Food Security Analysis in Pakistan: A Multi-Indicator Approach[1]

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Abstract

This study attempts to examine the food security situation in Pakistan. It examines the different dimensions of food security in Pakistan by analysing the underlying indicators developed by FAO. The study reveals that although the average food availability in terms of average calorie supply per capita in the country has increased from 1870 to 2450 during 1961-2013 but the average food deficit per person per day is still present in the country. Food security index shows that, despite the overall increase in food production or availability of food, the food security situation is deteriorating over time in Pakistan and it is a serious matter of concern for the policy makers to think about it. Although, agricultural production is increased but speed of this increment is slow as compare to the growth of population. Since, agricultural output is the only source of food supply. Hence, it is necessary to raise agricultural growth to make Pakistan as a food secure country. However, Government is continuously ignoring agricultural sector and resources are shifted to industrial and services sector in order to improve their performance. How the performance of these sectors affects the agricultural growth is an important question to analyse the future of food supply in the country.

JEL Classification: C43, Q18

Key Words: Food Security, Food Security Index in Pakistan, Agriculture Production

1. Introduction

Although the "food production of the world has gone up by two folds during the last three decades but the number of malnourished people has also increased by more than 900 million around the world (FAO, 2009). Malnourishment exists when the household's calorie intake falls below the

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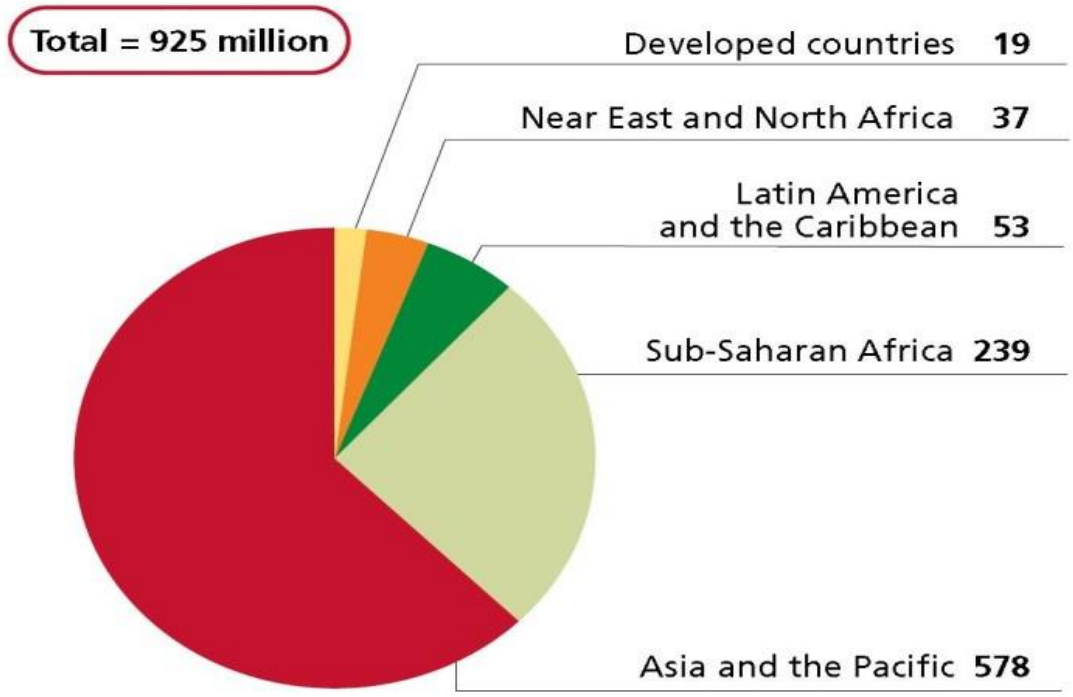
minimum requirements of the dietary energy (FAO, 2010). The individuals whose intake of food is inadequate to meet their daily energy requirements, they are considered as food insecure.

Food insecurity is not a problem of a single country. It is an alarming issue for both the developed as well as developing countries of the world but unfortunately the situation is more terrible in developing countries. Figure 1.1 shows that 906 million undernourished people out of the total 925 million undernourished people are living in developing countries. The situation is getting worse in Asia and Africa where more than 800 million undernourished people lives".

Figure 1.1 Number of Undernourished Across the World (FAO, 2010)



Many factors are responsible for this high level of food insecurity in the world ranging from drought, famines, climate change, and growing population to greater level of urbanization. Besides these, one of the most important factors for food insecurity in the developing world is that growth rate of population is high and these countries are unable to improve food security situation despite of agricultural growth. Another important factor in this high food insecurity is the role of sectoral growth in agricultural production. Because agricultural and rural economy is largely affected by

the policies and outcomes in rest of the economy (Timmer, 2000).

In order to highlight the different causes of this high level of food insecurity, it is important to understand the concept of food security. FAO (2010) contains the latest comprehensive definition of food security as following:

> *"food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".*

Contrarily, "food insecurity is known as the absence of any conditions written in the above definition of food security at any level i.e. household, regional and national level. If individuals continuously take the amounts of food that are insufficient to meet the requirements of their daily dietary energy, it is regarded as severe food insecurity. It may lead to the hunger, which is most severe case of food insecurity (FAO, 2010).

According to the above-mentioned definition of food security, this concept is divided into three components; food availability, accessibility to food and food utilization. Stability of all these three components is considered as the fourth dimension of food security. Research with respect to all four dimensions of food security is being done all over the world. These dimensions are analysed at individual, regional as well as national level. When we consider the above mentioned four dimensions of food security at national level, availability of food is turned out as the most important and basic factor.

Source of food supply is the agricultural output of an economy although it contains a small part of non-food commodities. It implies that agricultural sector plays a key role for food security in any economy and especially in a developing economy like Pakistan. Accessibility is the second important factor in the discussion of food security. Accessibility is further discussed by disintegrating it into two components, i.e. economic access and physical access. Economic access is analysed by income and food prices. As most of agricultural markets are near to perfectly competitive markets; hence, food prices are determined by supply and demand. Because basic source of food supply is agricultural sector; so, agricultural output is of direct importance at least in first two dimensions, and has indirect effects through income on the third dimension. Therefore, agriculture's role to food security of a country can be explained by the following two key criterions:

1. Increasing food availability at the prices that are affordable for the poor.
2. Providing employments and incomes that improve the food access of the poor people.

Agricultural sector plays a crucial role in the socio-economic development of many countries. It is the primary source of employment and food security for most of rural population. Future success of these contributions depends mainly on the impact of agricultural sector on the growth of other sectors of the economy and how other sectors stimulate the growth of agricultural sector. It is because structural changes in the economies have large impact on the composition of sectoral output. Literature shows that the importance of different sectors in the overall output of an economy does not remain same due to structural changes that take place over time in almost every country. Therefore, understanding the role of agriculture sector and its linkages to the rest of the sectors of the economy are important especially for food security of a country like Pakistan that has undergone large structural changes since its independence.

Pakistan is a developing economy and its agricultural sector is considered as backbone of the economy which contributes more than 21% of Gross Domestic Product and generates employment opportunities for the 43.7% of its labour force[5]. It is the primary source of food supply. Besides meeting the food and fibre requirements of the local population, it also supports other sectors of economy such as industrial and services because of having very strong backward and forward linkages with them.

Most of the research related to food security in Pakistan is conducted at micro level while some other studies that are conducted at macro level; are qualitative in nature. Many studies have been conducted analysing the problem of food security using micro data at individual level as well as regional level. These studies have significant contribution in literature and highlight causes and cures for food security. However, scope of these studies is also limited due to the use of limited data analyses and, hence, may not be too much fruitful for devising macroeconomic policies. However, with the best of authors' knowledge these studies contain very limited empirical analysis of the dimensions of food security problem in Pakistan at national level.

The above discussion shows that agriculture, industry and service sectors are highly interlinked to each other. So, it is important to determine the linkages among the growth of different sectors of Pakistan economy and

[5] Pakistan Economic Survey 2013-14

their impact on food supply. Thus, the present study made effort to analyze food security situation in Pakistan at national level with respect to its various dimensions and by developing food security index. The study also made proposals for policy makers to improve food security of Pakistan for long term. Moreover, the study helps the policy makers to derive appropriate policies according to the linkages among different sectors of the economy and their impact on food supply". The very next section of the study emulates the review of literature. Section 3 represents methodology and data sources. Findings are placed in section 4 and conclusion and policies are enlisted in the last section.

