperatures. Therefore, it is a common perception that climate variability will turn out to be a multiplier increasing the prevailing risks to food security.

3.1.3. Data description and sources

The empirical analysis draws from nationally representative time series data over the period 1991 to 2018, to examine the dynamics of food security in Azerbaijan. Annual time series data is taken from the Food and Agricultural Organization (FAO) and World Development Indicators (WDI). The food supply (per capita/year) is used as a proxy for national food security and as an endogenous variable in the model. Annual food import (FIM), trade to GDP ratio (TGDP), exchange rate (ER), consumer price index (CPI), carbon emission CO2 as a proxy of climate change (CC), and urban population growth (UPG) are used as exogenous variables and major determinants of food security. The food supply (per capita/year) as a proxy of food security also uses calorie availability at the national level. Historical carbon emission CO2 data are obtained from FAO for estimating the impact of annulling climate change in Azerbaijan. In this article, time series analyses include the annul series of all relevant determinants of various food security components (availability, access, affordability, stability) at the national level.

3.1.4. Methodological Setup

It is a precondition to test the stationarity and order to the integration of each variable in a model before employing the short and long run econometric technique. For this purpose, this study used the ADF test (Dickey and Fuller, 1981) for analyzing the order

of stationarity of each time series. Unit root analysis was used for both conditions, with and without trend at 5 percent level of significance. The general equation of the augmented Dickey-Fuller (ADF) is bellow (Eq.1).

$$\Delta Y_t = \alpha + \beta_1 t + \delta Y_{t-i} + \sum_{i=1}^{m} \lambda_i \nabla Y_{t-i} + \varepsilon_t \qquad (1)$$

Where ε_t is error-term (white noise).

3.1.5. Specification of Co-Integration Model

There are numerous models proposed to estimate cointegration such as Enger-Granger (1987), Johansen and Juselius test (1990), and ML-based Johansen model (1992). It is a criterion for the applications of these cointegration approaches that time series variables be stationary or integrated at the same time; otherwise they produce spurious results (Kim *et al*., 2004). ARDL bounds testing approach or Autoregressive Distributive Lag Model to estimate long-run cointegration as developed by Pesaran *et al*. (2001), which is appropriate to small samples (Haug, 2002). This model can also be relevant, regardless of stationary level e.g. I (1) or I (0) (Pesaran *et al*., 2001). In ARDL test, if estimated F-statistics value exceeds the upper critical bound value, then the time series is said to be cointegrated and vice versa. If the estimated F-statistics fall between the lower and upper bound values, then the series is said to be inconclusive cointegration. After establishing the long-run cointegration, the error correction method (ECM) used to examine the short-run relationships take the form defined in Eq (3) below:

$$\Delta FS = a + \sum_{i-1}^{m} \emptyset\dot{1}\ FIM \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{2}\ TGDP \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{3}\ ER \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{4}\ CPI + \sum_{i-1}^{m} \emptyset\dot{5}\ CC + \sum_{i-1}^{m} \emptyset\dot{6}\ UPG + \sum_{i-1}^{m} \emptyset 7\ FS + \in \ ---------- Eq2$$

$$\Delta FS = \sum_{i-1}^{m} \emptyset\dot{1}\ \Delta FIM \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{2}\ \Delta TGDP \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{3}\ \Delta ER \underset{t-i}{\longrightarrow} + \sum_{i-1}^{m} \emptyset\dot{4}\ \Delta CPI + \sum_{i-1}^{m} \emptyset\dot{5}\ \Delta CC + \sum_{i-1}^{m} \emptyset\dot{6}\ \Delta UPG + \sum_{i-1}^{m} \emptyset 7\ \Delta FS + \in \ ----Eq3$$

F test of the null that: $\phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = \phi_6 = 0$

Determinants of Regional Food Security

Under the Sustainable Development Goals (SDG), countries committed to eliminating all kinds of nutritional and food insecurity (UN, 2015). And still, food and nutritional insecurity remains one of the most critical sources of hunger and poverty, particularly in the developing nations (FAO, 2017a). The prevalence of undernourishment in young children, the micro and macro nutrients deficiency in particularly infants and women are critical in the less developed countries (Stevens *et al.*, 2015). Many international institutions place more emphasis on food security problems, especially in developing countries, where a huge amount of people suffers from such with main aim of combating and tackle the problems of malnutrition and malnourishment (Asatiani, 2009). Asia for instance is faced with two major challenges: food insecurity and climate change. The prices of food increased in 2007/2008 and has become volatile due to some critical issues and a great threat to food security. Nevertheless, it should be controlled by the cooperation of nations since it is an important factor in preserving regional stability (Chandra and Lontoh, 2010). Food represents the basic need of humans that provides nutrition for the living. In the meantime, Asian countries are facing several other challenges as well, such as high and rapid growth in population, adverse environmental conditions, rural poverty with very little growth in agricultural development (Marzęda-Młynarska, 2017). Problems related to food insecurity arose frequently, their number showed a sharp increase between 2007 and 2012 (Utter *et al*., 2018). The main reason for food insecurity could be looked at as the inequality of the society where the poor, due to insufficiently available food or not affordable healthy food, suffered from many diseases (Schlichting *et al*., 2019). Human development is valuable due to its comparability across regions however, it may not be the best indicator for food security (Maxwell et al., 2008).

Regional food security has become a major challenge and a primary focus of sustainable developmental goals in the past few decades (ADB, 2006). A country is said to be food secured when all its people always have enough economic and physical economic access to nutritious and safe food to meet their nutritional requirements, in order to keep on an active and healthy lifestyle (FAO, 2003). Therefore, that has become a primary focus in the millennium development goals (MDGs). And as such, food security is observed and examined in the different countries, thus it is measured through the progress of any government, and as part of social well-being (Carter *et al*., 2010). However, achieving regional and country-level sustainability of food is still a great challenge (Smith, 2011). While many countries have presented social development programs and policy interventions for it, none of these efforts led to reaching the desired goals (Chaaban, *et al*,.2018). Particularly, food security in Asian countries did not increase enough to meet the regional demand. The gap between the national food supply and demand has led to an increase in the import of food and livestock (Zahrnt, 2011). Furthermore, there is lack of adequate publications and data on regional and national food security in the Asian region, which raised a problem for sustainable policymaking and implementation. The policymakers and implementers of the regional food security program have been gradually seeking for the tools of measuring food security, which are reliable, easy to use and help to interpret the dynamics of food security (Feizizadeh *et al*., 2015; Godor, 2016). The analysis of regional and national food security determinants and their status is, therefore, useful for not only policymaking but implementation as well (FAO, 2015b). Hence, its suggested that there is need to look at some key areas and several factors to be examined empirically that directly or indirectly impacted food security in some regions (Islam and Wrong, 2017). However, according to the literature review, no study applied macro-level or large-scale data to estimate the regional dynamics of the food security situation and its key determinants from a macro prospective recently. Studies having a target population or a micro perspective while investigating the determinants of food security could not only mislead policymakers but also could give a spurious situation analysis on countries under analysis (Oglu, 2018). Food import in these economics was seen as an effective policy that improved food security at national level and regional level. However, for achieving the sustainable food security goals, trade liberalisation and more economic integration is required, which could bring mutual benefits. These types of trade policies will contribute immensely to the improvement of national and regional food security. Moreover,

achieving the GDG 2 (sustainable development goals) that targets the eradicating hunger and malnourishment and the attainment of sustainable food security in such countries like Azerbaijan, Singapore, Austria, Georgia and Hungary by the end of 2030. Therefore, the current paper aims to fill in this gap by examining the dynamics of regional food security. The main research objective is to identify the determinants of food security in Azerbaijan, Singapore, Austria, Georgia and Hungary. These counties have small population size and had quite comparable socioeconomic situations and demographical profile. So, we selected them for examining the food security dynamics. Moreover, a specific objective is to investigate the short- and long-term impacts of both endogenous and exogenous shocks on the food security of the selected countries.

3.1.6. Theoretical Framework

A few recent papers focused on the analysis of food security, on short- and medium-term. They highlighted that the dynamics of food security were not dependent on the food balance sheets but on the countries' ability to maintain food consumption through domestic food production and to finance food import. On the short-run, hunger was just increased by such social policies as food aid, and on the medium-run, it was maintained by income inequality (i.e. the higher income of certain people). Higher trading prices for food were found beneficial for agricultural development but could not be expected to drive directly the agricultural growth. Herein, two factors were involved: first, the change in trade prices, and then, in response to it, the rise in agricultural production (Herrmann, 2009). For the argument on food security and the increase in agricultural growth, the European Union's Common Agricultural Policy (CAP) was taken under scrutiny. Hunger was and is a major issue in developing countries which unfortunately did not receive the right attention and response from European farmers. Clearly, in order to boost the agricultural sector, financial investments were needed in the developing countries (Zahrnt, 2011).

Another paper provided information on the agricultural sector's development in Hungary and explored the creation of Agricultural Knowledge System (AKS) in the country. Significant changes were implemented in the agricultural sector to address the challenges of traditional AKS institutions, which sometimes failed to meet new requirements. The study was based on the perspective of a national stakeholder workshop

and meetings with professionals, where the literature review gave recommendations for the development of agricultural sector and the Hungarian AKS institutions, and established a platform or organisation for further communication among concerned parties and for solving the major problems which were related to the creation of the system. Therefore, the findings are also important in terms of agricultural knowledge in Europe and food security (Nemes and High, 2013). issues of insecurity and its effect on inhabitants of regions mostly affected is considered a serious and critical issue. Another paper suggested that in order to improve the food security system, a food policy council should be established, and the locally determined work should be promoted. Work might be related to growth and development in food system. Food policy, as such, has defined many goals and planning, involving food retail, waste management, urban agriculture, community health, for economic development. Although the findings of the study are wide-ranging, the author highlighted the determining role of local government in addressing food security. Therefore, it was found important to provide a toolkit that could guide local governments in that activity, and in developing the council, or in conducting local food and environmental research. Hence, with the collaboration of the local government and the community, moving toward food security could be possible (Stevenson, 2013). Similarly, another study pointed out that, food availability is determined by local supply through agricultural and industrial activities. In its measurement, the food security was assessed by GIS multi-criteria analysis through the depiction of a food security map. In that map, 905 villages (57 percent of rural area) were found to be in the insecure zones and 544 villages (22.15 percent of rural area) were found to be located in the secure ones. The results of that research were particularly important for authorities in East Azerbaijan and Iran (e.g. Ministry of Water Resource Management, Ministry of Agriculture, Ministry of Natural Resources) (Feizizadeh *et al*., 2015). According to Farmar-Bowers (2015), Austria exported more than the half of its agricultural production. According to the study, Austria failed to control its food security problems, to provide a healthy diet for its people, and to expand the natural resources. In the next decades, a lower yield production is expected due to the changing climate conditions and the higher prices, which together will challenge the food supply systems. Austria people had many interests in the food security-related issues. That is also because food security forms a necessary part of a healthy food plan. This research suggested that a new policy could not be acceptable for problems in food security and agriculture. It used a seven-method structure for the classified goals of economic

growth and other techniques for the improvement of food security. The study explained these basic goals and ideas for the improvement of food security and agriculture system and suggested further techniques for the resolution of food supply system in Austria. In the beginning of the 20th century, the level of expenditure on food was much lower than in recent decades, when food production significantly increased. Moreover, a significant relationship was found between the quality of food and the income level, since healthier food was more expensive than simple cereal and fat. Consumer attitude toward food could change due to a change in the level of income. Hence, consumer preference toward choosing food was different at people with lower income. The personal income per capita was (and is) higher in the developed regions and lower in the less develop regions, therefore, developed regions spent more money on better food in terms of quality healthier functional foods. In the consumer basket, foodstuff accounted for approximately one-third of the overall expenditure. The major finding of the research was that the annual food expenditure and the annually consumed quantity of food per capita between 2010 and 2013 (Godor, 2016).

