

**FOOD SYSTEMS AND FOOD SECURITY:
LINKAGES AND CHALLENGES**

**A
SYNOPSIS**

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1. INTRODUCTION

Hunger is not an issue of charity. It is an issue of justice.

- Jacques Diouf.

The world welcomes 353,000 people every day (UNICEF, 2013). In the purposeful creation, everything and everyone is intrinsically valuable. All members of the human family are born free and are equal in dignity and rights (United Nations, 1948). Therefore, accumulated population is much more than just a 'quantitative figure'. Population is an asset for the development and progress of a nation. However, the increment in population beyond a certain level is perceived as the challenge to the carrying capacity of earth.

Unbridled population progression leads in more mouths to feed and it turns out as a challenge to gratify all with scant resources. India is facing the same challenge as it is the second most populated country in the world, and it has been projected that it would be the largest populated country surpassing China by the year 2050.

India has emerged as one of the fastest growing economies in the world with spectacular improvement in all economic sectors (Rekhy, 2016). It ranks third in terms of Gross Domestic Product with annual growth rate of 7.6 per cent (World Bank, 2016). It is the second largest producer of wheat and rice in the world and accounts for 10 per cent of the world fruit production (CSC, 2015). Nevertheless, such accomplishment of India, being one of the largest producers of food in the world, takes a shattering twist when one looks at the hunger problem booming within it (Jaswal, 2014; Timmer, 2010). According to the International Food Policy Research Institute (2015), about a quarter of the world's hungry people are living in India and it falls under the 'serious' category of countries classified by severity of hunger¹. Out of the

¹ Global Hunger Index, 2015

estimated 1.27 billion people of India, 16.2 per cent remain hungry every day. In spite of huge buffer stocks, 8 per cent of Indians do not get two square meals a day, and there are pockets where severe under-nutrition take its toll even today (Mehta, 2013). Every third child born in India is underweight (TNN, 2015). Despite ensuring ample availability of food, India is not in the condition to meet the basic food requirements of all people.

Ironically, utmost of the underfed are the very ones producing half of the world's food: peasants women. Similarly, most of the food anxious people are food and farm workers and many of those bear the brunt. The reason behind prevailing hunger and malnutrition, in spite of overall economic growth and adequate aggregate food supplies, is that millions of them are caught in a vicious circle of hunger and poverty. Hunger is often not only the result of poverty, but also its major cause that deprives people from the means to buy or produce food (Mehta, 2013).

A segment of population is living in vulnerable conditions despite that the right to food is acknowledged from very early times. The International Covenant on Economic, Social, and Cultural Rights (1966) stressed 'the right of everyone to adequate food' and specifying 'the fundamental right of everyone to be free from hunger'. In the United Nations Guidelines for Consumer Protection (1985), Right to Food was mentioned as the first need under the Right to Basic Needs. At the national level, Article 47 of the Constitution of India, *inter alia*, provides that the State shall regard raising the level of nutrition and standard of living of its people and the improvement of public health as among its primary duties.

In 1996, the formal adoption of the Right to Adequate Food by the World Food Summit paved the way for the possibility of a rights-based approach to food security. Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life

(World Food Summit 1996). The World Food Program (2008) emphasized the following dimensions of food and nutrition security:

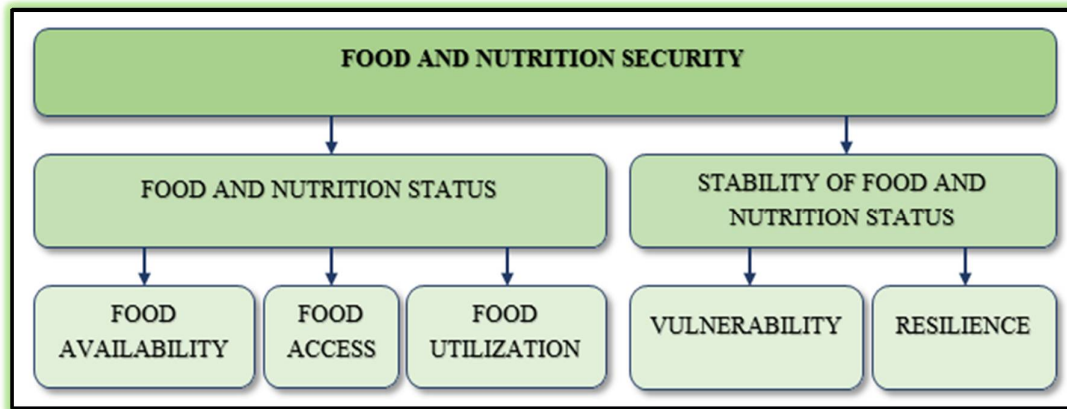


Figure 1: Dimensions of Food and Nutrition Security at Micro Level
Source: Food Secure Working Paper: 13²