2. Review of Literature

This section contains historical background of the concept of food security and its various dimensions, inter-sectoral linkages, and the literature on food security.

History of the concept of food security goes back to the Universal Declaration of Human Rights in 1948 in which the right to food is recognized as an important element of standard of living. But this concept gets attention only in 1970s, at the time of international food crisis. Initial focus was mainly on food supplies to ensure the availability of food along with the stability of prices of basic food items in the national as well as international markets.

A process of global debate results in the World Food Conference of 1974. The initial focus of this conference is on the amount and stability of food supplies. In this conference acknowledgement is made that this issue concerned the whole of mankind:

> *"Every man, woman and child has the inalienable right to be free from hunger and malnutrition in order to develop fully and maintain their physical and mental faculties. Accordingly, the eradication of hunger is a common objective of all the countries of the international community, especially of the developed countries and others in a position to help"* (UN, 1975).
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> World Food Conference (1974) defines food security as:
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> *"Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices"* (UN, 1975).

In 1983, FAO broadens this concept and includes the access of the people to available food supplies to concentrate on the balance between demand and supply side of the food security:

> *"Ensuring that all people at all times have both physical and economic access to the basic food that they need"* (FAO, 1983).

World Bank (1986) introduces the widely accepted difference between chronic food insecurity, which is linked with the issues of low incomes and continuous poverty, and transitory food insecurity, that involves the periods of enhanced pressures caused by conflicts, natural calamities or economic collapse. So, the definition of food security is explained in terms of:

> *"Access of all people at all times to enough food for an active and healthy life"* (World Bank, 1986).

This definition is again refined to include food safety and nutritional requirements that are important for an active and healthy lifestyle. Social and cultural food preferences are also considered. The World Food Summit 1996 takes a more broadened definition:

> *"Food security, at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"* (World Food Summit Plan of Action, 1996).

This definition is again refined by FAO in a report titled "The State of Food Insecurity in the World 2001":

> *"Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"* (FAO, 2002).

Essentially, one can describe the food security as a phenomenon which relates to the individuals. It is the nutritional position of individual family members that is the ultimate focus. Food security at household level is the application of this concept at family level, with the individuals in the households as a focus of concern, and food insecurity exists when people do not have sufficient economic, social or physical access to food as defined earlier.

Food availability indicates a sufficient quantity of appropriate quality or nutritious food which is available to all the individuals within a country or area through household's own food production, domestic output,

and level of food stocks, net food trade or food assistance (WFP, 2009). "Food production can be affected by various factors such as land ownership, soil management, selection of crops, livestock breeding and harvesting (FAO, 1997). Moreover, economic conditions of the farmers also affect the domestic food production. Better access to credit, financial, transportation, infrastructure, and other services may affect food production positively. Industrial sector is also very important contributor to food production through demand and supply linkages. Argo-based industries use agricultural output in their production as input and some other industries provide inputs such as fertilizer, machinery, pesticides and high yielding seeds to the agricultural sector. All these factors affect agricultural production positively. However, even with the sufficient availability of food at national level, food availability is a serious matter of concern in the areas having armed conflicts, non-availability of the arable lands, high rate of inflation and existence of long term droughts and it is true for many areas in Pakistan.

Because consumers of food are large in numbers than the food producers in every country, so the distribution of food must be fair to the different regions and nations (Tweeten, 1999). Whereas the food distribution is linked with the industrial and services sector through storage, processing, packaging, transport and marketing of food (Godfray *et al.*, 2010). On farm storage and infrastructure facilities can also have an effect on the amount of food waste during the distribution process. Poor infrastructural and transportation facilities can raise the price of water supply and fertilizer as well as the cost of moving food to the national and global markets (Godfray *et al.*, 2010). This creates the need for developing an efficient trading system and market institutions, which can have positive impacts on food security (Ecker and Breisinger, 2012).

The food accessibility can be divided into economic and physical access to food. The former indicates the "entitlement" to food and latter denotes the place where the food is available (Sen, 1982). Services sector is involved to ensure physical access as it requires efficient market infrastructure to have food access of the people at low cost. It can also be ensured if sufficient land and other resources are available to grow household's own food (Garrett & Ruel, 1999). On the other side, economic access represents the food buying capacity (income) of the households from the market at the prevailing prices that meet their nutritional requirements and dietary needs or having access to other sources of getting the desired food (Staatz *et al*., 2009). Incomes earned in agriculture, industry and services sector play a vital role in determining the access to food. Moreover, food inflation due to supply-demand gap in competitive markets of food

items may be an important hindrance in economic access in developing countries.

Access to food requires that adequate food is continuously available in the local or country level markets. But this availability does not ensure the food security for all, because low incomes, food inflation, lack of infrastructure could be a problem in the way of access to desired quantities of quality food (Haq, 2002). People may lack enough purchasing power to obtain the necessary amounts of quality food. Hence, both availability and access components of food security are interlinked to each other (Andersen, 2009).

The definition of food security also consists of the term "safe and nutritious food" which is needed for living a healthy and active life. For living an active and healthy life, human body has to make efficient use of the available nutrients in food consumed (Staaz *et al*., 2009). Hence, an effective biological utilization of food in the body is also as essential factor for food security as the food availability and access are. Biological utilization of food is determined by preparation, processing, and cooking of food in the community and household (FAO, 1997) and health conditions of the individuals are affected by access to clean and safe drinking water, sanitation and knowledge of the households about food storage, processing, and basic nutrition. In addition, food preferences also add another dimension to food security which is associated with the social and religious norms. People with equal access to food may have different food preferences based on religious and social norms or taste etc. and can show totally different levels of food security. So, food must be acceptable socially and culturally and consistent with religious and ethical values (Andersen, 2009).

Timmer (2000) analysed the ways in which the threat of hunger and famine can be escaped altogether. South Asian countries should make their strategies that are based on the sectoral composition and stability of food price because agriculture and the rural economy are mostly influenced by policies and outcomes in the rest of the economy. The policy of redistribution of growth along with the large investments in human capital and R & D can lead to the economic growth and employment opportunities, and the hunger and famine can be overcome with increase in per capita average income.

Singh (2002) investigated the sustainable development of agricultural sector to ensure food security needs by incorporating the role played by three essential institutions; state, markets and the civil society. The study also discussed the role of science and technology for enhancing agricultural production, and benefits and failure of the liberalization in the

context of agriculture and poverty alleviation. To achieve food security at national level, many suggestions are given e.g. raising the farmers' income, strengthening the role of science and technology without excluding labour force participation, involvement of women etc.

Iram & Butt (2004) examined the main determinants of food security in Pakistan. Per capita calories consumption is used as the dependent variable whereas household income, mother's age and education, availability of independent house, piped water and toilet facilities in the house are used as explanatory variables. Findings revealed that mother's age has a significant impact on the average calorie intake while the household income has a positive and significant impact in acquiring adequate average calorie intake at household level. Environmental factors such as access to safe drinking water, and improved sanitation facilities enhance the absorption capacity of food intake.

Hussain & Akram (2008) examined the determinants of the three pillars of food security in Pakistan. It has been shown that food insecurity in Pakistan is the outcome of policy failures and it can be removed from the country by enhancing the agricultural production particularly the production of wheat, rice and maize. The research exposed that agricultural productivity in Pakistan is very low as compared to the many other countries. The study suggested the policy recommendations for the growth of agricultural sector and concluded that modern techniques of production along with R & D are important to eliminate food insecurity.

Farkhanda, *et al.* (2009) presented food security situation in slum areas of Faisalabad. The study elucidated the intensity of food insecurity, contribution of women in food security, and present food security strategies of the households. For this purpose, a sample of 100 respondents are randomly taken from the slum areas of the district of Faisalabad. The results shown that majority of respondents can understand a balance diet, but due to limited resources they are unable to provide their families with a balanced diet. Most of the respondents are not happy with the quality of their food. A significant number of respondents suffered from diarrhea that is caused by the drinking water. At the end, the study suggests that government should develop a mechanism to ensure easy access to quality food at the affordable prices to the public.

Shahid & Siddiqui (2010) examined the relationship between food security and its components in Pakistan by applying VECM. The long run results show that the female literacy rate has an insignificant impact on per capita food availability while the impact of total food production is positive but also insignificant. The study concludes that despite of some improvement in most of the food security indicators, food security situation

in Pakistan needs drastic development because Pakistan's performance is quite low as compared to the other regional as well as developed countries.