Another paper explained that the problem of climate change was a major issue in economic growth and identified its effects on the quality of life and standard of living. It had often been assumed that food security and agricultural food production would be affected by climate change. The paper, upon identifying the effects of climate change on food security, gave some recommendations on how to overcome that situation. Its paper provided many information on the relationship between food security and climate change by critically examining both of them (Islam and Wrong, 2017). Furrther, Tortajada and Zhang, (2017) proposed some important policies for Singaporean economy, to extend on the agricultural trade and investment. The authors found that the proposed export-led policies would increase the research and development, the overall national welfare and the control over food insecurity. They explained how the climate condition and some other major problems were related to irrigated agricultural lands, hydrography, vegetation, soil erosion and salinity there. Another research defined the agriculture-related problems in Azerbaijan and the role of the country in economic development. The findings determined the current situation of agriculture and its possible development strategy and priorities (Oglu, 2018). Another study was carried out to investigate the role of price volatility among the import-dependent countries in Central Asia, particularly among wheat exporters

in order to check the efficiency of wheat market the study relates to the availability of wheat on the market so that food insecurity could be reduced. It applied OLS model and concluded that the major threat to food security in Central Asia was the low production of wheat and the high transporting costs. However, the volatility of prices was also a major issue in the examined countries which also reduced the efficiency of wheat market. And finally, the food insecurity was just created. According to the study, in order to secure ghee food and to meet the needs of people in these countries, the market infrastructure should be developed, the unofficial payments should be eliminated, and the geopolitical conflicts should be resolved. Thus, the trade-enhancing policies should be linked to wheat sufficiency policies so that food security may improve (Svanidze *et al*., 2019). Another research examined those four major pillars that might affect food security and the availability of food, the access to it, its utilisation and the stability of food. The issues created around these pillars meant a great challenge that should be resolved. Herein, a systematic study was conducted to analyse the future problems of agriculture and food. According to the findings, both were affected by climate change as well as by many other socioeconomic factors. They also highlighted that political interference was major issue in some countries where the food departments were not properly established and showed no improvement in self-sufficiency of wheat and other staple foods. The authors suggested that to maximise the possible policy actions should be taken by the countries' governments (Calicioglu *et al*., 2019).

3.1.7. Econometric Modelling Framework

This study assessed the dynamics of food security of five selected regional economies by employing the Panel GMM estimation approach as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). In order to study the empirical dynamics, we will estimate the moment conditions for $f(FPI, \lambda)$ that is used as proxy of the food security (Eq.1):

$$m(\lambda_0) \cong E[f(FPI, \lambda_0)] = 0, \quad (1)$$

where FPI is the proxy of food security dynamics in each moment condition $\lambda \neq \lambda_0$.

The estimation of moment condition represents the simple average function (Eq.2):

$$\hat{m}(\lambda) \cong \frac{1}{n}\sum_{n=1}^{n} f(FPI, \lambda) \quad (2)$$

.

Let us minimise the $f(FPI, \lambda)$ with respect to the λ, using the Eq.2. The estimator results will depend on the choice of the norm function as given (Eq.3):

$$\left\|\hat{m}(\lambda)\right\|_W^2 = \hat{m}(\lambda)^n W \hat{m}(\lambda), \quad (3)$$

Here W represents the weight norm function bases of the given data set.

The Eq.4 represents the final equation of the GMM, based on all properties of GMM (consistent, efficient, and asymptotically normal):

$$\hat{\lambda} = \arg\min_{\lambda \varepsilon \Theta} \left(\frac{1}{n}\sum_{n=1}^{n} f(FPI, \lambda)\right)^n \hat{W} \left(\frac{1}{n}\sum_{n=1}^{n} f(FPI, \lambda)\right). \quad (4)$$

$$\ln FPI_{ij} = \beta_{ij,1} FPI_{t-1} + \beta_{ij,2} CPI + \beta_{ij,3} FII + \beta_{ij,4} FEI + \beta_{ij,5} PCGDP + \beta_{ij,6} FDIGDP + \beta_{ij,7} HDI + \varepsilon_{ij} \quad (5)$$

Where "I" represents cross section (number of countries) and j represents data spam (1992-2019).

3.1.8. Data Description

Panel data were used to examine the regional dynamics of food security of selected five economies (Azerbaijan, Singapore, Austria, Georgia, Hungary). The annual data were taken from the World Development Indicators (WDI) published by World Bank for the period 1992 to 2019. Table 1 represents the detailed description and the unit of all variables used to estimate the dynamics of food security of selected countries.

Table 3-1 Variable Description

Sr.	Variables	Unit	Description
1	Food Production Index	Index	FS
2	Per capita GDP	Dollar	PCGDP
3	Consumer Price Index	Index	CPI
4	Food Import Index	Percentage (%)	FII
5	Food Export Index	Percentage (%)	FEI
6	Human Development Index	Index	HDI
7	Foreign Direct Investment to GDP Ratio	Percentage (%)	FDIGDP

Source: Author's own table

Estimation of food and nutritional security in Azerbaijan

Azerbaijan is considered a food secured country due to staple food availability and its import of food produce in order to meet the domestic demand of the country (FAO, 2015; ROA, 2016). In contrast, FAO, (2015b) reported that at the household level, achieving food security is still a major challenge. household food security is a multidimensional phenomenon and may be studied in three broad dimensions such as food availability, food accessibility and food utilization Jafarova, (2016). The issue of food insecurity is not only as a result of food supply shortage, but also due to lack of affordability or accessibility to food at household and individual level (Vasa, 2005). Similarly, growing urbanization coupled with increased incidence of climate change and global warming has expedited the stress on the present food supply system and has loomed national and household food security in most of the less developed countries.

The study of Murgai et al. (2001), showed that in Azerbaijan, factors such as low rural income level relative to increasing cost of living, household dependent ratio, and extensive unemployment contribute to household food insecurity. Therefore, individuals need to a satisfactory level of income or other modes to be able to purchase goods and services. Further low-income earnings in addition to unemployment has been associated to Azerbaijan's rural household's food insecurity status. (FAO, 2003) highlighted that since

independence, achieving food security has been admitted as an imperative priority in Azerbaijan. However, of recent, the agricultural and food sector has been prioritized by the government for targeting economic growth and improvement of living status of rural individuals. For this reason, loans have been made available through easily accessible to the farmers through the National Fund for agricultural venture. Document released by IFAD (2008) revealed that since Agriculture is a major tool for growth, job creation and food security, there is need to launch several programmes targeted at resuscitating the entire agricultural sector which will intensify crop and livestock production and household income in both rural and urban regions. Another study by (Schmitz and Kennedy, 2016) established that food utilization was still a prime issue in the poorest areas of Azerbaijan. Despite efforts made so far, food security among rural households is still a complex issue in some areas of Azerbaijan. While a sustainable food security situation in its totality at the national level remains a great challenge (Barrett, 1996). Although, the Azerbaijan government has introduced many programs and policies on intervention, aimed at attaining food security all these efforts have not produced the required objectives (Chaaban, et al., 2018). The main reasons for this were the element that food availability and accessibility in Azerbaijan has not increased that can meet up the demand for socioeconomic circumstances at household and individual level. The domestic gap between the food supply and demand has led to increased food and livestock product importation, as well as increased inflation and currency deprecation thereby making it thornier for the middle and lower-middle-class people to meet their dietary needs (Chabot and Tondel, 2011). The available information and data on household and national food security situation in Azerbaijan has remained a problem for both the policymakers and government as well. The government program implementers and policymakers are gradually seeking food security measurement tools that are reliable and easy and reliable to use (Clapp, 2017). The analysis of national food security determinants and its status is therefore, useful not only for policymaking but also for better policy implementation (FAO, 2015b). Although, numerous factors are a direct or indirect consequence of food security that had been examined empirically in Azerbaijan at the micro-level or using targeted group approach such as household or farm level (Djuric et al., 2017). To our knowledge, none of the recent studies on food security have seek to estimate household food security situation and factors affecting the food and nutritional security. Therefore, this study aims to examine the food and nutritional security situation at the household level by the primary data.

3.1.9. Materials, methods and experimental design

3.1.9.1. Location of Data collection

The primary data was collected from the Ganja-Gazakh economic region of Azerbaijan that consists of Deshkesen, Goygol, Samukh, Agstafa, Gadabay, Gazakh, Garanboy, Tovuz, Shamkir districts and cities such as Naftalan and Ganja. The most developed city is Ganja city in Ganja-Gazakh economic region. This region represents 14% of the country's total population. In Ganja-Gazakh economic region, 53 percent population lives in rural areas and 47 percent live in urban areas (ROA, 2016).

The main reason for collecting these primary data was to tie the relationship between food intake, food nutrition, and socioeconomic factors. The primary research questions are given below:

- What is the household food security situation in the Ganja-Gazakh region of Azerbaijan?
- What are the main factors affecting household food security and food nutrition in the Ganja-Gazakh region of Azerbaijan?

The core premise behind the development of the questionnaire was dependant on the above-given research questions and our empirical results in the Ganja-Gazakh region of Azerbaijan.

3.1.9.2. Sampling Method

Simple random sampling technique was applied to collect primary dataset in this study. Town council was randomly selected from the Ganja-Gazakh region,hen a record of all villages, communities, and sub-villages was made containing the record of the head of households and their spouses and kids. A total sample of 300 households was randomly collected. However, for the survey activity relevant respondents we wished to interview such as the wife of household or any other housemate who normally cooks food since they were the most relevant person to respond batter about food security questions.