Food and Nutrition Security can be divided into two broad categories i.e. Food and Nutrition Status and Stability of Food and Nutrition Status.

1. Food and Nutrition Status is further classified into three categories:

- *Food availability* addresses the “supply side” of food security and is determined by the level of food production, stock levels, and net trade.
- *Access to food* is concerned with the ability of people to meet their minimum food requirement over a sustained period of time.
- *Utilization* is the way the body makes the most of various nutrients in the food. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals.

²Pieters, H., Guariso, A., & Vandeplass, A. (2013). Conceptual framework for the analysis of the determinants of Food and Nutrition Security, Food Secure Working Paper: 13.

2. Stability of Food and Nutrition Status is divided into Vulnerability and Resilience.

- *Vulnerability* is the likelihood of experiencing future loss of welfare, generally weighted by the magnitude of expected welfare loss.
- *Resilience* refers to the ability to recover from such a welfare loss.

Food security is a multi-dimensional concept and extends beyond the production, availability, and demand for food (Pieters, et al., 2013). There has been a definite and significant paradigm shift in the concept of food security from mere macro level availability and stability to micro level household food security, and from an assessment of energy intake to measures and indicators of malnutrition (Ittyerah, 2013).

To make India food secure, an act was passed on September 10, 2013 by the Parliament of India, notified as the National Food Security Act, 2013. The Act aims to provide food and nutritional security in human life cycle approach by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity and for matters connected therewith or incidental thereto. The Food Security act is not only the scheme, but also an opportunity for India to assume full responsibility for food safety of its citizens (Karhad, 2014). The food production provides the base to food security. Production alone will not be sufficient to pave the way to food security rather food security relies on the complete food systems. Food system is a network that encompasses various stages in the mode transfer of food from production to consumption.

Food systems support a vast range of stakeholders from the farmers to the final consumers, from governments to private sector to civil society. Food systems overlap and operate at local, regional, national, and global levels and hence it cover both micro and macro level (UN, 2015). To ensure food security in nation, managed food systems is a plot.