Mushtaq, *et al.* (2011) attempted to find out the impacts of monetary as well as macroeconomic factors on wheat prices in Pakistan by employing Johansen's co-integration technique. The results show that a long run relationship exists between the variables. Moreover, results reveal that the real money supply, real exchange rate as well as trade openness significantly affect the long run real wheat prices. The findings of this study recommend that the focus of policy makers should be on the improvement of wheat supply through the growth of wheat production or trade liberalization.

Ringler *et al.* (2011) studied the theoretical linkages between the three sectors; food, water and energy which are inter-linked and argues that each of these sectors can either help or harm the other two sectors. Particularly, food security can be threatened by the shortages of water and energy. Higher energy prices have a positive impact on the price of agricultural inputs and it reduces the land and water availability for food production due to the competition that arises from the expanded bio-fuel production. Due to strong linkages between food, water and energy, policymakers should develop such policies in their respective ministries so that food, water and energy security can be maximized.

Bashir, *et al.* (2012) analyzed the determinants of household food security in rural areas of the 3 different regions of Punjab Pakistan by using Binary Logistic modeling. Results show that Central Punjab is the most food insecure region where 31% of the households are food insecure followed by North and South Punjab where 15% and 13.5%, respectively. Education, monthly income and livestock assets have positive while the family size has negative impact on household food security for all regions. In addition, the old age household heads have a negative impact on food security in the Central Punjab. Whereas, the higher number of household earning members in North Punjab helps to improve food security.

Khan, *et al.* (2012) examined the determinants of the three dimensions of food security in the rural areas of Pakistan. OLS method applied to a series of models. Study revealed that 80 districts out of 120 are food insecure in rural areas and more than 21 million urban population in Pakistan is food insecure in calorie consumption. Results indicate that production of rice, wheat, maize, pulses, oilseeds, fish, poultry, and meat positively affects the availability of food. In accessibility to food, adult literacy rate and electrification while in food absorption child immunization, number of hospitals and safe drinking water have positive impact.

According to Arshad & Shafqat (2012), food insecurity is the outcome of many factors such as gender inequality, poverty, health and environmental conditions, availability of water, natural calamities, population growth, and urbanization. Contribution of agriculture sector is most important for food security in a developing country like Pakistan. The objective of the study is to analyse the food security at district level in Pakistan. The study suggests agriculturalists and policy makers to develop low cost input technologies for sustainable production of food to handle current and future problems of food insecurity.

Amir, *et al.* (2013) estimated that the food prices are much higher in Northern areas of Pakistan. Study also depicted that the lack of irrigation water, inadequate access to markets and increasing cost of fertilizer are the production constraints. It is also observed that there had been a shift by the growers from subsistent crops to cash earning crops. That increase in income was observed as a mean to ensure food security of the households. The respondents at household level expressed that they will reduce their expenditures on agricultural inputs in the future. It was concluded that 60% of the respondents were food insecure.

Joiya & Shahzad (2013) empirically investigated the long run and short run determinants of high food prices in Pakistan for the period of 1972-2009 by using ARDL and ECM techniques. The key findings of the study revealed that GDP and food exports cause higher food prices while food imports and credit to agriculture sector contributed negatively to food prices. The evidence from the study strongly recommended to reduce export and import of food items until the country would be fully declared as a self-sufficient.

All the above literature and some others on food security have been conducted qualitatively or analyzed at household or regional level. Some other studies that have been conducted nationally, focuses on some of its dimensions only. However, we could not find any study that contains the analysis of food supply at national level with reference to Pakistan economy especially in the context of structural changes". The changing patterns of sectoral growth affect agricultural output, income distribution and price level of a country and hence it may affect food supply and economic access to food of the people.

3. Data and Methodology

The present study collected the data from Food and Agriculture Organization (FAO) on variables representing the different aspects of food security to analyse the problem of food insecurity in Pakistan for the period of 1990 to 2013. FAO has developed many indicators representing the food security but data on most of these indicators are not available before 1990.

Four indicators have been chosen for which data is available from 1960's by following the study of planning commission of Pakistan, to construct food security index for Pakistan. These four indicators are as follows:

1. Food availability per capita index
2. Food production per capita index
3. Food self-sufficiency index
4. Real food price index

Data on average calorie supply per capita per day which represents the food availability per person in the economy is available from FAO. Index of food availability per capita is constructed by using 2005-06 as base year.

This index covers all food crops that are edible and include nutrients. Tea and coffee are not included in this index, although they are edible, but these do not have nutritive value. World Bank has constructed this food production index for many countries including Pakistan, so the study has taken this index from world development indicators.

In the context of food security, this ratio shows that how much a country depends upon its own food production, i.e. higher the ratio, larger will be the self-sufficiency.

Self-sufficiency ratio is measured as follows:

$$\mathrm{SSR} = \frac{\mathrm{Q}}{\mathrm{Q} - \mathrm{X} + \mathrm{M}}$$

Where $\mathrm{Q} = \text{value of food production}, \mathrm{M} = \text{value of food imports}, \text{and } \mathrm{X} = \text{value of food exports}$

The study has subtracted the forestry's output from total agricultural output and this difference is used as a proxy for the value of domestic food production. The value of cotton and other non-food crops is not deducted from agricultural output due to the unavailability of data. Data on food imports as a percentage of merchandise imports and total value of merchandise imports is obtained from the World Bank indicators for Pakistan and then by using these variables we have derived the value of food imports. Value of food exports is also calculated in the same way. Changes in food stocks are not considered in analysis because of the unavailability of data.

The food price index is obtained by Economic Survey of Pakistan (various issues) and real price of food (RPF) can be measured as following:

$$\mathrm{RPF} = \frac{\mathrm{FPI}}{\mathrm{PI}}$$

Where $\mathrm{FPI} = \text{food price index}$ and $\mathrm{PI} = \text{overall consumer price index}$. Both indices are transformed to a same base. The inverse of this index is used as a measure of food security.

The above mentioned four indicators are transformed into indices by using 2005-06 as a base year. Inclusion of many other indicators may improve this index but time series data is not available on these indicators. As food availability index is an important indicator in determining the food security; so, it is given a weight equal to 1/2. Food production is not a sufficient factor; therefore, given a weight of 1/6. Both relative food price index and the index of self-sufficiency ratio are also assigned a weight of 1/6. We have used same weights in this study as used by the report of Task Force on Food Security in Pakistan (GOP, 2009). Food security index (FSI) for Pakistan is constructed for the period 1962-2012 as follows:

$$FSI = \frac{1}{2}(FAI) + \frac{1}{6}(FPI) + \frac{1}{6}(FSSI) + \frac{1}{6}(RFPI)^{-1}$$

Where

FAI = food availability per capita index

FPI = food production per capita index

$FSSI$ = food self − sufficiency index

$RPFI$ = real food price index

These indicators are greatly influenced by the performance of agricultural sector which is the main source of food supply. The first two indicators are directly linked to the agricultural production while the last two indicators are also affected by agricultural performance through market forces of supply and demand.

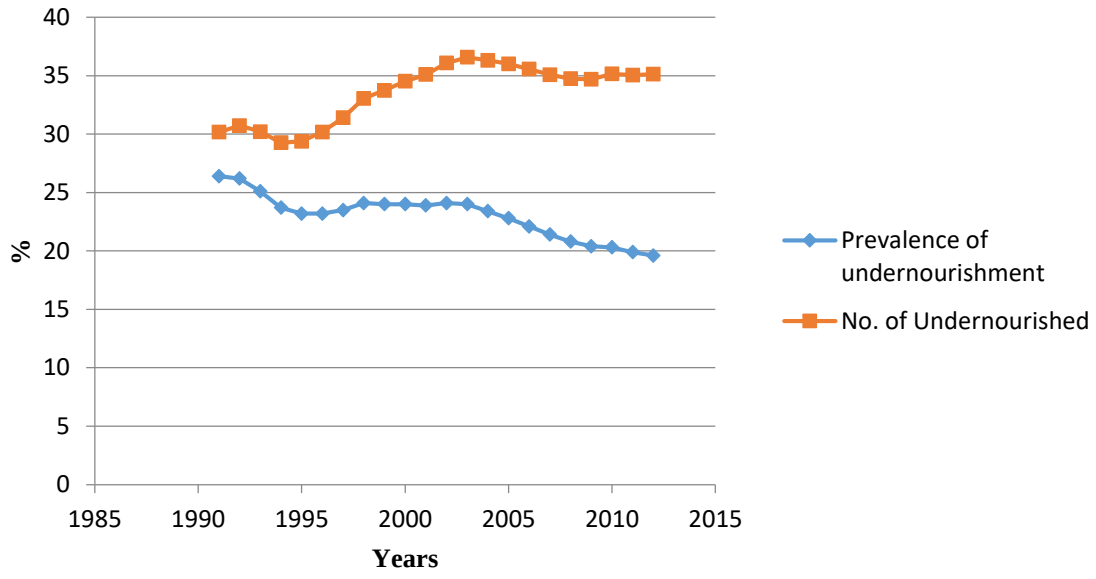
4. Key Findings and Results Discussion

Food insecurity can arise in a country due to various reasons. "It can be the result of inadequate availability or access to food. Food availability depends upon agricultural production while access to food not only varies with the economic conditions, particularly food prices and income levels but it is also affected by the performance of other sectors and particularly services sector of an economy. To analyse this multifaceted character of food insecurity, FAO has composed a set of indicators. Some indicators describe the food insecurity as an outcome "the number of undernourished people and the prevalence of undernourishment in the population". While focus of others is on conditions that can cause food insecurity such as, food availability, access, utilization, and poverty, vulnerability and instability. Following is the descriptive analysis of the main indicators of food security for Pakistan which are computed by FAO, starts from the outcomes of food insecurity and then moves on to consider the conditions that can cause food insecurity.