3.1.9.3. Implementation of face to face survey

Primary data was collected with the help of trained enumerators who had contributed in different survey projects conducted by governmental and non-governmental organizations. They got a two-day questionnaire filling training and social and professional ethics for gathering socioeconomic primary data. For the training and accuracy purpose, the sample questioner was also interpreted in Azerbaijan's local language that makes it easy for data enumerators while asking questions. A pilot survey was conducted to pre-access to the findings to our research. The date of the primary survey was 1st May to 10th May 2019. The bellow Fig. 1 displays the map of Azerbaijan.

Figure 3-1 Map of Azerbaijan's Region

3.1.9.4. Data coding and management

To increase the reliability and robustness of the results, we have cross-checked the data to remove the inconsistencies, outliers, and patterns in the data. For this purpose, data were imported into SPSS software for cleaning.

3.1.9.5. Household food security (Dietary Intake Approach)

This study applied the dietary intake approach (DIA) as used by Bashir et al., (2013) for estimating the household food security status. Seven (7) days recall approach was used, household and per capita food intake were estimated. Thus, the adult equivalence units

was used concerning gender and age groups. The mathematical expression of the DIA approach is given as:

$$FSi = \sum cal'i - L \geq 0$$

Where FSi represents the status of Azerbaijan's food security at the ith household.$(i = 1,2, \ldots, n)$. The expression of Cal i is exhibited total food intake in the form of calories. The 2450 kcal/per person/ per day criteria is used as a threshold for food security individuals. Azerbaijan household is said to be food secure household if the FSi of a given household is greater than 0.

Dynamics of Multidimensional food security in Azerbaijan

Important policy objectives which will focus on elimination of poverty and hunger which are major and fundamental aspects of cause and consequence of food insecurity are key to solving Azerbaijan's National food security challenge. Several studies have highlighted the status of food security at national, household and individual's food security level. However, a model for estimation of national food security tends to be dissimilar in different countries across the world. This is because every country has a distinctive characteristics and prevailing social and economic situations and many indicators such as availability, access, utilization and stability have been used along with four key dimensions of food security (FAO,2003; Grainger, 2010). These dimensions play a significant role in the food security status of any country. One of the key causes of food insecurity issue is non-availability of food that produce price shocks. A country like Azerbaijan with limited agriculture share to GDP growth has more problems with food security. In Azerbaijan, despite massive investment in macro-economic programs, improvements in gross domestic product growth, and trade between 2010 to 2015, rural households and individual's food insecurity is still a great challenge (FAO,2015). The agricultural sector plays a pivotal role in the economy of Azerbaijan. The major area of the country is used for agricultural activities. About 58% area of Azerbaijan was used for growing the different crops and farming of different animals. The major crops which are grown in 2010 were wheat and tomatoes. These two crops provide the maximum amount of production which was the highest value of the ever production. The peoples of

Azerbaijan also take interest in cattle breeding, fishing, and forestry. They earn a lot of money by adopting such type of profession which directly affects the economy of the country. The country made progress through an investment of money in the field of Agriculture. Poultry farming and buffalo breeding are also done for obtaining the highest monetary return. These two fields play a great role in developing the economy of the country. Meat is used by people and indirectly provides great money to the country and in return boosting the country's economy (GOA,2016). The main causes of rural food insecurity in Azerbaijan are numerous, including environmental, structural, political, social and economic policy failures (Schmitz and Kennedy, 2016). Thus, the food availability dimension involves economic factors on demand and supply side. On the supply side of the economy, food availability and food stability dimension of food security characterize economic factors, relating foreign trade and macroeconomic production levels. On the other side, food access and food utilization dimension denote the demand side of the economy such as income and price level. Therefore, economic factors have a significant role for the national, household and individual level food security status. To understand the deeper the dynamics of national food security, it is important to examine the impact of multidimensional factors. This study aims to explore the size of the dynamics of multidimensional factors on food security status, which gives deeper understandings to decision and policymakers. It will give a rational choice for food security policymaking for any country (Vasa, 2011). The basic and foremost step to address with food insecurity issue is to examine its performance and to appraise the available policy choices (Vasa, 2010). To attain sustainable food security is one of the prime objectives of social and economic policy formulation. A well-targeted policy could overcome the food insecurity gap caused by multidimensional factors. This study seeks to study the factors that influence national food security in Azerbaijan and give multidimensional food security that is useful for a comprehensive policymaking in Azerbaijan.

3.1.10. Historical Background

The agriculture sector in Azerbaijan is facing many challenges. Agriculture is very sensitive to climate because when climate changes there is a great effect on the production of crops because specific crops grow with specific temperature, specific day length, specific photoperiod, and specific water requirements. When any one of these factors

changes then the crops are automatically affected and finally the production of such crops is decreased. If crops are grown under favourable conditions, there tends to be a spontaneous increment in their growth with an increase in the overall production. With the incidence of climate change, the climate in Azerbaijan is also changing and the sector of agriculture is being affected. The agriculture facing drought, water scarcity, salinity and soil degradation in Azerbaijan (Chaaban, et al., 2018). About 47% of the population of Azerbaijan is currently living in rural areas and they depend on agriculture, so their lifestyle is affected due to changes in climate. Around 39% of employers are working in the agriculture sector so their living habits and living styles are also affected. Currently, the peoples of Azerbaijan are working to address climate change. Many other environmental issues in Azerbaijan are pollution if water resources with wastewater including transboundary pollution, insufficient quality of water and the soil of Azerbaijan are degraded due to soil erosion and salinity, etc. It is stated that 39km water is present in Azerbaijan and out of it, 29.3 km is surface water and 8.8 km of water is underground. The agriculture sector in the country is facing the problems of water shortage due to the uneven distribution of water in the country and wastage of water regularly without considering its importance. The main reason for the shortage of water is due to reliance on irrigated lands. Azerbaijan produces a huge amount of waste which is polluting the water and lands are irrigated with this polluted water, so the crops grown are not healthy and beneficial (Clapp, 2017).

The other major problem in Azerbaijan is the problem of soil erosion. Erosion is caused in soil due to poor management, dropped irrigation and drainage infrastructure. The chemicals are applied in the soil to increase productivity in the form of fertilizers and pesticides, this also causes the erosion of soil (FAO, 2015). The pastures are being degraded due to overgrazing and which also leads to soil erosion. 96% of soil erosion is due to agricultural activities in Azerbaijan. About 3.7 million ha of land in Azerbaijan is eroded and 0.7 million ha of that area is intended for agriculture. The soil in Azerbaijan is eroded due to heavy winds, gullies, due to improper land management, water, and irrigation. Some factors which also because soil erosion includes poor cultivation practices, overgrazing, and soil salinization. The reduction of forests grown in Azerbaijan and reduction in vegetation is also caused by soil erosion. Flooding also causes major damage to Azerbaijan. About 1 million ha of soil is damaged due to floods. This was a

huge loss to the economy of the country in the year. Similarly, in different years the loss occurred due to flooding. Due to these challenges, the production of different crops was affected, and the production of cereal was reduced from 3% to 14% in 2005 and 2009, all due to flooding and other environmental issues (Djuric, et al., 2017).

3.1.11. Building and Scope of multidimensional food security definition

The multidimensional food security (MFS) is based on World Food Summit definition: "When all the people, all the time have availability and access (physical, economic, social) of Sufficient, safe and healthy food, to fulfil their food demands for living an active and healthy life". The data for building the index is taken from FAO, WHO and the world data bank. The data of diverse indicators are classified into four dimensions to get food security status ranking at the national level based on FAO definition. Dimension 1, 2 and 3 contain food availability, access and utilization indicators. Dimension 4 provides information about food stability and resilience. The food availability dimension examines each factor that controls the food supply and eases the food availability access within Azerbaijan. It studies how supply-side structural framework determines the ability of a country to supply the food and finds significant factors that might influence the supply chain. The food accessibility and affordability dimension explore the ability of common people within a country to buy food items and the relative cost they may face in the short run and long run. It a crucial dimensional of national food security. The food utilization dimension examines the nutritional value and verity of average food within the country. In this approach, we will use the indicators that explore the quality of aggregate food supplied. The food stability dimension forecasts the future outlook of the first three dimensions at a national level in Azerbaijan. This multidimensional food security index (MFSI) will serve as a warning parameter for examining the food price shocks that may worsen or threaten the national food security status of Azerbaijan.

3.1.12. Selection of Azerbaijan’s national food security indicators

The relevance of selecting the national food security indicators is that policymakers and researchers could easily compare the progress and performance of Azerbaijan’s government programs on national food security over time. This section presents a selection process of macro and micro scale indicators that have been employed to construct a

multidimensional index. The distribution of indicators within food security dimensions are below:

3.1.12.1. National food availability dimension

The four indicators used to estimate the food availability dimension include (1) average food energy supply, data is taken from FAO from the period of 1992 to 2018. It is determined by the ratio of food energy supply in Azerbaijan to the average food requirement of energy. It involves both food waste and food consumed at a national level (2) average value of food production. It is also called an annual value of food production per capita at the national level. Data is also taken from the FAO over the period 1992 to 2018. This indicator explains the significance of the agriculture sector in Azerbaijan and the share of this sector to attain food security (3) average supply of protein. It is expressing the national supply of protein taken from various resources. Data is also taken from the FAO over the period 1992 to 2018, (4) average protein supply from animal origin. It is explained as an average per capita national supply of protein from the animal resources. This indicator reflects the significance of meat products such as animal meat, fats, eggs, milk, seafood, and fish products. Data is also taken from FAO for 1992 to 2018.

3.1.12.2. National food access and affordability dimension

Road density (FAO, 1990–2015: 2013) is expressed as kilometres of road per 100 square km of land area across countries. The road in general, paved or non-paved, is important for trade and makes physical access to food easier. Four indicators were used to estimate the food access and affordability dimension: (1) Density of road. It is expressed in terms of kilometres of each 100 square kilometres of land. The provision and standard of the road are played an important role in physical food access and trade. (2) Consumer price index. It is used for examining the relative price change at the national level. The food price shock during 2007-08 leads to an increase in the food insecurity level by about 11 percent in 70 developing countries. (Shapouri, 2010). (3) GDP per capita. It is used to measure the average purchasing power of common consumers at the national level. (4) POU (prevalence of undernourishment). It is using to reflect the level and sufficiency of caloric intake. POU is a traditional indicator to study the dynamics of food utilization dimensions. The dataset of all four indicators was taken from FAO from the period 1992 to

2018.