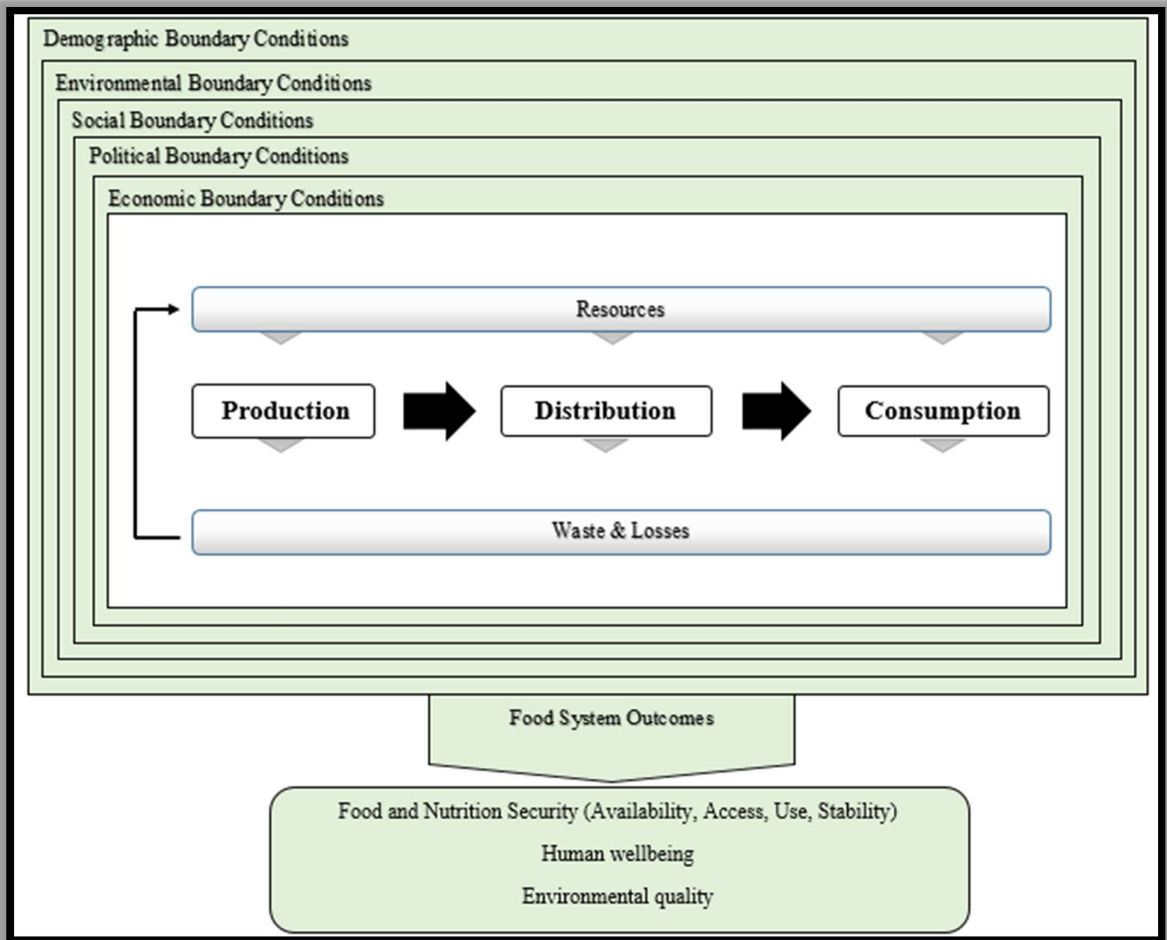


Figure 2: Food Systems' Framework

Source: *A Food Systems Approach for Food and Nutrition Security*³

Figure 2 exhibits the food systems' framework that comprises sub- systems viz. production, distribution, and consumption. Food systems get affected by various demographic, environmental, social, political, and economic boundary conditions. It also depicts that how the food systems' outcomes bring food and nutrition security, human wellbeing and environmental quality. There is an urgent need for systemic change to end hunger and malnutrition. In this regard, community food system is a prescriptive approach to building a

³Grant. M. (2015), *A Food Systems Approach For Food And Nutrition Security*, World Food System Center, Zurich, Switzerland

food system, one that holds sustainability – economic, environmental and social – as a long-term goal toward which a community strives.

A community food system is a food system in which food production, processing, distribution and consumption are integrated to enhance the environmental, economic, social and nutritional health of a particular place (Garrett and Feenstra, 1999) i.e. realizing a food secure community. A food secure community is a place where all community residents obtain a safe, culturally appropriate, nutritionally sound diet through an economically, socially and environmentally sustainable food system that promotes community self-reliance and social justice (Hamm & Bellows, 2002).

Food system is a lead to feat the maze, and it is possible to triumph the challenge and make India food secure through managed food systems. Therefore, the present study has been undertaken and entitled as *Food Systems and Food Security: Linkages and Challenges*.

2. REVIEW OF LITERATURE (*Summary Sheet: Annexure 1*)

World is home to 7.419 billion people, on World Population Day i.e. July 11, 2016 (UN, 2016). Current population is more than double the number of people living on the earth 50 years ago, and it is estimated that by 2050, it will be 9.374 billion (USCB, 2016; Bloom, 2011). Increasing population is putting tremendous pressure on world's natural resources (Pritchett, 1996) specifically agriculture to meet out its food requirements for survival that poses one of the biggest dangers to planet (National Geographic, 2014; A. Debata, 2014; Kulkarni, et al., 2014; Foster, 2005).

Every day one billion people go hungry and they do not have access to clean water (Zelman, 2011; Athreya, et al., 2010). This number is equivalent to the entire population of India. By

2050, we further need to feed two billion more people (Cribb, 2010). At the one hand, people are dying due to hunger (FAO, 2015); paradoxically over two and a half billion people (globally) are consuming too much (ECI, 2016; Mukherjee, 2008).