Undernourished population is that segment of population whose dietary energy consumption is below the minimum level (also referred as

prevalence of undernourishment)". This indicator shows the percentage of the population whose intake of food is insufficient to meet their dietary energy requirements continuously.

Figure 4.1. Prevalence of Undernourishment and No. of Undernourished in Pakistan



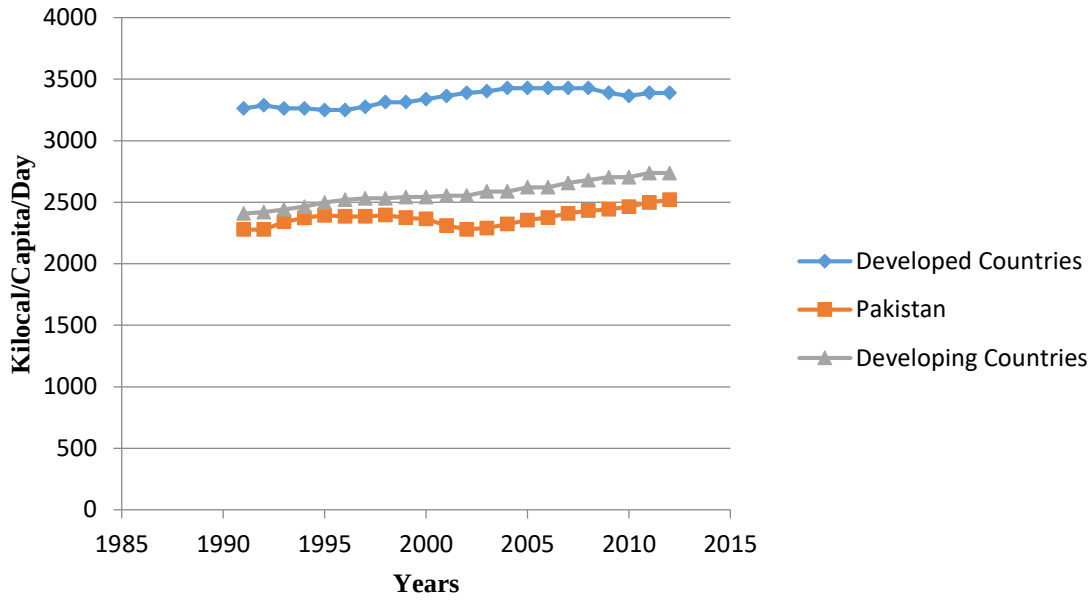
Graph is generated by the authors and data source is WDI (2013)

Figure 4.1 shows that an approximately 26 percent of the population of Pakistan in 1991 was undernourished. Their food consumption was below the threshold level of dietary energy. But in the recent years, the proportion of undernourished population in Pakistan has decreased. Data show that even after this progress, approximately 19 percent of our population is still undernourished.

Even the percentage of undernourished population in Pakistan has decreased but if we look on the number of undernourished people, it is increasing day by day. An estimate of 30 million or 1/4th of the people in Pakistan were undernourished in 1991 which started to decrease for three to four years but after that these numbers again made an increasing trend. Figure 4.1 shows that overall hunger in Pakistan is increasing day by day as the number of undernourished people has increased to 35 million in 2012 from 30 million in 1991. Estimates show that the percentage of population that is undernourished has decreased from 26 percent in 1991 to 19 percent in 2012. But in absolute terms, the undernourishment remains high in Pakistan due to population growth and progress in its reduction is very slow.

These estimates for Pakistan need a considerable concern of the policy makers.

Figure 4.2 Average Calorie Supply Per Capita Per Day



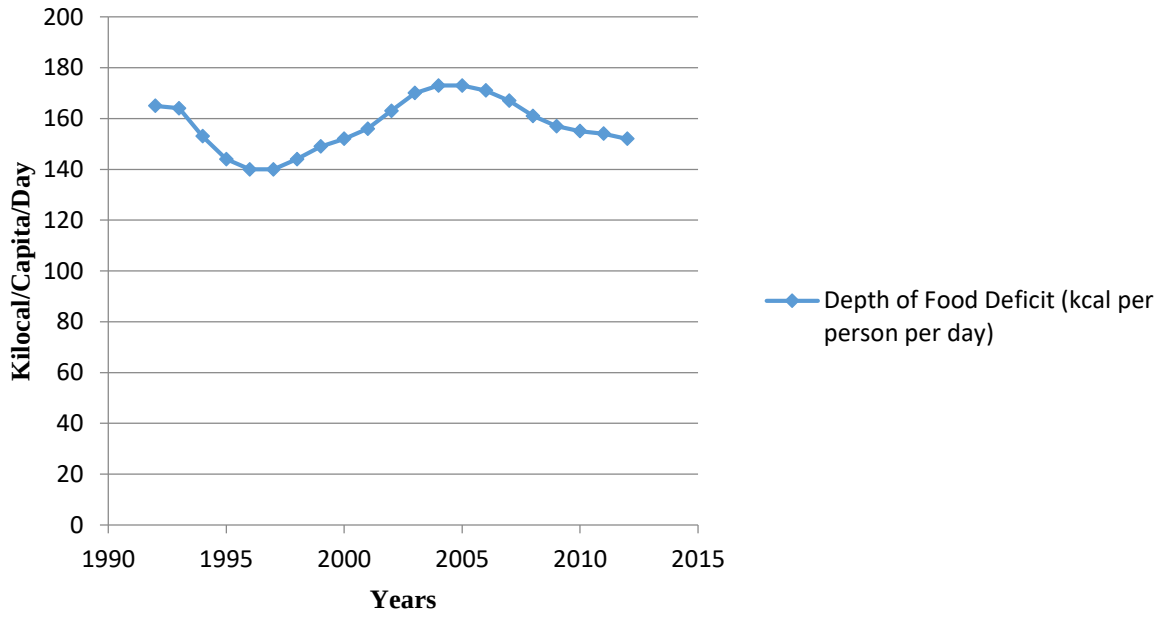
Graph is generated by the authors and data source is FAO (2012)

The aspect of food security can be judged by average calorie supply per capita in the country. This indicator can be considered as the average supply available for human consumption while actual consumption of the individuals can differ greatly. Figure 4.2 represents that the average calorie supply per capita in Pakistan has increased over time but this increment is very slow as compared to the developing and developed countries' average calorie supply per capita. This figure represents the comparative analysis of the performance of calorie supply per capita per day of Pakistan with the developing and developed countries.

"Depth of food deficit shows that how many calories are required to lift the status of undernourished people, by keeping all other factors constant. Average intensity of this deficit is measured by multiplying the difference between average dietary energy requirement and consumption of food deprived population by the number of undernourished people to provide an estimate of the total food deficit in the country, then it is normalized by whole population. Figure 4.3 portrays that the average food deficit was 165 kilocalories per person per day in 1992 which after some fluctuations came to 152 kilocalories per person per day in 2012. Although

the average calorie supply per capita in Pakistan has increased but food deficit is still present in the country. Because the available average food supply in terms of kilocalories is not fairly distributed among the whole population of Pakistan. So, the average food deficit per person per day is still present in the country and it is approximately at the same point where it was in 1992.