3.1.12.3. National food safety and utilization dimension

In this dimension, there are also four indicators used to estimate the food utilization status of Azerbaijan at the national level. (1) Access to clean/improved water sources. It represents the percentage share from the total population drinking clean and improved water. This indicator gives data that is important to examine the food security outcome of utilization dimension. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018. (2) Prevalence of anaemia among pregnant women. It will explain the percentage share of pregnant women who have anaemia at the national level in Azerbaijan. (3) The percentage share of kids under 5 years of age who are underweight. This indicator will give you data about kids 5 years or bellow whose weight for age is less than the standard level. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018. (4) Prevalence of iodine deficiency. This indicator is selected to get the information about parentage share of the population who have iodine levels less than standard. The dataset was taken from World Data Bank (WB) from the period 1993 to 2018.

3.1.12.4. National food stability and resilience dimension

The food stability and resilience dimension explain the outlook of the national food security of Azerbaijan. There were also four indicators used to estimate it. (1) Food import dependency ratio. It examines Azerbaijan's dependence on the import of food items to fill the demand gap of the domestic market. According to Napoli, 2011), any increase in the food dependency ratio is indicating the domestic shortfall of food production. (2) Percentage of food imports over total merchandise exports. It examines the share of food items imports over other products imports over time. Increases in the gap between shows that there is more emphasis on other sectors over the agricultural sector. (3) Variability in CPI (consumer price index). (4) Variability in the exchange rate. Both variables will explain the domestic Vis a Vis international market volatility that could directly influence the national food security of any country. All selected indicators dataset was taken from World Data Bank (WB) from the period 1993 to 2018.

3.1.13. Empirical Model (Principle Component Analysis*)*

The study used secondary data that is taken from the Food and Agricultural Organization (FAO) and the World Bank. In the case of Azerbaijan, data limitation is the major problem that is faced by the researchers. Therefore, this study used only those indicators in which data was available for the period 1992 to 2018. There were still a few food utilization and access indicators that had some years missing data. We imputed the missing data and omitted those variables which have less than 5 percent missing data of total data. This study used the Principle Components Analysis method to construct the multidimensional food security status for Azerbaijan. Before applying the PCA method, the selected data need to be transformed or normalized for creating the index on a standard scale. Several methods are useful for the normalization of variables that are estimated on various scales (Freudenberg, 2003). The Z-Score method was applied for each indicator over the period 1992 to 2018. The PAC analysis was done with the help of STATA software. The PAC analysis gives separate estimation results for each food security dimension.

4. RESULTS

Results of National Food Security in Azerbaijan

The Augmented Dickey-Fuller (ADF) test was applied to examine whether the data used in this paper had a unit root problem or not (Table 4.1).

Table 4-1 Unit Root Results

Endogenous & Exogenous	Log Level Form		Log Level Form		Decision
	Without Trend	Pro	With Trend	Pro	
LnFS	-4.19	0.03	-2.34	0.05	Stationary
LnFIM	-1.20	0.34	-3.01	0.47	I(0) Non-Stationary
LnTGDP	-1.34	0.48	-1.54	0.78	I(0) Non-Stationary
LnER	-1.52	0.49	-1.80	0.64	I(0) Non-Stationary
LnCPI	1.30	1.70	-3.17	0.03	I(0) Non-Stationary
LnCC	-0.87	1.20	-1.41	0.42	I(0) Non-Stationary
LnUPG	-4.65	0.04	-2.80	0.04	Stationary
Log First Difference Form					
LnFIM	-5.69	0.00	-6.76	0.00	Stationary
LnTGDP	-4.40	0.00	-6.15	0.00	Stationary
LnER	-5.70	0.00	-6.03	0.00	Stationary
LnCPI	-3.06	0.04	-4.85	0.00	Stationary
LnCC	-8.10	0.01	-7.10	0.00	Stationary

Source: Author's calculations

First series ADF estimation shows that food security did not have a unit root problem and was stationary at level form. ADF unit root testing of the remaining variables indicates that four of the time series variables which include FIM food imports, TGDP trade to GDP ratio, ER exchange rate and CPI consumer price index attain their stationarity at order one, which means they were all integrated at first difference while UPG urban population growth and FS food security make stationarity at level and integrated at zero. Above

results indicate that all series were not integrated in identical order, thus we employ the ARDL bound testing model (Table 4.2).

Table 4-2 ARDL Bound Test

ARDL Bounds Test		
Null Hypothesis: No long-run relationships exist		
Test Statistic	**Value**	**K**
F-statistic	5.020390	6
Critical Value Bounds		
Significance Level	**Lower Bound**	**Upper Bound**
10%	2.24	3.25
5%	2.76	3.60
2.5%	2.88	4.20
1%	3.35	4.58

Source: Author's calculations

Empirical evidence shows that the value of F-statistics (5.020) drives beyond the upper bound critical values at 5% level of significance, confirming the long term cointegration between multidimensional determinants and food security dynamics, explaining the long-term relationship. The coefficients of long term cointegration estimated following the empirical finding of the ARDL model are given in Table 4.3.

The empirical findings of long-term estimates show that food import has a negative and statistically significant impact on the domestic food supply of Azerbaijan. The coefficient of food imports suggests that a 1% increase in food import will lead to a decrease of 0.38% in the domestic per capita food supply in Azerbaijan. The existing evidence supports this long-term negative relationship (Mary, S. 2019).). Empirical evidence suggests that if Azerbaijan adopts more in-ward looking policies to develop the agriculture sector, it will improve the sustainable food supply and security as well as economic growth and trade terms. However, the long-term estimates show trade to GDP ratio has a positive and significant impact on access to food security. The estimated coefficient of trade to GDP ratio suggests that a 1% increase in trade to GDP ratio leads to an improvement of 0.13% for the access to food security in the long term in Azerbaijan. In Table 3, empirical results

show that depreciation in the exchange rate has a negative and significant impact on the food security situation because Azerbaijan's national food security largely depends on import of food products. Depreciation in domestic currency against the foreign currency leads to an adverse impact on food access and availability in Azerbaijan.

The exchange rate coefficient is interpreted as 1% depreciation in the local currency against the foreign currency which leads to a 0.19% negative impact on the food security situation in the long term for Azerbaijan. There are a number of papers that confirm this adverse dynamic of exchange rate depreciation on food security of developing countries (Ilyasov, J. (2016). Similarly, CPI, a proxy of inflation rate, also has negative costs and significant impact on long term food security dynamics of Azerbaijan. The coefficient of inflation in Azerbaijan interprets as a 1% increase in inflationary phenomena leading to a decrease of 0.41% in national food security in the long term. Inflation is a determinant of food accessibility at the national level; more inflationary pressure in the domestic market leads to more possibility for suppressing the food demand and accessibility in Azerbaijan.

This study employed carbon emission CO2 as a proxy of climate change in Azerbaijan. The increase in carbon emission leads to climate change vulnerabilities, but its impact is ambiguous in Azerbaijan. Climate change creates volatility and insecurity in domestic food supply; thus it slows down the rate of agricultural growth in Azerbaijan. The low agricultural growth rate does create food insecurity and malnutrition, particularly for the poor, and thus adversely impacts sustainable development (see FAO,2010; FAO2013). Our empirical findings confirm those found by Swart, et al, (2003) and Chaaban, et al, (2018). Climate change has an adverse and significant impact on national food security. For Azerbaijan, a 1% change in the current state of climate leads to deterioration of long-term food security dynamics at both a national and household level. Similarly, UPG urban population growth also has a negative and significant impact on national food security dynamics in Azerbaijan.

Table 4-3 Coefficients of Long-term Relationships

Long Run Co-integrating Form				
Dependent Variable: LnFS				
Selected Model: ARDL (6, 6, 6, 5, 6, 6)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LnFIM	-0.380	0.170	-2.234	0.048
LnTGDP	0.134	0.065	2.061	0.034
LnER	-0.196	0.052	-3.769	0.040
LnCPI	-0.415	0.123	-3.373	0.005
LnCC	-0.503	0.114	-4.412	0.008
LnUPG	-0.151	0.053	-2.849	0.019
C	-22.519	7.617	-2.956	0.038

Source: Author's calculations

Table 4 reports and discusses the empirical findings from Error Correction model (ECM) technique and if ECM value falls between 0 to -1 the results will confirm the short-term existence of long term established cointegration. In this study, the value of ECM is -0.44 and significantly indicates that the convergence from the equilibrium level of food security during the present period will be adjusted by 44% in coming years. The empirical finding confirms that in the short term, food security appears to be better with an increase in food imports from foreign countries. The results show that short term coefficient of food imports is significant and positive, which indicates that the Azerbaijan government is successfully filling the local food supply and demand gap. The exchange rate, inflation, and climate change have a negative and significant impact on food security. In Azerbaijan, rural people have limited purchasing power, therefore, they face a lot of problems in food access and affordability due to poverty. Rapid urbanization and urban population growth are inversely correlated with national food security dynamics. Urban food demand also seems to increase food insecurity in Azerbaijan.

Table 4-4 ECM Results

Dependent Variable: LnFS				
Selected Model: ARDL(6, 6, 6, 4, 6, 6)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LnFIM)	0.51	0.22	2.318	0.01
D(LnTGDP)	0.11	0.03	3.667	0.04
D(LnER)	-0.18	0.05	-3.600	0.03
D(LnCPI)	-0.28	0.13	-2.153	0.01
D(LnCC)	-0.05	0.02	-2.501	0.00
D(LnUPG)	-0.14	0.13	-1.07	0.28
ECM (-1)	-0.44	0.15	-2.03	0.05
Cointeq = LnFS - (0.51*LnFI0) M + 0.11*LnTGDP – 0.18 *LnER -0.28*LnCPI -0.05*LnCC -0.14*LnUPG-C				

Source: Author's calculations

Determinants of Food Security in Regional Economies

The results of descriptive statistics explain the dynamics of the food security of the selected economies. The value of average food production value is 70.27, while 339.02 was the maximum and 3.17 was the minimum value, respectively (Table 4.5). The average ratio of foreign direct investment to GDP was 9.62 percent between 1992 and 2019. The maximum and minimum values of foreign direct investment to GDP were 55.08 to -15.98 percent, respectively, where 55.08 was the maximum foreign direct investment to GDP in the selected countries during 2003. The lowest foreign direct investment to GDP ratio was observed during 2010. Similarly, the average human development index value was around 0.79, while 0.94 was the maximum and 0.61 was the minimum value of HDI, respectively. The average value of CPI was 89.63 between 1992 and 2019, the maximum and minimum CPI values were 155.22 and 48.02. The average food import index value was about 9.22, while the average food export index value was 3.60. (see Table 4.5)

Table 4-5 Descriptive Statistics

	FDIGDP	HDI	CPI	FII	FEI	PCGDP	FPI
Mean	9.62	0.79	89.63	9.22	3.60	25556.85	70.27
Median	7.03	0.79	86.05	5.70	3.48	30413.93	89.68
Maximum	55.08	0.94	155.22	39.10	8.34	59754.99	339.02
Minimum	-15.98	0.61	48.02	2.26	1.11	1238.48	3.17
Std. Dev.	13.15	0.09	25.58	7.18	1.59	19524.17	57.46
Skewness	0.50	-0.12	0.43	1.48	0.98	0.06	0.82
Kurtosis	8.21	2.17	3.08	6.11	3.79	1.54	4.87

Source: Authors' own calculations

Table 4.6 presents the results of correlation matrix that explains the dynamics of the food security on the selected regional economies. The main diagonal of the correlation matrix shows the self-association of each variables which was 1 that explains self-association was 100 percent.