According to the Population Reference Bureau, 60 per cent of the world population is concentrated in Asia. Encompassing 36 per cent of world population, China and India - materialize as populace colossus (Exner, 2011; Kattumuri, 2011). Various studies have projected, that India will surpass China in terms of population by the year 2050 and will become the most inhabited country in the world.

India has accomplished notable socio-economic achievements after independence (Singh et.al., 2002), but it is in its evolving phase, and population growth is a major hurdle in its growth (Chadha, 2016). Indian Economy is primarily dependent on agriculture to nurture its population but agriculture is confronted with several long and short-term issues (Dev & Sharma, 2010; Jain, 2016)

The contribution of agriculture and allied activities to the GDP is 18 per cent at 2011-12 prices, whereas the average size of operational holding has declined to 1.15 ha in 2010-11 as compared to 1.23 ha in 2005-06 (CSC, 2015). The significant differences in agricultural productivity across regions and among different crops, is giving rise to regional disparities and resulting in inequalities (ADB, 2013). Low yields occur due to technical constraints (Patel, 2014) that prevent local food producers from increasing productivity (Porter & Xie, 2014; OXFAM, 2013).

By 2030, India will be the world's largest importer of food in the world and the country needs to outsource the production of different cereals to feed its population. Increasing global demand for resources due to growing population and increasing wealth has brought the issue of resources scarcity to the forefront (Freibauer, E. et.al., 2011). India is struggling with the

problem of scarce resources, and increasing population has reduced the per person resource availability (Kendell and Pimentel, 1994; Mohanty, 2013). It leads to poverty, malnutrition, and other large population size related problems (Nagarajan, 2016; Stiegert, 2009).

India has one-third of the world's poor (World Bank, 2011), and 21.9 per cent citizens of India fall below its official poverty line (GOI, 2013). According to the World Bank International Comparison Program (based on 2005's Purchasing Power Parity), 23.6 per cent of Indian population i.e. about 276 million people lived below \$1.25 per day on purchasing power parity (World Bank, 2011). India is home to a quarter of the undernourished people in the world (FAO, 2015) and 194.6 million people bear hunger pangs every day (IFB, 2016). Malnutrition is a serious dent on the development of India (Kaur, 2014). In such a critical condition, proper food, being prime requirement of every human, becomes nightmare for a poor. Poverty leads to hunger that ultimately affects the health and productivity of person (Dhawan, 2014; Roberts, 2015).

However, high economic growth in India in the last three decades has been accompanied with increased agricultural production with sufficient buffer stocks of food grains in government stores (Smytha et.al., 2015; Brahmanand, et al., 2013). In the period between 1950 and 2012, India's food grain production has gone up by five times, whereas its population increased during this period by roughly three and half times (Saxena, et al., 2014; IED, 2013). Statistics reflect that globally, there is adequate food available for all and enough food can be produced for the world's mounting population (Bogart, 2014; Dobermann & Nelson, 2013) but the availability does not guarantee accessibility.

The inability to access nutritious food due to poverty is the main reason people face food insecurity in India (Himanshu, 2013). Therefore, 30.7 per cent of children under the age of five are underweight and 58 per cent of children stunted by 2 years of age. Approximately, one in

four children is malnourished due to starvation and unfortunate diet related illness (IFB, 2016). The statistics demonstrate the miserable situation of the country regarding poor availability and accessibility to nutritious foods (HIVOS, 2016). It reflects that the nation is producing enough food but growth and higher level of production alone are insufficient to ensure food security for all (Guinn & Hamrick, 2015). The consumption of adequate food containing the required calorie, proteins and micronutrients are necessary for combating malnutrition (Chakravarty & Dand, 2005). Population is a key issue, which catalyzes the problem of food insecurity and needs to be addressed (Upadhyay & Palanivel, 2011).

The challenge for the Indian agriculture that lies ahead is not only to increase the agricultural production substantially but also to achieve stability in it (Nawani, 1994; IEBF, 2016). Therefore, food security has taken center place in policy discussions around the world. There has been a definite and significant paradigm shift in the concept of food security from mere macro level availability and stability to micro level household food insecurity, and from an assessment of energy intake to measures and indicators of malnutrition (Radhakrishna & Reddy, 2016).