Figure 4.3 Depth of Food Deficit (kcal per person per day)



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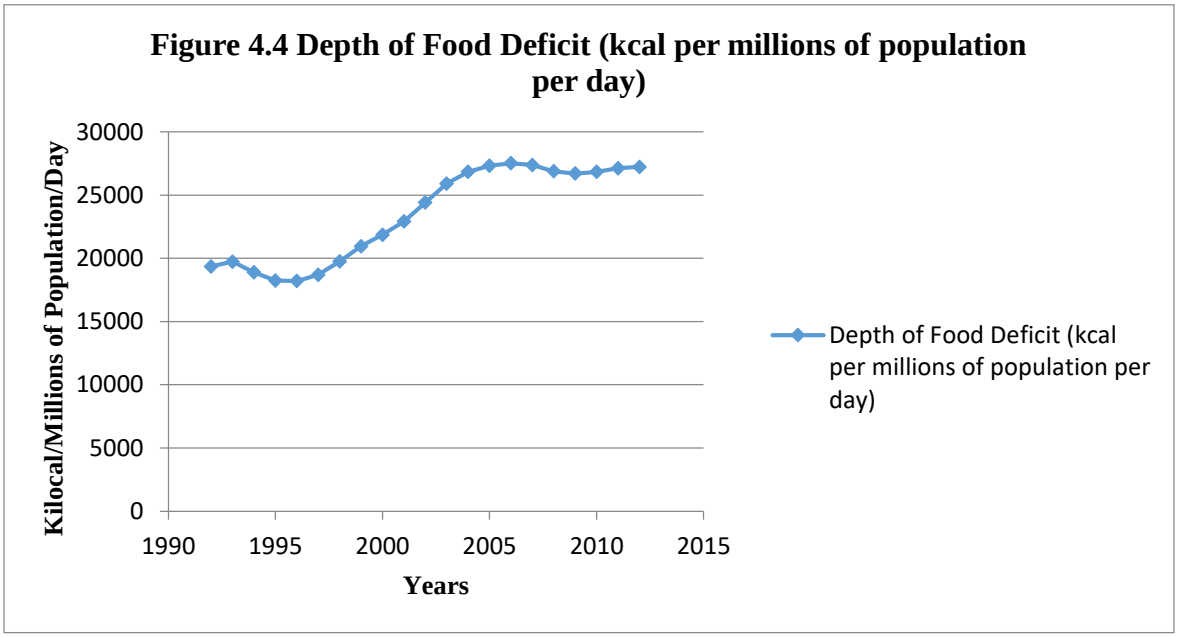
If we calculate this food deficit for the whole population (in millions), it indicates that the average food deficit per day in terms of kilocalories in the country is continuously increasing day by day as shown by figure 4.4.



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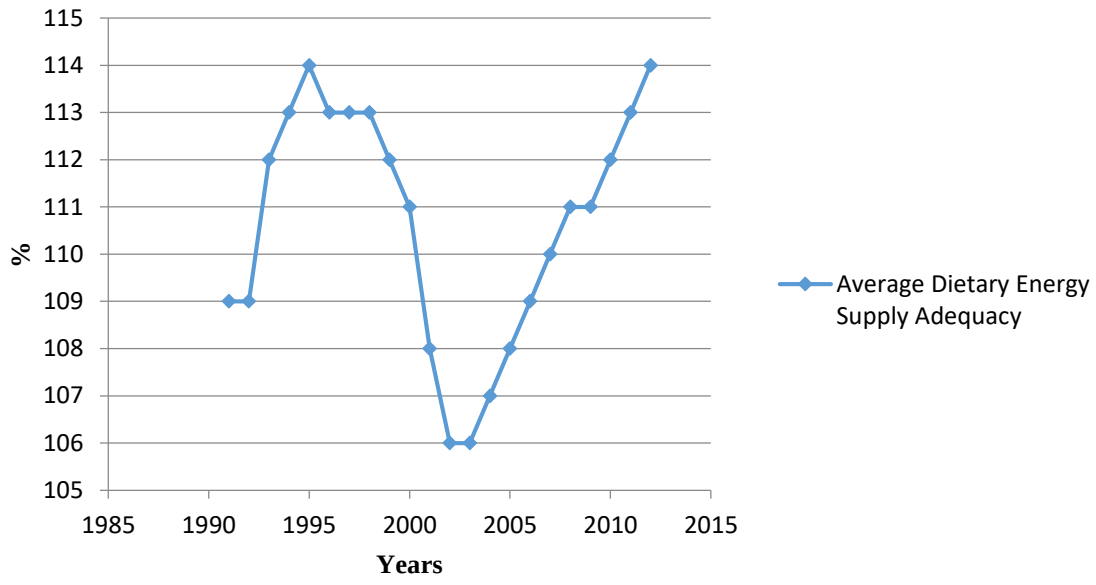
Average dietary energy supply adequacy measures dietary energy supply as a percentage of average dietary energy requirements in the country. To estimate this, the national average calories supply for the consumption of food is normalized by the average requirements of dietary energy for the country's population to provide a percentage of the food supply adequacy in terms of kilocalories. Figure 4.5 shows that average dietary energy supply adequacy has showed mixed trends over the past two decades. It is increased from 109 to 114 between 1991 and 1995. Then it decreased to 106 in 2003 and again starts increasing. Overall, average dietary energy supply adequacy has increased in Pakistan from 109 to 114 in last 22 years. It means that we are still at the point where we were in 1995. Moreover, the value 114 of average dietary energy supply adequacy indicates that the dietary energy supply adequacy is 14 percent higher in Pakistan than the nation's average requirement but still more than 35 million people in the country are food insecure". This insecurity in food can be due to unequal distribution of available food among the whole nation or due to the increasing prices of food in the country which is a hurdle in accessing the food items.

Figure 4.5 Average Dietary Energy Supply Adequacy



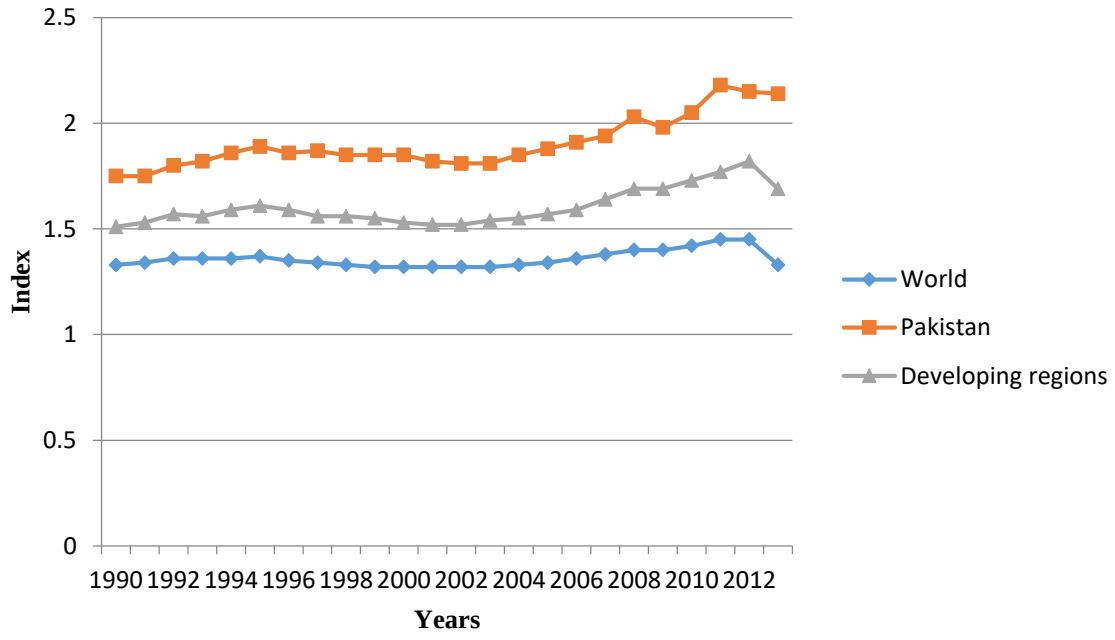
Graph is generated by the authors and data source is FSI (2013)

At the same time, share of the energy which is provided by the cereals, roots, and tubers have been shrinking and reached to 50 percent in 2009 from 55 percent in 1991. Amount of available protein supply per capita per day has increased by 10 percent in Pakistan between 1991 and 2009. The share of livestock in protein supply measured by the average supply of protein of animal origin is also increasing in Pakistan, showing that Pakistan is making high progress in livestock sector (FAO, 2013).