Table 4-6 Correlation Matrix

	FPI	FDIGDP	HDI	CPI	FII	FEI	PCGDP
FPI	**1.00**						
FDIGDP	**0.77**	**1.00**					
HDI	**0.29**	**0.64**	**1.00**				
CPI	**0.55**	**-0.70**	**0.54**	**1.00**			
FII	**0.63**	**0.31**	**-0.78**	**-0.16**	**1.00**		
FEI	**0.83**	**0.51**	**-0.57**	**-0.33**	**0.43**	**1.00**	
PCGDP	**0.61**	**-0.45**	**0.93**	**0.26**	**-0.82**	**-0.48**	**1.00**

Source: Author's own calculations

The estimated results show that food production index as proxy of food security situation is strongly and positively correlated to the foreign direct investment inflow (r=0.77). Likewise, there is a 0.29 correlation between the food production index and the human development index. The food production index is moderately and positively

(r=0.55) correlated to the consumer price index. Food security situation was massively dependent (r=0.63) on food import index. Per capita income also played an important role (r=0.61) for attaining the regional food security dynamics in the selected countries.

Table 4.7 reports the estimated results of panel GMM estimation approach for examining the regional food security dynamics. The reliability of model results, the Sargan over identification restriction test was applied as post estimation test (Table 4.8). Table 4.7 reports the elasticities, standard error (SE), probability and t-statistics of all model variables, where food production index was the dependent variable. Food security was found to have a positive and statistically significant relationship with it that was explained by its lag values. The result indicates that one percent change in the lag values leads to 0.60 percent increase in food security of selected countries. Similarly, CPI inflation also had a positive and statistically significant relationship with the food security of selected countries. This type of positive relationship suggests that the price of agricultural output is a key motivation for farmers to grow more and more food. The estimated result shows that one percent change in the inflation lead to 0.40 percent increase in food production in the selected countries. There are a number of papers that confirm these positive dynamics of inflation rate on food supply like (Oglu, A. Z. H. 2018).

The results showed that food import has a positive impact on the food security of Azerbaijan, Singapore, Austria, Georgia and Hungary. The empirical results show that the flow of food import has a positive and significant impact on food security because the national food security of these selected countries largely depends on the import of food products. The coefficient of food import suggests that 1 percent of increase in food import could lead to 0.05 percent increase in national food availability in the selected economics. The evidence exists which supports this long-term positive relationship (Zahrnt, V. (2011).

But long-term estimates show that food export index has a negative and significant impact on the access of food security. The food export leads to an increase in food insecurity in the selected economies. The estimated results also revealed that one percent change in food export leads to a reduction in the domestic food availability by 0.05 percent. The results suggest that the governments of the selected countries and certain developmental organisations take efforts to achieve national food security through indigenous agricultural interventions, which should support domestic growers by investing

in agricultural education and skill development, and infrastructure programs. The ratio of income per capita to and the foreign direct investment to GDP of the selected economies positively affects food security. The estimated coefficient of income per capita and foreign direct investment suggests that one percent increase in the income per capita and FDI inflow leads to an improvement of 0.16% and 0.08% in the access to food security on long-term, respectively. Similarly, HDI as a proxy of human capital and development also has a positive and significant impact on long-term food security dynamics. The coefficient of HDI in the selected economics is interprets as one percent increase in the quality of human capital that leads to an improvement of 0.045 percent in national food utilisation on long-term. HDI actually determines food utilisation at national level. The results suggest that human development played a significant role to achieve the sustainable and long-lasting food security goals.

Table 4-7 Results of Panel GMM estimation approach

System dynamic panel-data estimation				
Dependent Variable: Food Production Index				
	Coef.	**Std. Err.**	**T-Stat**	**Prob.**
$lnFPI_{t-1}$	0.60***	0.08	7.15	0.00
lnCPI	0.40***	0.12	3.41	0.00
lnFII	0.05***	0.02	3.06	0.00
lnFEI	-0.05***	0.01	-3.41	0.00
lnPCGDP	0.16**	0.07	2.15	0.04
lnFDIGDP	0.08**	0.03	2.46	0.02
lnHDI	0.045	0.08	0.55	0.81
Constant	-0.97***	0.18	-5.43	0.00
Wald chi2(8)		285.76	**Prob > chi2**	0.00

Legend: * p<0.10; ** p<0.05; *** p<0.01

Source: Author's own calculations

From results presented on Table 4.7, it was seen that long-term coefficient of food import has a significant and positive effect on food production, it indicates that the selected countries' governments are successfully filling in the local food supply and

demand gap. The GDP per capita, inflation, FDI and HDI also have a positive and significant impact on food security. In these economics, rural people have limited purchasing power, therefore, they face many problems to access and afford food because of poverty. The rapid urbanisation and urban population growth are inversely correlated to national food security.

Table 4-8 Sargan Post-estimation Test

Sargan Identification Restrictions test	
H_0: Over Identifying Restrictions are Valid	
Model Post Estimation Results	
chi2(277)	67.31737***
Prob > chi2	0.0002
legend: * p<0.10; ** p<0.05; *** p<0.01	

Source: Author's own calculations

The above Table 4.8 reports the results of Sargan test post-estimation for examining the reliability of the model. The Sargan test examines the over identification restrictions of the model. The results show that there was no problem of over identification restrictions in the model and that instrumental variables were uncorrelated with the error term and were correctly specified. The estimated value of the chi square was greater than the critical value of 1,5, while the level of significance was 10 percent.

Results of Household Food and Nutritional Security in Azerbaijan

Table 4.9 indicates that the average age of the sampled respondent was about 51.7467 with a standard deviation of 12.76397 and minimum to a maximum range of 23-92. While the average height was 169.6600 with a standard deviation of 7.63492 and minimum to a maximum range of 150 to 190. 74.8233. Weight was observed with a standard deviation of 11.57694 within the range of 48 to 120 years.

Table 4-9 Descriptive statistics of sampled data

Variables	Mean	Std. Deviation	Minimum	Maximum
Age	51.7467	12.76397	23.00	92.00
Height	169.6600	7.63492	150.00	190.00
Weight	74.8233	11.57694	48.00	120.00
How many Children	2.6875	1.10096	1.00	8.00
Income other than agriculture	320.4122	176.75482	60.00	1200.00
Number of people live together	4.3867	1.43201	1.00	11.00
Number of household's person dependent on income	4.3867	1.43201	1.00	11.00
Number of persons employed in the household	1.3200	.61552	.00	4.00
Number of people who shared the food	10.0233	70.02639	1.00	1000.00
Minimum monthly household income.	874.5000	457.18868	300.00	5000.00
Current (take home) monthly household income.	449.6600	233.57938	2.00	2000.00
Satisfied with the current financial situation.	2.5633	.70307	1.00	4.00
The financial situation in the past 12 months has	3.0500	.92936	1.00	7.00
In the next 12 months, financial situation will be	5.0833	1.49348	1.00	7.00
Current level of food consumption of family.	2.6067	.61635	1.00	5.00
Level of expenditures of family for food	2.9467	.42160	1.00	5.00
Necessities in the next 12 months?	1.6900	.83038	1.00	6.00
Life in general in the past 3 years has	3.0667	1.00611	1.00	7.00
The aspect of life that concerns the most	1.7333	1.00278	1.00	6.00
Food availability in a household in the last 12 months	2.5400	.68064	1.00	5.00
Worried whether food would run out in the last 12 months	2.0368	.87200	1.00	6.00
How often couldn't afford to eat balanced meals	2.6500	1.05096	1.00	6.00
Source of the food item	1.0133	.18239	1.00	4.00
Easy access to variability	1.6267	.51786	1.00	3.00
Price fluctuations of food affect household consumption	2.1233	.63991	1.00	5.00
Frequently buy the food commodity	2.3067	.77973	1.00	3.00
Preferred method to buy food	2.0000	1.64184	1.00	5.00

Source: Author's own calculations

Average number of children of the sampled respondent was about 2.6875 with a standard deviation of 1.10096 and minimum to a maximum range of 1 to 8. While the average income from other resources other than agriculture was 320.4122 with a standard deviation of 176.75482 and a minimum to a maximum range of 60 to 1200. 4.3867 Number of people live together was observed with a standard deviation of 1.43201 within the range of 1 to 11.

The average number of households' person's dependent on the income of sampled respondents was about 4.3867 with a standard deviation of 1.43201 and minimum to a maximum range of 1 to 11. While the average number of persons employed in the household was 1.3200 with a standard deviation of .61552 and minimum to a maximum range of 0 to 4. 10.0233 Number of people who shared the food was observed with a standard deviation of 70.02639 within the range of 1 to 1000. The average minimum monthly household income of sampled respondents was about 874.5000 with a standard deviation of 457.18868 and minimum to a maximum range of 300 to 5000. While the average Current (take home) monthly household income was 449.6600 with a standard deviation of 233.57938 and minimum to a maximum range of 2 to 2000. 2.5633 Satisfied with the current financial situation was observed with a standard deviation of .70307 within the range of 1 to 4. The average of the financial situation in the past 12 months of the sampled respondent was about 3.0500 with a standard deviation of .92936 and minimum to a maximum range of 1 to 7. While the average of next 12 months' financial situation was 5.0833 with standard deviation of 1.49348 and minimum to maximum range of 1 to 7. 2.6067 current level of food consumption of family was observed with a standard deviation of .61635 within the range of 1 to 5. Average Current level of expenditures of family for food and other necessities like clothing and housing of sampled respondent was about 2.9467 with standard deviation of .42160 and minimum to maximum range of 1 to 5.