India ranked 65th in the Global Food Security Index carried out in 2012 whereas, as per 2016 index, India is at 75th position out of 113 countries. India has been slipped 10 points down in past 4 years. The Government of India has launched number of schemes like Target Public Distribution System (TPDS), National Program of Nutritional Support to Primary Education (NPNSPE), Antyodaya Anna Yojana (AAY), Annapurna Scheme, and Indian National Food Security Act (INFSA), 2013 to make India food secure but the condition is unsound, and country is struggling to accomplish its food security mission.

Food security is by and large depends upon food supply (Ilona, 2010). Temporary disruption in food supply can have long-term impacts. Therefore, food security issue is related with

managed food systems (Capone, et al., 2014). The traditional role of agriculture in producing food and generating income is fundamental (John, 2013), but agriculture and the entire food systems from inputs and production through processing, storage, transport, and retailing to consumption can contribute much more to the eradication of malnutrition (FAO, 2013). A sustainable food system supports food security that makes optimal use of natural and human resources. It is culturally acceptable and accessible, environmentally sound and economically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy, and affordable food for present and future generations (IPES, 2015; Capone, et al., 2014; Feenstra, 1997).

Exponential population growth is chief obstacle for any nation in triumphing food security for all (Mitra, 2014). Food security policies are not fruitful until they are grasped by the destitute. It has been realized that a nation's food systems work as connecting dots between producers and consumers. In the path of achieving food security with population expansion, effective and efficient food systems can evolve as a game changer.

Food systems' activities have changed dramatically over recent decades (UMICH, 2009). The context of food systems helped to identify and integrate the links between a number of activities "from plough to plate" (Bowler & Atkins, 2001). Transformations in the global food systems are causing changes in food production and marketing. In India, renovations are taking place at a slower rate in comparison to other countries (Dyson, 2011; Deshingker et.al, 2003; Cincotta & Engelman, 1997). Therefore, India's food system is largely unorganized and highly fragmented (Durkin, 2016) and food insecurity arises from vulnerability of the food systems (Ingram, 2011). Mismanaged food systems' activities are responsible to degrade the natural resources on which the food security mission depends (ECI, 2016; Martinez, 2010).

For holding major segment of the world population, it is essential for India to contemplate strategy in order to feed all its citizens. Limited availability of additional arable land and water resources make food security a major challenge in the 21st century (Meybeck & Redfern, 2014; Cakmak, 2002). To accelerate the shift towards food security, a new science of sustainable food systems is needed. Although, the government is working hard on the track of building food secure nation but still there is a long way to go. Achieving food and nutrition security requires strong commitment from policy makers (Fischler, 2015). India's dynamic and prospering economy needs another approach to unlock its anchor so that efforts can turn out in upshots.

3. NEED OF THE STUDY

The population is growing rapidly, even though the rate of growth has slowed down. Increasing numbers of people often drive up demand for food, a basic constituent to survive. Therefore, population growth has been the most discussed demographic dimension of the food crisis because it has direct impact on the growing demand for food.

Almost, one of seven people around the world is chronically hungry, lacking enough food to lead a healthy and active life. The problem highlights the poor access to sustainable availability of adequate nutritious foods. Most of the countries due to increasing population are facing food insecurity, despite the fact that enough food exists for all of the people in the world. Therefore, for the world community, hunger and food insecurity has been one of the highest priority issues.

India is featuring prominently in the emerging economies. Even when India is doing well in its GDP growth rate, its performance is still unfortunate in Human Development Indicators. India produces enough food and has at its disposal enough arable land not only to feed its population, but also to export. Hitherto millions live without two square meals per day as India ranked 55th in Global Hunger Index in 2015. Five decades after the start of the Green Revolution India's

food grain production has increased five-fold and the country is one of the world's largest producers of staples like rice and wheat. However, its hunger and malnutrition levels are still extremely high, and great inefficiencies remain within the food systems.

Food system has an enormous effect on achieving food security mission and sustainable development. The existing literature on the linkages of these two dimensions is limited in terms of providing strong empirical evidence on the scope and the impacts of the initiatives taken in this direction. The present research will be conducted to find the answers of the following questions: What is the status of food security at micro level (household)? How far the food system in India is well organized to nurture its population? What strategies can be adopted to achieve Food Security Mission?

The present study will be a significant endeavor in articulating that how can sustainable food systems be helpful in achieving food security for ever-increasing population. Therefore, to fill the research gap, it is required to study the interconnectedness of food systems and food security.