Economic access to food is mainly determined by food prices and incomes. An individual's access to food is also affected by many social variables, like gender positioning and power hierarchies within households. Engel's law explained that the share of disposable income that is spent as food expenditure is expected to decrease with the rise in income levels. It means that the poor households have to spend relatively a large share of their disposable income on food items, which makes them more vulnerable to a sudden increase in food prices or with any loss in income. The vulnerability that results from the rising domestic food prices can be captured by a country's food price index. The Domestic Food Price Index computed by FAO is derived by dividing the Food Purchasing Power Parity (FPPP) by the General PPP, which provides an index of the price of food in the country relative to the price of the general consumption basket. Food price index is an important indicator for global monitoring of food security

because it compares the relative price of food across countries and over time.

Figure 4.6 Domestic Food Price Index



Graph is generated by the authors and data source is FSI (2013)

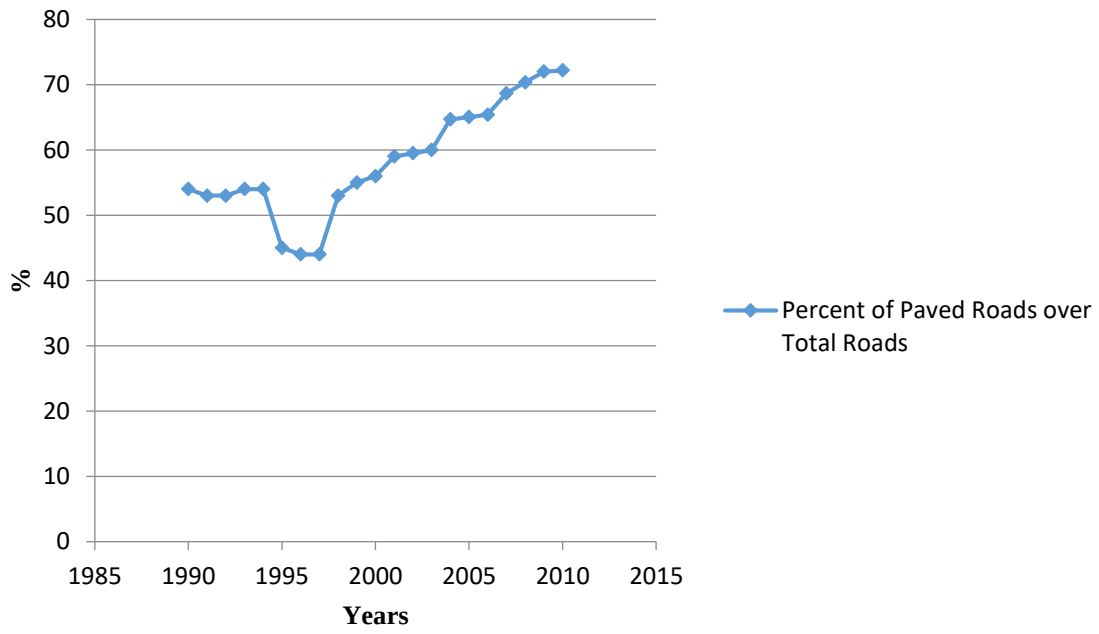
Food prices in Pakistan always remain high as compare to general consumption items. Figure 4.6 shows that our domestic food price index was 1.75 in 1990 which means that the prices of food items in Pakistan was 75 percent higher as compare to the other consumer goods. "Growth in food prices over the prices of general consumer goods remains stable during the 1998-2003. This growth in food prices over general price level is increasing and reached to the level of 2.14 in 2013. Comparing our domestic food price index with the other developing nations as well as the whole world, the above figure shows that the domestic food price index always remains high in Pakistan although the trend is same. Moreover, this index is continuously making an upward trend which can be the main hindrance in achieving the food security in the country because many of the people lack sufficient economic access to food.

With the economic affordability, physical access to food is also play an important role by sufficient infrastructure, such as the paved roads over the total roads, road density and railway lines density. These variables facilitate in functioning of the markets and help to reduce price arbitrage and also can improve the delivery of food items among the regions as well

as between rural and urban areas of the country. Infrastructure is inadequate than the food prices, but it shows a direct link with the food security outcomes in many countries.

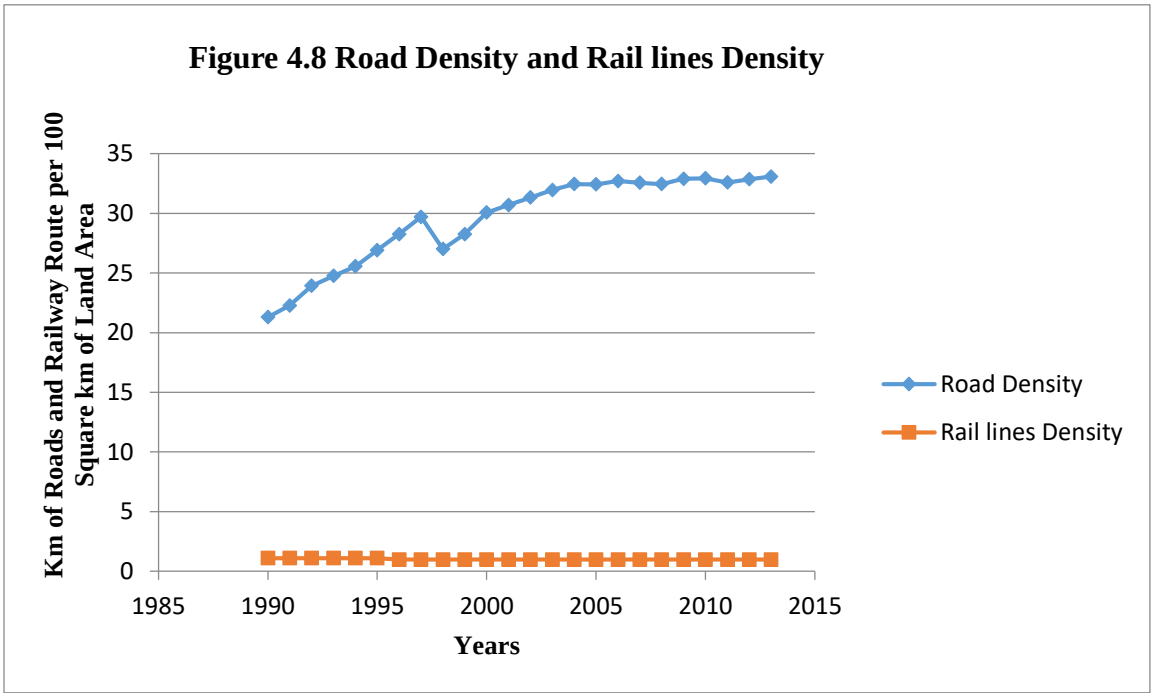
Figure 4.7 shows that the percentage of paved roads *"the roads which are surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length"*. The graph shows that percentage of paved roads in total roads is increasing with a downfall during 1995-1997. Data shows that Pakistan is making progress in its road infrastructure as percentage of paved roads in total roads has increased from 54 percent in 1990 to 72.2 percent in 2010". The indicator gives information both for consumers and producers on the possibility of the physical access to the domestic markets for food as well as for other non-food items.

Figure 4.7 Percent of Paved Roads over Total Roads



Graph is generated by the authors and data source is FSI (2013)

Road density is the ratio of length of a country's total road network over country's land area. The road network covers all types of roads in the country i.e. highways, motorways, main or national roads, regional roads and other urban, rural roads. Figure 4.8 shows that the road density is continuously increasing in Pakistan which shows that the country is making progress towards its physical infrastructure as discussed above.