While the average necessities in the next 12 months was 1.6900 with standard deviation of .83038 and minimum to maximum range of 1 to 6. 3.0667 Life in general in the past 3 years was observed with a standard deviation of 1.00611 within the range of 1 to 7. Average the aspect of life that concerns the most of sampled respondent was about 1.7333 with standard deviation of 1.00278 and minimum to maximum range of 1 to 6. While the average number of respondents satisfied with current food availability in household in the

last 12 months was 2.5400 with standard deviation of .68064 and minimum to maximum range of 1 to 5. 2.0368 respondents were concerned about whether food would run out before getting money to buy in the last 12 months was observed with a standard deviation of .87200 within the range of 1 to 6. Average how often could not afford to eat balanced meals in household of sampled respondents was about 2.6500 with standard deviation of 1.05096 and minimum to maximum range of 1 to 6. While the average of a household member not able to eat the kind of food preferred to eat because of lack of resources was 2.6633 with standard deviation of .79083 and minimum to maximum range of 1 to 6. 3.4267 one month was any household member go a whole day and night without eating anything at because there was not enough food was observed with a standard deviation of 1.15863 within the range of 1 to 6.

The average Source of the food item of the sampled respondent was about 1.0133 with a standard deviation of .18239 and minimum to a maximum range of 1 to 4. While the average Easy access to variability was 1.6267 with standard deviation of .51786 and minimum to maximum range of 1 to 3. 2.1233 Price fluctuations of food affect household food consumption was observed with a standard deviation of .63991 within the range of 1 to 5. Average frequently you buy the food commodity of sampled respondent was about 2.3067 with standard deviation of .77973 and minimum to maximum range of 1 to 3. While the average preferred method to buy food was 2.0000 with a standard deviation of 1.64184 and minimum to a maximum range of 1 to 5.

Table 4.10 reports the household's food security situation in Ganja-Gazakh region in Azerbaijan. According to threshold level 2350kcal/day/person about 81 percent households were found to be a food secure households and 19 percent households were found as a food insecure household in Ganja-Gazakh region. If we increase the threshold level from 2350 to 2450kcal/day/person then household food insecurity level increased from 19 percent to 23 percent. Likewise, this study also estimated the nutritional security of the same area through estimation of micro and macro nutrients of Ganja-Gazakh region. The nutrition security situation of protein intake at 70gm/adult equivalents/day threshold level, about 55 percent households were found as food secure household while remaining 45 percent were found food insecure household.

Table 4-10 Household food security status in Azerbaijan

Household Food security Status	Frequency @ 2350kcal/day/person	Frequency @ 2450kcal/day/person
HH food secure	243 (81%)	231 (77%)
HH food insecure	57 (19%)	69 (23%)
Nutritional Security of Household (Proteins Intake Level)		
	FS Status 70Gm in Proteins	Percentage %
HH food secure	165 (300)	55%
HH food insecure	135(300)	45%
Nutritional Security of Household (Fats Intake Level)		
	FS 80Gm FATS	Percentage %
HH food secure	153(300)	51%
HH food insecure	147(300)	49%
Nutritional Security of Household (Carbohydrates (CH) Intake Level)		
	FS 180Gm CH	Percentage %
HH food secure	180(300)	60%
HH food insecure	120(300)	40%
Nutritional Security of Household (Iron Intake Level)		
	FS 180Gm Iron	Percentage %
HH food secure	138(300)	46%
HH food insecure	162(300)	54%
Nutritional Security of Household (Zinc Intake Level)		
	FS 15mg in Zinc	Percentage %
HH food secure	159(300)	53%
HH food insecure	141(300)	47%
Nutritional Security of Household (Calcium Intake Level)		
	FS 1000mg in Calcium	Percentage %
HH food secure	204(300)	68%
HH food insecure	96(300)	32%
Nutritional Security of Household (Phosphorus Intake Level)		
	FS 1000mg in PHP	Percentage %
HH food secure	216(300)	72%
HH food insecure	84(300)	28%

Source: Author's calculations

Similarly, this study also examined nutritional food security in terms of fat intakes. At the 80gm/adult equivalents/day threshold level, in terms of fat intakes nutritional security about 51 percent Ganja-Gazakh region households were food secure while the remaining

49 percent of households were found intakes of fats insecure. On the other hand, we have also studied the intakes of carbohydrates' nutritional security. According to 180gm/adult equivalents/day threshold level, about 60 percent of households were found 60 percent while reaming 40 percent were found to be carbohydrates insecure. In terms of iron security, 56 percent of households were found iron deficient. The iron deficiencies were the main cause of anaemia among women and kids under 5 years. Same in the case of zinc security level, almost all the population were suffering from zinc deficiency. Therefore, it is essential to ensure the micronutrient balance among the households to attain sustainable food and nutritional security in Azerbaijan. According to the nutritional security of calcium by using the 1000mg/adult equivalents/day threshold level, about 32 percent of households were found insecure in calcium intake. Same in the case of phosphorus security by using 1000mg/adult equivalents/day threshold level, about 28% of households were found insecure in a selected region of Azerbaijan.

Dynamics of Multidimensional food security in Azerbaijan

The multidimensional food security index was constructed on diverse indicators based on food security pillars (availability, access, utilization, stability). The PCA analysis suggests that 4 indicators characterize food availability dimensions, 4 indicators embody food accessibility dimension, 4 indicators represent food utilization and safety dimension and also 4 indicators choose for food stability and resilience dimension.

Generally, the multidimensional food security index is comprised of 16 indicators represents the national food security of Azerbaijan. Overall weights are got with the help of multiplying PCA loading indices with component assigned weights and each food security dimension with equal weights specifies the uniform importance of each food security dimension for multidimensional index and these established the robustness of index results. Each indicator indices from the estimation have the expected sign of weighting relative to their impact on national food security. According to Harman, (1976), the sign of loading PAC factor is arbitrary whereas indicator variance will unchanged as signs of selected indicators are reversed. Hence, this criterion is equally applied to all dimensions of food security.

Table 4-11 List of selected food security indicators

S/N	Food security Indicators (Data Sources)	Dimension	Weights	PCA loading
1	Average food energy supply (FAO)	Availability	0.25	.413
2	Average value of food production (FAO)			.342
3	Average supply of protein (FAO)			.457
4	Average protein supply from animal origin			.830
5	Density of road (WB)	Access	0.25	.40
6	Consumer Price Index (WB)			-.53
7	GDP per capita (WB)			.33
8	Prevalence of undernourishment (FAO)			.74
9	Access to clean/improved water sources	Utilization	0.25	.39
10	Prevalence of anemia among pregnant women			-.45
11	Percentage share of kids under 5 years of age who are underweight			-.23
12	Prevalence of iodine deficiency			-.13
13	Food import dependency ratio	Stability	0.25	-.67
14	Percentage of food imports over total merchandise exports			-.42
15	Variability in CPI			-.34
16	Variability in Exchange rate			-.64

Source: Author's Calculations

The signs of for selected indicators of PCA loading are negative in food utilization and food stability dimensions because any variation in these indicators leads to changes in national food security status in the opposite way. In the next step, we will estimate the score of multidimensional food security for Azerbaijan for the period 1993 to 2018. Table 4.12 represents the multidimensional food security index score for Azerbaijan. The negative values of the index in the results Table 4.12, because PCA analysis uses a normalization process for all the indicators.

Data from the Global Food Security Index (GFSI) indicated that Azerbaijan food security has received significant improvement over time as shown in 2017-18. But the ranking of Azerbaijan as per multidimensional food security in 2017-18 obtained in present study does not correspond with ranking given by Global Food Security Index (GFSI).

Table 4-12 Results of Multidimensional Food Security in Azerbaijan

AZERBAIJAN	Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	MFSI Ranking 2018	GFSI Ranking 2018
	MFSI Ranking	-0.74	-0.73	-0.77	-0.77	-0.81	-0.85	-0.91	-0.9	-0.92	59th	54th
	Year	2002	2003	2004	2005	2006	2007	2008	2009	2010		
	MFSI Ranking	-0.94	-0.96	-0.95	-0.94	-0.96	-0.96	-0.93	-0.96	-0.99		
	Year		2011	2012	2013	2014	2015	2016	2017	2018		
	MFSI Ranking		-1.03	-1.02	-1.04	-1.06	-1.06	-1.06	-1.05	-1.07		

The differences in the ranking of Azerbaijan in both indexes was because we used more diverse and broad-spectrum indicators. It gave us deeper insights about food utilization and stability dimensions.

Figure 4-1 Food Insecurity Trend in Azerbaijan (1993-2001)

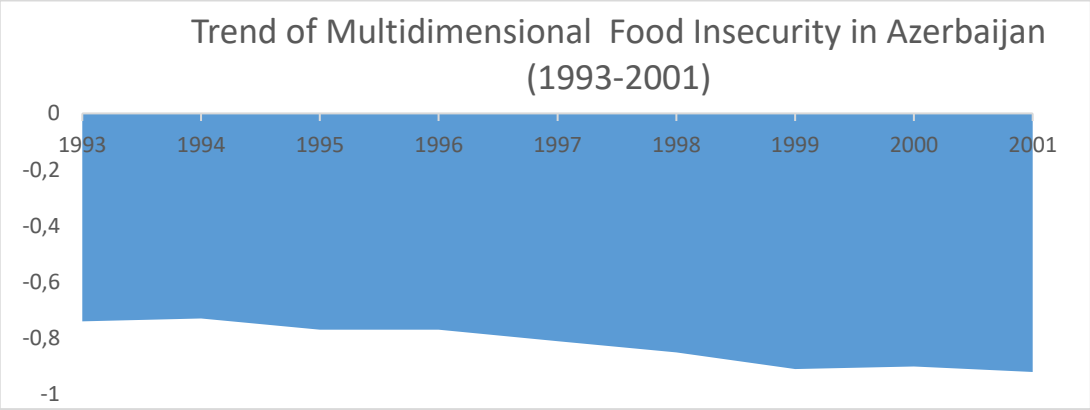


Figure 4.1 reports the trend of multidimensional food insecurity in Azerbaijan from 1993 to 2001. The graph is showing a downward trend. However, Figure 4.2 is portraying a reverse situation. It shows high volatility in national food security dynamics in Azerbaijan. It might be due to the economic crisis and food price shocks in the global market which happened in 2007-08. In Azerbaijan, such up and down movement of food insecurity situation is the outcome of various factors, such as food price shocks, low agricultural production, deprecation of domestic currency, climate change and rising in oil prices (FAO, 2014).