Graph is generated by the authors and data source is FSI (2013)

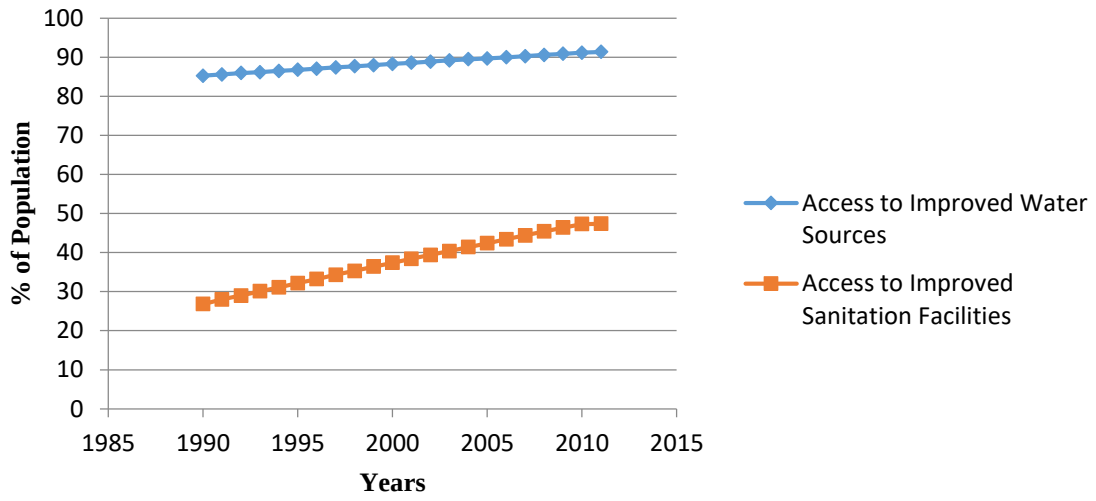
Besides roads, railway is also an important factor in providing infrastructural facilities for the regional distribution of food. Figure 4.8 show that the railway lines density which is the ratio of the length of railway lines available for train service (rail lines, total route in km) with the area of country. Figure 4.8 shows that the railway lines density has been deteriorated slightly in Pakistan. During 1990-1995, it was 1.10 but after that it decreased to 0.98 and still it is standing at the same point which can create problems in food distribution across the country.

Utilization is the third important dimension to achieve food security in a country. "This dimension of food security can be judged through different indicators like access of the population to clean water and sanitation facilities. The capacity of the body to absorb the nutrients needs a good health status, particularly in the young individuals. The poverty, which is related to the roles of women in the collection of water and storage and the link between clean water and good sanitation as well as child health and wellbeing also influence the ability to utilize food. Therefore, these two indicators of the utilization of food are considered an important part of the food security indicators calculated and monitored by FAO.

According to FAO (2013), access to improved and clean water refers to the percentage of the country's population with the reasonable

access to a sufficient amount of water which can be acquired from an improved source such as a household water connection, public stand pipe, bore water, protected well or spring and collection of the rainwater. The availability of at least 20 litters of water per person per day from a source which is within one kilometre of the dwelling is considered as the reasonable access to safe and clean water". However, this definition has ignored the quality of water from the above-mentioned water sources.

Figure 4.9 Access to Improved Water Sources and Sanitation Facilities (% of population)



Graph is generated by the authors and data source is FSI (2013)

Figure 4.9 indicates that an estimated nine percent of the population of Pakistan was living without any access to the safe drinking water in 2011. This upward sloping curve shows that Pakistan has made a significant progress in providing clean drinking water to its masses in the last 20 years and shows a decline from the level of 15 percent in 1990 to nine percent in 2011.

The second important indicator of food utilization is the access to improved sanitation facilities. Access to improved sanitation facilities is measured as the percentage of the population with at least sufficient access to the excreta disposal facilities that can prevent the human, animal and insect's contact with excreta. Improved facilities may range from simple but protected pit latrines to flush toilets with a sewerage connection. Significant improvement has been made in a Pakistan over the past two decades. Figure

4.9 shows that the access to improved sanitation is increased from 27 percent to 47 percent of population during 1990-2011 but still more than half of our population lacks these facilities. They don't have any access to improved sanitation facilities. Access to improved sanitation facilities at the country level has a positive impact upon food security.

Stability refers to the consistent supply of nutritious and quality food at the national level as well as stability in access to food at the household and individual levels. The fluctuations in the above-mentioned indicators adversely affect the food security situation in the country.

The above analysis of the first three dimensions of food security indicators for Pakistan shows that most of the indicators remain stable to some extent over time although there were some fluctuations. But when we compare the food availability and economic accessibility of Pakistan with that of other developing as well as developed countries, it shows that we are far behind them in terms of food availability and economic accessibility. Food prices in Pakistan are not stable and making an upward trend continuously. Moreover, the food price index for Pakistan is above than the other developing as well as developed countries of the world. This is one of the major causes of food insecurity in the country. The stability of this indicator depends upon many factors. One of the most important factors that create inflation or food inflation is the unbalance growth of different economic activities in the country. So, stability of this as well as other indicators requires the balance growth of different sectors of an economy. All sectors of an economy are important in this regard because the performance of agriculture sector along with its stable linkages to the rest of the economy help in the stability of the food availability. Industrial sector is also important in this regard because of food processing. While services sector helps in physical access to food. Moreover, industrial as well as services sectors have significant impact on economic access of the people due to employment generation. Therefore, besides production, stability requires better management of domestic production, food markets integration, rational and effective use of buffer stocks and trade (FAO, 2002).

After doing the dimension wise analysis of food security, present study also constructs the overall situation of food security in Pakistan by developing an index of food security over the period 1962-2012. Many indicators of food security have been developed by Food and Agriculture Organization (FAO) for most of the countries of the world, but data on most of these indicators is not available before 1990. Based on the study of the planning commission of Pakistan, four indicators have been chosen for

which data is available from 60's to quantify the level of food security in Pakistan over time.

These four indicators are as follows:

1. Food availability per capita index
2. Food production per capita index
3. Food self-sufficiency index
4. Real food price index

There are many other factors/indicators, the inclusion of which may improve this index if the time series data is available on these indicators. Food availability per capita clearly is a critical indicator in determining the food security and was given a weight equal to 1/2. Food production is not itself a sufficient indicator thus assigned a weight equal to 1/6. The relative food price and the self-sufficiency ratio indices were also given weight of 1/6 each. The weights used in this study are like those used in the Report of Task Force on Food Security in Pakistan (GOP, 2009). The food security index (FSI) for Pakistan is given in table 4.1.

"Food security index was 158 during the early 60's which was increased to 166 and 178 during the late 60's and 70's. According to the figure 4.10, food security index is showing a steady improvement during 1962-1981. It starts falling after 1980's till 2001. Factors like food inflation caused by floods of 80's and early 90's may have contributed to this decline in food security index. The figure is showing a worse situation of food security in Pakistan during 1997-01. Its reason may be the floods of mid 90's in the country and international banes on Pakistan after 1998 atomic blasts or political instability. After this period the index is showing little improvements. If we look on the overall trends of food security, it is very unfortunate to say that despite the overall increase in food production or availability, the food security situation is deteriorating over time in Pakistan and it is a serious matter of concern for the policy makers" to think about it.

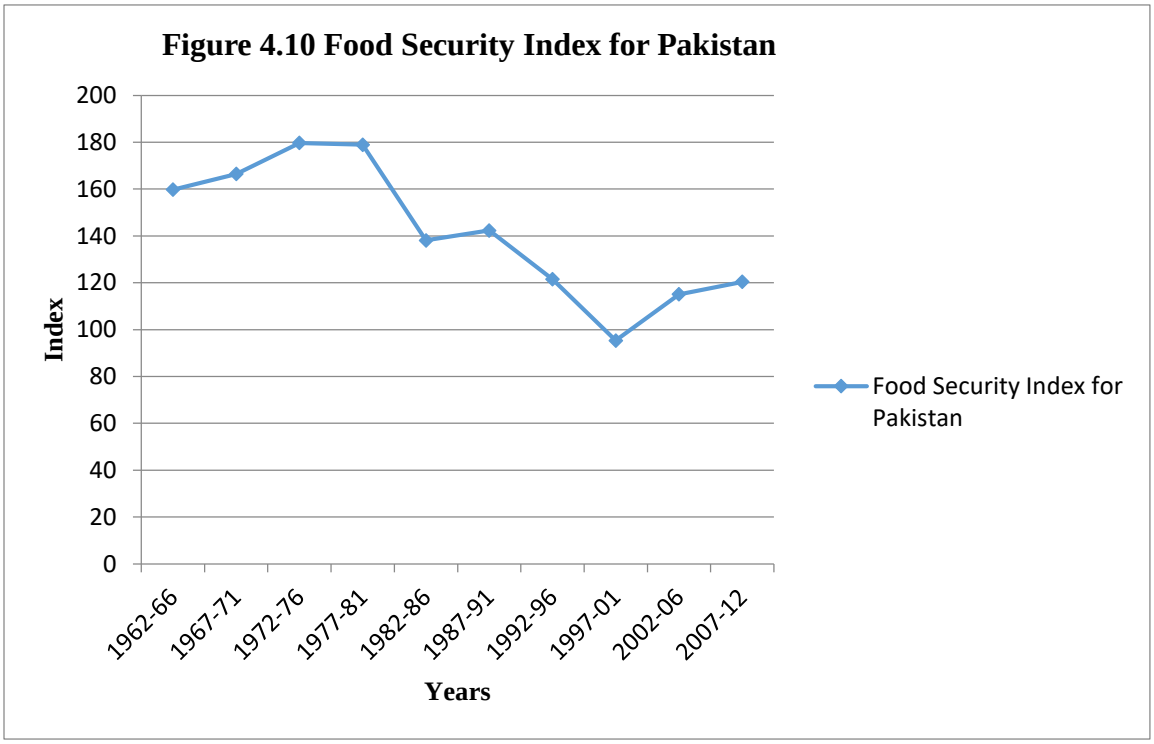
Table 4.1 Food Security Index for Pakistan

Years	Food Security Index[6]
1962-66	159.73
1967-71	166.42
1972-76	179.71
1977-81	178.96
1982-86	138.09
1987-91	142.33
1992-96	121.49
1997-01	95.329

[6] FSI is calculated by taking 2005-06 as the base year.

2002-06	115.06
2007-12	120.38

Source: Author's Calculation



Source: Generated by the authors

As the above analysis shows that despite of a significant progress, still Pakistan is a food insecure country and it is deteriorating with the passage of time as shown by food security index. How this deteriorating condition can be controlled, it depends upon agricultural output. It is because agricultural output is the major determinant of four indicators of food security index calculated above. Moreover, agricultural output is the basic factor that determines the food availability and economic access in the Pakistan economy. The results of correlation matrix and granger causality tests given in appendix prove the key role of agricultural output to the food security indicators.

Table 4.2 Correlation Matrix

	Agricultural Output	**Food Production Index**	**Average Calorie**

			Supply per Capita
Agricultural Output	1	0.9638	0.6894
Food Production Index	0.9638	1	0.7476
Average Calorie Supply per Capita	0.6894	0.7476	1

Source: Author's Calculation

Table 4.3 Granger Causality Test

Null Hypothesis	F-Statistic	P-Value
Agricultural Output does not Granger Cause Food Production Index	4.2395	0.04506
Agricultural Output does not Granger Cause Average Calorie Supply	4.5493	0.03811

Source: Author's Calculation

It is a fact that Pakistan's economy is the 26th largest economy of the world (WB, 2011), have largest canal system and its agriculture sector is one of the world's leading producer of important agricultural commodities (FAO, 2011a), the proportion of the undernourished population is 26% that is too high (FAO, 2011b). More than 60% of the population lives in rural areas and more than 85% of the farmers own less than 2.5 hectares of land (GOP, 2010). These households are the most vulnerable ones to become food insecure as they have to deal with the uncertainty in their food provisioning on a daily basis (Yasin, 2000). It is important to understand this complex phenomenon of malnourishment in Pakistan to make suitable policies to eliminate the hunger from the country.

Despite a significant growth in production of staple crops, Pakistan has showed a sharp decline in the food security in recent years due to population growth. The country experienced a worst natural disaster in 2010 when floods destroyed infrastructure and damaged its agriculture sector, and left almost 20 million citizens in the country without access to food, clean drinking water and health services. The food insecure population in

the country rose from 38% to 50% of total population between 2003 and 2009. It is estimated that this number has risen further to 90 million people in the aftermath of the 2010 floods[7].

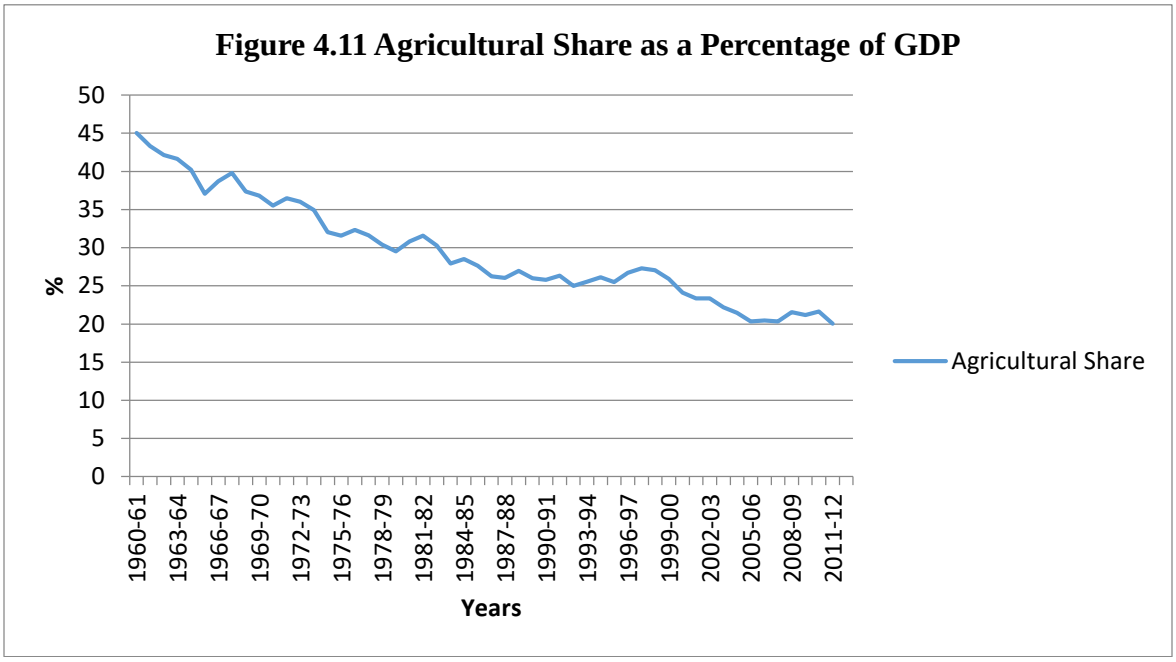
The share of agricultural sector in our Gross Domestic Product (GDP) showed a declining trend, but still it accounts for 21% of Pakistan's GDP and employs 45% of our labour force. Figure 4.11 shows that the share of agricultural sector over time has been continuously declining from 45% in 19961 to 21% in 2013. This downward trend is not a surprising one because it is consistent with the theory of inter-sectoral growth i.e. the resources shift from agriculture to industrial and then to services sector as an economy develops, and hence the share of agriculture falls in total GDP while share of industrial and services sector increases. Structural change is necessary for development process of an economy. But the important point for food security is to analyse the impact (short-run and long-run) of structural change upon agricultural sector as a source of food supply.

Table 4.4. Agricultural Value Added (% of GDP)

Years	Agricultural value added
1961-70	40.22
1971-80	33.05
1981-90	28.19
1991-00	26.13
2001-10	23.18
2011-13	23.81

Source: Arranged by the authors and data source is WDI (2013).

[7] http://www.foodsecurityportal.org/pakistan/resources



Source: Generated by author and data source is WDI (2013)

5. Concluding Remarks and Policy Implications

On the bases of the results presented in this study, it can be concluded that we are still behind many nations of the world. "Even after more than six decades, agriculture sector in Pakistan has not reached to its potential level. The underlying reason is the biased policies of the government in Pakistan. Most of the time, excessive protection of industrial sector by the government resulted in inefficient allocation of resources in the industrial sector. Government fiscal policy steps show that policy makers have been ignoring agricultural sector but industrial and services sectors are promoted. This type of exercise has adversely affected the agricultural output and hence food security in the long-run in the Pakistan economy. So, policy makers are recommended to revise their policy for promoting industrial sector at expense of agriculture sector. The following measures are suggested to improve the situation.

Pakistan has been undergoing a structural change and shifting from agricultural based economy to services based economy but food security situation is not improving so much that it may become a food secure country. The reason is that population growth rate is high and food supply is not increasing to the level that it can bring significant and positive changes in the long-run. Therefore, it is necessary to increase food supply.

Public investment in agriculture sector is very small as compared to all other sectors and it has been decreasing over time". Public investment is very important for enhancing capital stock of agriculture sector which will improve agricultural output and hence food supply in the country. Hence, government should revise its policy of biased emphasis towards industrial sector and pay due attention to the agriculture as well. Moreover, agricultural research and development department needs improvements as current agricultural research is not enough and funds of this department should also be increase. Government should also devise more effective policies to control population growth rate in the country. As the growth in population puts more pressure on natural resources and hence deteriorate food security.

The index of food security developed in this study has included only two dimensions of food security. Moreover, many indicators are missing in this index due to the lack of historical data or methodological constraints. So, there is a need to construct an index of food security covering all the dimensions of food security along with all the underlying indicators.

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