Figure 4-2 Food Insecurity Trend in Azerbaijan (2002-2010)

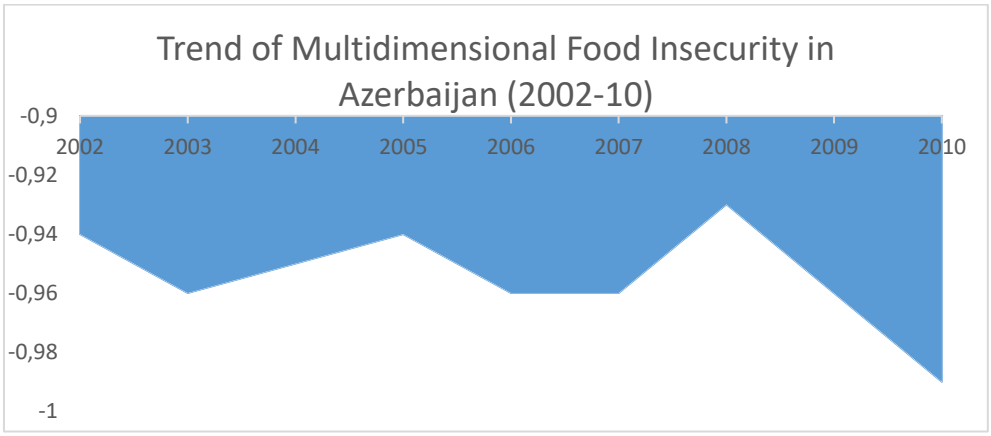
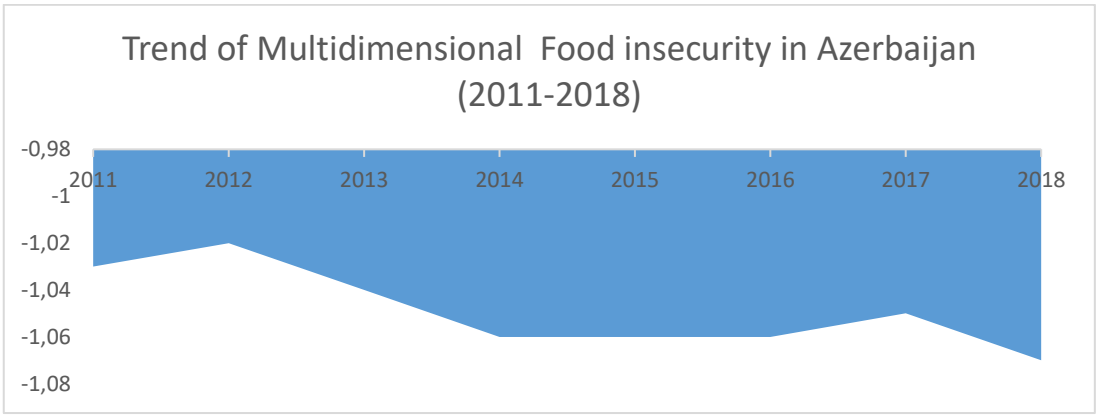


Figure 4-3 Food Insecurity Trend in Azerbaijan (2011-2018)



On the other hand, from 2013 to 2018 again food insecurity levels decreased in Azerbaijan (see Figure 4.3). Our results conclude the 16 indicators share the dynamics of diverse food security dimensions. They come up with results that a simple food security index shows improvement over time as shown Global Food Security Index (GFSI) in 2017-18. But the ranking of Azerbaijan as per multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI). The difference in the ranking of Azerbaijan in both indexes was because we used more diverse and broad-spectrum indicators. It offered us deeper insights into food utilization and stability dimensions. In Azerbaijan, such up and down in the food insecurity situation was the outcome of various factors, such as food price shocks, low agricultural production, and deprecation of domestic currency, climate change and rise in oil prices.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The first objective was motivated to empirically analyze the dynamic relationship between food security and selected multidimensional determinants (food import, trade to GDP ratio, exchange rate, inflation rate, climate change, urban population growth) in Azerbaijan by employing ARDL approach. The ARDL model suggested that food import, exchange rate, inflation, climate change, and urban population growth have a negative impact on national food security dynamics of Azerbaijan. On the other hand, trade to GDP ratio has a positive impact on food security. This study finding is quite comparable to (Sutton, et al, 2013) because his paper also focused on food security dynamics and examined its linkages with socioeconomic determinants and climate change. The approach to food security and food insecurity issues applied in the second objective revealed that food import, FDI, income per capita, inflation and HDI have a positive impact on the dynamics of the national food security in the selected economics. Thus, associating food security to caloric availability and food consumption in some dimensions but not completely. A study by Warrant *et al*. (2015) similarly found a positive relationship between food availability and food intake and consumption level. It is also essential to identify that food availability does not necessarily attain and improve health and nutritional outcomes (Berti et al., 2004). Our findings suggest studies should be conducted in order to investigate the health and nutritional characteristics of individual countries looking at food security at regional, national and household levels. Also, food export was found to have had a negative impact on food availability and access.

A country can achieve sustainable development in many ways. Household food security is a multidimensional and complex issue. At present times, when household and individual food security is vulnerable due to climate change and exchange rates for currencies and international price volatility. There is a need for both domestic as well as global responses. Based on the findings of this study, there is a need for inclusive household food security policy for sustainable development plans that consider Azerbaijan's household characteristics and specificities and address both food accessibility and utilization dimensions of food security. Household food security strategies which should include short- and long-term policies. Research and development are critical for social and

economic development of a country. Nations that are doing better in terms of household food security are those with high budget for intensive and continuous research and development that is economy driven in terms of implementation and sustainability. This forth objective explores the size of the dynamics of multidimensional factors on food security status, which gives deep understandings to decision and policymakers. This study provides a rational choice for food security policymaking for any country. The basic and foremost step to address with food insecurity issue is to examine its performance and to appraise the available policy choices. The multidimensional food security index was constructed by using diverse indicators based on food security pillars (availability, access, utilization, stability). The PCA analysis was used to construct multi-dimensional food security by using the 16 diverse indicators. They come up with results that a simple food security index shows improvement over time as shown Global Food Security Index (GFSI) in 2017-18. But the ranking of Azerbaijan based on multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI). The difference in the ranking of Azerbaijan in both indexes was because we used more diverse and broad-spectrum indicators. It offered us deeper insights into food utilization and stability dimensions.

The demonstrated hypothesises in the thesis.

H1: confirmed that food security determinant has a significant influence on the Ganja-Gazakh region. The following hypothesis come up with the conclusion that food insecurity situation was the outcome of various factors, such as food price shocks, low agricultural production, and deprecation of domestic currency, climate change and rise in oil prices.
H2: confirmed that Azerbaijan's food security program has a significant impact on the participant. At present times, when household and individual food security is vulnerable due to climate change and exchange rates for currencies and international price volatility. There is a need for both domestic as well as global responses. Based on the findings of this study, there is a need for inclusive household food security policy for sustainable development plans and address both food accessibility and utilization dimensions of food security.
H3: confirmed that regional food supplies have significance impact on regional economics and their food security. The analysis of regional and national food security determinants

and their status is, therefore, useful for not only policymaking but implementation as well. Hence, its suggested that there is need to look at some key areas and several factors to be examined empirically that directly or indirectly impacted food security in some regions.
H4: confirmed that multi-dimensional determinants have a significant impact on the dynamics of national food security in Azerbaijan. The empirical findings of long-term estimates show that food import has a negative and statistically significant impact on the domestic food supply of Azerbaijan. The coefficient of food imports suggests that a 1% increase in food import will lead to a decrease of 0.38% in the domestic per capita food supply in Azerbaijan. Empirical evidence suggests that if Azerbaijan adopts more in-ward looking policies to develop the agriculture sector, it will improve the sustainable food supply and security as well as economic growth and trade terms. However, the long-term estimates show trade to GDP ratio has a positive and significant impact on access to food security. The estimated coefficient of trade to GDP ratio suggests that a 1% increase in trade to GDP ratio leads to an improvement of 0.13% for the access to food security in the long term in Azerbaijan. The depreciation in the exchange rate has a negative and significant impact on the food security situation because Azerbaijan's national food security largely depends on import of food products. Depreciation in domestic currency against the foreign currency leads to an adverse impact on food access and availability in Azerbaijan.

Recommendations

Normally, in less developed countries like Azerbaijan, the limited adaptive and innovation capacity to develop agriculture poses a limitation on small farmers' agricultural production, creation of income and investment. Food import in Azerbaijan is seen as an effective short-term policy for improving food insecurity at the national level. To attain the sustainable food security objectives in Azerbaijan, in-ward looking policies need to be developed and agricultural research and development should be expanded in order to raise agricultural growth and the livelihood of rural farmers. There is no doubt that these types of policies will contribute immensely to improving the national and household food security levels. As would achieving the GDG 2 sustainable development goals, which are targeted at eradicating hunger and malnourishment and attaining sustainable food security in developing countries like Azerbaijan by the end of 2030. In light of this, the present

paper also advocates broadening the frontiers of knowledge for policymakers in order to help overcome the problem of food insecurity, including the potential impact of climate change phenomena on national food security in Azerbaijan. Policymakers should develop a set of policies to mitigate climate change and food insecurity concurrently. This study suggests that there is a very strong requirement to develop effective institutional structures if the Azerbaijan government genuinely hopes to attain sustainable food security.

This finding is quite comparable to existing studies because they also examined food security dynamics and its linages with socio-economic determinants and human development. Evidence reveals that food import provides a greater access to exclusive food baskets, such as fruits and vegetables, which might increase national food security, and the food accessibility and utilisation of adequate healthy food. Future food security research should also focus on food availability, diversity and quality, more specifically, on vegetable and fruit consumption. Normally, in the less developed countries, there is a limited adaptive and innovation capacity to develop agriculture, besides there is a limitation on small farmer's agricultural production, and on the creation of income and investment. Our findings show that agriculture may be the only source of rural household income in these countries. Agriculture sector promotes food security by providing income for rural households, to meet their daily needs including the purchase of food. Therefore, in this regard, future food security studies should assess the role of agriculture on intra-household distribution of food (e.g. to vulnerable groups of rural households like children and women).

Finally, governments of the selected countries and developmental organisations, could channel efforts towards achieving national food security through indigenous agricultural inventions and interventions targeted toward a national support for local food producers in order to achieve sustainability and long-term effect to problems associated with food insecurity. This will improve the potential of domestic agriculture food supply for meeting national household and individual's needs. At the household level, every nation, including Azerbaijan, need a database and cross-sectional, time series and penal datasets to examine the food availability, accessibility, affordability, utilization, hunger and malnutrition that will provide early warning assistance effectively. The structure of social safety nets can mitigate the impact of food inflation on most vulnerable populations. Our study findings have important implications for Azerbaijan government and policy makers for achieving

household food security outcome. Food access, utilization and stability should put in place in term of policy and planning that will enhance the long-term development and sustainability of a country like Azerbaijan. This could be attained by investment in infrastructure, education, health, and food safety, giving importance to rural areas socioeconomic development. In Azerbaijan, such up and down in the food insecurity situation was the outcome of various factors, such as food price shocks, low agricultural production, and deprecation of domestic currency, climate change and rise in oil prices. Hence this study suggests that the Azerbaijan government should develop a comprehensive and broad-spectrum food security policy. This study advocates a well-targeted policy could overcome the food insecurity gap caused by multidimensional factors.

New Scientific findings from Thesis

This thesis has made following scientific and academic contributions to Azerbaijan's food security literature.

1	The debate to describe the food insecurity started in 1993 but this issue was assessed on household, national and regional level. In some studies, the causes of food insecurity and hunger are estimated through the food availability dimension. But, to the best of my knowledge, none has measured the partial as well as combined dimensions of food security (availability, access, utilization, stability) of Azerbaijan.
2	This thesis examined the broad concept of food security to review the existing food security studies for mapping the way in which food security is estimated and identified research priorities and gaps. This research also examined the usefulness of various food security dimensions for policy making and suggested possible modifications to food security research priorities related Azerbaijan.
3	This thesis used a cross-disciplinary method to estimate the multidimensional and complex nature of food security. To our best knowledge, this research was the pioneer study to conduct a multi- sectoral intervention together to explore a sustainable approach.
4	Existing studies that is national or regional in scale and estimates the concept food security using multidimensional approach is rare in Azerbaijan. To fill this gap, this research uses a multidimensional approach. In our best knowledge, this research is the pioneering research and ties all dimensions of food security together.

6. SUMMARY

Food intake is a prerequisite for human beings to live a healthy lifestyle. The attainment of food security is crucial and is a prime development priority for all developing countries. The inability to provide reliable evidence of national food security has remained a problem for both policymakers and researchers alike. The present study helps fill this gap by incorporating the multidimensional determinants of food security at the national level in Azerbaijan. The specific objectives of the study were to evaluate the short-term and long-term dynamics of these determinants on food security. The empirical analysis draws from nationally representative time series data over the period 1991 to 2018, taken from FAO and WDI. The ARDL model suggested that food import, exchange rate, inflation, climate change, and urban population growth harm national food security dynamics of Azerbaijan. On the other hand, trade to GDP ratio has a positive impact on food security. Overall results suggest that there is a pressing need to improve its institutional framework if the Azerbaijan government sincerely desires to have sustainable food security, as organizations control all other issues.

Achieving food security is a serious primary global developmental goal faced with several challenges related to problem associated with sustainable policymaking. The second objective of study aims to highlight gaps which are key factors in trying to explore the dynamics of regional food security. We highlighted the determinants of food security in Azerbaijan, Singapore, Austria, Georgia and Hungary while focusing on the short- and long-term impacts of both endogenous and exogenous shocks on the food security of the selected countries. In this study, large dataset between 1992 and 2019. The empirical model suggested that food import, foreign direct investment, inflation, annual per capita income and Human development index had a positive, while the flow of food export had an adverse impact on the food security status of the selected countries. These findings suggest that the governments of the selected countries and to developmental organisations to put in more attention and investments in agricultural inventions and intervention strategies, to support domestic farmers and food producers for sustainable food security strategy policy making and implementation. Based on the findings of our study, a way forward for the frontiers of knowledge and policymakers that could facilitate overcoming the problem of food insecurity has been set.

The third objective of study seeks to estimate household food security situation in the Ganja-Gazakh region of Azerbaijan based on both rural and urban areas of the Ganja-Gazakh region by identifying the food consumption and nutritional security situation of individual households. Primary data was generated from 300 households through simple random sampling. A face to face survey interview was conducted to collect quantitative and qualitative data on food and nutritional security such as availability, access, utilization, and stability. The Dietary intake method (DIA) was applied to estimate the food and nutritional security of households with the help of 7 days' recall method. The empirical results showed that besides the adequate food availability situation, the problem of malnourishment is still existing among both urban and rural households of Ganja-Gazakh region of Azerbaijan. More than 20 percent of households were found food insecure in the selected region. Likewise, the situation of nutritional security was also estimated. It the study revealed that most of the households were undernourished. The present level of protein, zinc, and iron was low among households. The condition of micro and macronutrients was severe. Based on the findings of this study, there is urgent need for the government to launch short- and long-term public and private programs to overcome the issue of food and nutritional insecurity rural and urban areas of Azerbaijan.

The last objective explores the size of the dynamics of multidimensional factors on food security status, which gives deep understanding to decision and policymakers. The multidimensional food security index was constructed by using diverse indicators based on food security pillars (availability, access, utilization, stability). PCA analysis was used to construct multi-dimensional food security approach by using the 16 diverse indicators. Ranking of Azerbaijan's based on multidimensional food security in 2017-18 obtained in the present study does not correspond with ranking given by the Global Food Security Index (GFSI) due to the more diverse and broad-spectrum indicators used in this study. However, it provides deeper insight into food utilization and stability dimensions. The volatile food security situation in Azerbaijan was the outcome of various factors, such as food price shocks, low agricultural production, and deprecation of domestic currency, climate change and rise in oil prices. Overall finding of this research suggests that there is an imperative need to develop a comprehensive multidimensional food security policy. Based on our findings, further studies should be focused on advocating for a well-targeted policy that could overcome the gap in food security caused by multidimensional factors.

7. APPENDICES

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Thesis Questioners

The regional aspects of food security: the case of Ganja-Gazakh region of Azerbaijan

Part 1

Personal Information

1. Age:
   Sex: Male / Female
   Height: Weight:
   Children: Yes / No
   If yes, how many:
2. Children: Male: Female:
3. Age distribution:
   1. Up to 18 2. 18-25 3. 25+

Part 2

Livelihood related information

4. Whether you run the family: Yes/ No

5. If yes, what is your major source of income: Agriculture/wage from selling labour as house worker/social safety net allowance/others?

6. Size of land you/your family owns:

7. Size of land you/your family rents:

8. Income other than agriculture: Yes/No

9. If yes, monthly amount: /month

Household size:		
Number of people live together		
Number of household's person dependent on income		
Number of persons employed in household		
Number of people who shared the food		

FOOD SECURITY AND ITS DETERMINANT FACTORS

Physical and economic condition		
What is the minimum monthly household income that you, in your circumstances, consider to be absolutely minimal?		
What is your current (take home) monthly household income?		
How satisfied are you with your current financial situation?	Fully Satisfied Rather Satisfied Less than Satisfied Not at all Satisfied Don't Know Refuse to Answer	1 2 3 4 5 6
Do you feel that your financial situation in the past 12 months has	Improved a Lot Somewhat Improved Remained the same Somewhat Deteriorated Deteriorated a lot Don't Know Refuse to Answer	1 2 3 4 5 6 7

Do you think that in the next 12 months your financial situation will be	Improved a Lot	1
	Somewhat Improved	2
	Remained the same	3
	Somewhat Deteriorated	4
	Deteriorated a lot	5
	Don't Know	6
	Refuse to Answer	7
Would you consider the current level of food consumption of your family as?	More than Adequate	1
	Just Adequate	2
	Less than Adequate	3
	Don't Know	4
	Refuse to Answer	5
Would you consider the current level of expenditures of your family for food and other basic necessities like clothing and housing as?	More than Adequate	1
	Just Adequate	2
	Less than Adequate	3
	Don't Know	4
	Refuse to Answer	5
How concerned are you about being able to provide yourself and your family with food and basic necessities in the next 12 months?	Very Concerned	1
	A Little Concerned	2
	Not Concerned at all	3
	Not too Concerned	4
	Don't Know	5
	Refuse to Answer	6
Do you feel that your life in general in the past 3 years has	Improved a Lot	1
	Somewhat Improved	2
	Remained the same	3
	Somewhat Deteriorated	4
	Deteriorated a lot	5
	Don't Know	6
	Refuse to Answer	7
What is currently the aspect of your life that concerns you the most?	Money	1
	Job Security	2
	Health	3
	Safety	4
	Food	5
	Don't Know	6

Food safety		
Has your household or any member of your household ever applied to receive benefits from government schemes?		
How many members of the household received benefit from government scheme?		
When did you start receiving this assistance?		
Do you think that government program has a positive impact on your household food security?	Strongly Agree Agree Slightly Agree Slightly Disagree Disagree Strongly Disagree	1 2 3 4 5 6
Do you think that the program is helping reduce the recipients' insecurity of food?	Strongly Agree Agree 179. Slightly Agree Slightly Disagree Disagree Strongly Disagree	1 2 3 4 5 6
Do you think the program alone is adequate to ensure food security of the extremely poor people?	Strongly Agree Agree Slightly Agree Slightly Disagree Disagree Strongly Disagree	1 2 3 4 5 6
Food availability		
How satisfied are you with your current food availability in your household in the last 12 months?	Fully Satisfied Rather Satisfied Less than Satisfied Not at all Satisfied Don't Know Refuse to Answer	1 2 3 4 5 6
How much worried whether your food would run out before getting	Strongly Worried	1

money to buy in the last 12 months?	Worried	2
	Slightly Worried	3
	Not Worried	4
	Don’t Know	5
	Refuse to Answer	6
In 12 mouth how often couldn’t afford to eat balanced meals in your household?	Always	1
	Sometime	2
	Rarely	3
	Never	4
	Don’t Know	5
	Refuse to Answer	6
How much you agree in past one month was any household member not able to eat the kind of food you would have preferred to eat because of lack of resources?	Strongly Agree	1
	Agree	2
	Slightly Agree	3
	Slightly Disagree	4
	Disagree	5
	Strongly Disagree	6
In the past, one month was any household member go a whole day and night without eating anything at because there was not enough food?	Often	1
	Sometime	2
	Rarely	3
	Neve	4
	Don’t Know	5
	Refuse to Answer	6
How much total commodity in total did your household consume in one day?	Cereals	1
	Pulses	2
	Oilseeds	3
	Vegetables and Fruits	4
	Meat	5
	Refuse to Answer	6
Source of the food item		
	Purchase and Consume at Home	1
	Own Production	2
	Received in Kind	3
	Consumed away from Home	4
	Don’t Know	5
	Refuse to Answer	6

Supply and access

How much you agree that you have easy access to variability (availability of different kinds) of food-related commodities?	Strongly Agree Agree Slightly Agree Slightly Disagree Disagree Strongly Disagree	1 2 3 4 5 6
How much you agree the price fluctuations of food affect your food household food consumption?	Strongly Agree Agree Slightly Agree Slightly Disagree Disagree Strongly Disagree	1 2 3 4 5 6
How frequently you buy the food commodity?	Daily Weekly Monthly Refuse to Answer	1 2 3 4
How far you have to travel to buy food items?		
What is your preferred method to buy food?	Local Retail Shop Farmer Market Mobile retail Shop Exchange from Neighbour Central Market	
Are you consuming food produced in your own farm/garden?	Yes No	
If yes, approximately how many % of your consumption is covered by your own production?		

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