4. OBJECTIVES OF THE STUDY

1. To analyse the status of food systems and food security in Uttar Pradesh.
2. To establish the linkages between food systems and food security.
3. To identify the major challenges for food security.
4. To study and analyse the case of Dayalbagh food systems approach to food security.

5. RESEARCH METHODOLOGY

In order to conduct research systematically, the following Research Methodology has been proposed:

5.1. Research Type: Descriptive and Analytical

5.2. Research Design: The research data will be collected as follows:

5.2.1 Research Data: The data will be collected from both primary and secondary sources. The secondary data will be collected from various published and unpublished records of government and non-governmental organizations, magazines, newspapers etc. Some of the sources for secondary data will be Food and Agriculture Organization of United Nations (FAO), Central Statistical Organization (CSO), Census (Government of India), World Bank, National Food Security Mission (NFSM), United Nations World Food Program (WFP), and Consultative Group for International Agricultural Research (CGIAR) etc.

5.3. Sample Design:

5.3.1. Region of Study: Uttar Pradesh, India.

Agriculture sector is the prime mover of economic growth in Uttar Pradesh. A vast majority of the population in the state relies on agriculture for its livelihood. Agriculture of the state has a paramount role in food production and food security of the country. Uttar Pradesh is the most prosperous, developed, and rich in agriculture region due to great impact of Green Revolution

in western region (FAO, 2007). Moreover, it is the most populated state of India (Census 2011); therefore, Uttar Pradesh has been taken purposively for the study.

Dayalbagh community is situated in Agra, Uttar Pradesh. Agricultural Operations System of Dayalbagh is interpreted as a collaborative network that integrates several components in order to enhance a community's environmental, economic and social well-being. The Dayalbagh model has emerged as an ideal model for achieving food security with functional stability. Therefore, Dayalbagh model will be considered as a case study.

5.3.2. Sampling Techniques: Purposive and Multi stage stratified random sampling techniques (*Annexure 2*).

To conduct a comprehensive study, two administrative divisions i.e. Gorakhpur Administrative Division and Agra Administrative Division have been selected randomly from Eastern and Western Uttar Pradesh respectively. From each Administrative Division, two districts are randomly selected viz. Agra and Mathura from Agra Administrative Division and Gorakhpur and Deoria from Gorakhpur Administrative Division consisting of rural and urban household population. Apart from households, people engaged in food production, processing and distribution would be interviewed to examine the status of food systems.

5.3.3. Sample Size: 400 households (*Annexure 3*)

On the basis of finite population correction sample size determination, sample of 400 households will be taken randomly according to the proportion of the size of stratum.

Sampling Framework will be as follows:

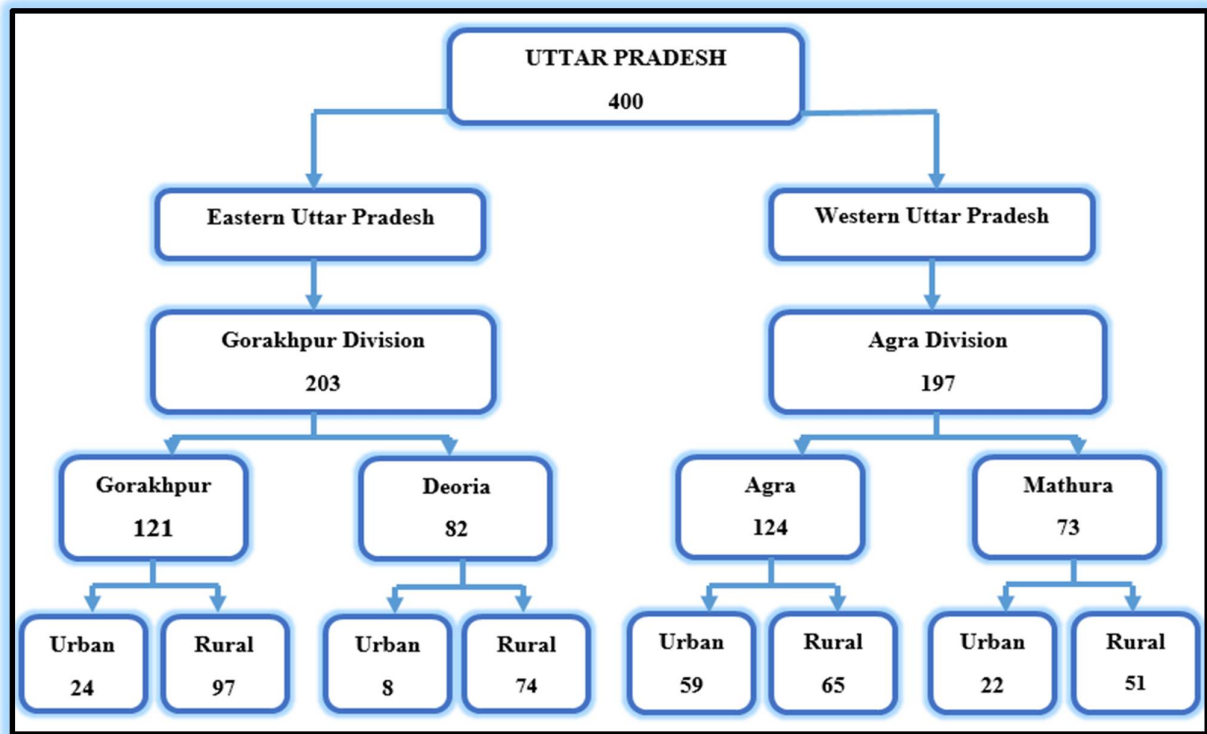


Figure 3: Sampling Framework

5.4. Research Methods & Tools for Data Collection: Survey method will be used, data will be collected through schedule/questionnaire and structured interview.

5.5. Statistical Tools/ Techniques: To carry out valid and reliable results the following statistical tools and scales will be used:

- Averages and Proportions
- Pearson's Correlation analysis and Multivariate Regression analysis
- Likert scale, The Household Food Security Survey Module (HFSSM) and Household Food Insecurity Access Scale (HFIAS)
- Content Analysis and Causal Loop Diagram (CLD)
- Binary Logit Model
- Z-test and ANOVA

5.6. Computer Applications: MS-Excel, SPSS and Vensim.

PROPOSED CHAPTERS

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3: Research Methodology

Chapter 4: Status of Food Systems and Food Security in Uttar Pradesh

Chapter 5: Linkages between Food Systems and Food Security

Chapter 6: Challenges for Food Security

Chapter 7: Food Systems Approach to Food Security - A Case Study of Dayalbagh.

Chapter 8: Conclusions and Recommendations

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ANNEXURE 1

REVIEW OF LITERATURE SUMMARY SHEET

F.S: Food Systems, F. Sec: Food Security

S. NO	AUTHOR	YEAR	SOURCE	F.S	F. Sec
1	A. Debata, M. D	2014	Journal of Ecology		
2	ADB	2013	Asian Development Bank Report		
3	Athreya, et al.	2010	World Food Programme		
4	Bloom	2011	Harvard School of Public Health		
5	Bogart	2014	World Food Programme		
6	Bowler & Atkins	2001	Arnold Publication		
7	Brahmanand, et al.	2013	Current Science		
8	Cakmak	2002	XIV International Plant Nutrition Colloquium Report		
9	Capone, et al.	2014	Science and Education Publishing		
10	Chadha, N.	2016	BEST: IJHAMS		
11	Chakravarty & Dand	2005	IIMAhmadabad		
12	Cincotta & Engelman	1997	Population Action International		
13	Cribb, J.	2010	CSIRO		
14	Common Service Centers	2015	Government of India		
15	Deshingker et.al.	2003	Development Policy Review		
16	Dev & Sharma	2010	OXFAM		
17	Dhawan, H	2014	Times of India		
18	Dobermann & Nelson	2013	Sustainable Development Solutions Networks		
19	Durkin, A	2016	Economic Times		
20	Dyson, T	2011	IGWG		
21	Environmental Change Institute	2016	University of Oxford.		
22	Exner	2011	Cleveland.com		
23	Food and Agriculture Organization	2015	Agriculture Outlook, FAO		
24	Food and Agriculture Organization	2015	FAO		
25	Food and Agriculture Organization	2015	FAO		
26	Feenstra	1997	Farmlandinfo.org		
27	Fischler, F.	2015	European Commission		
28	Freibauer, A.	2011	European Commission		

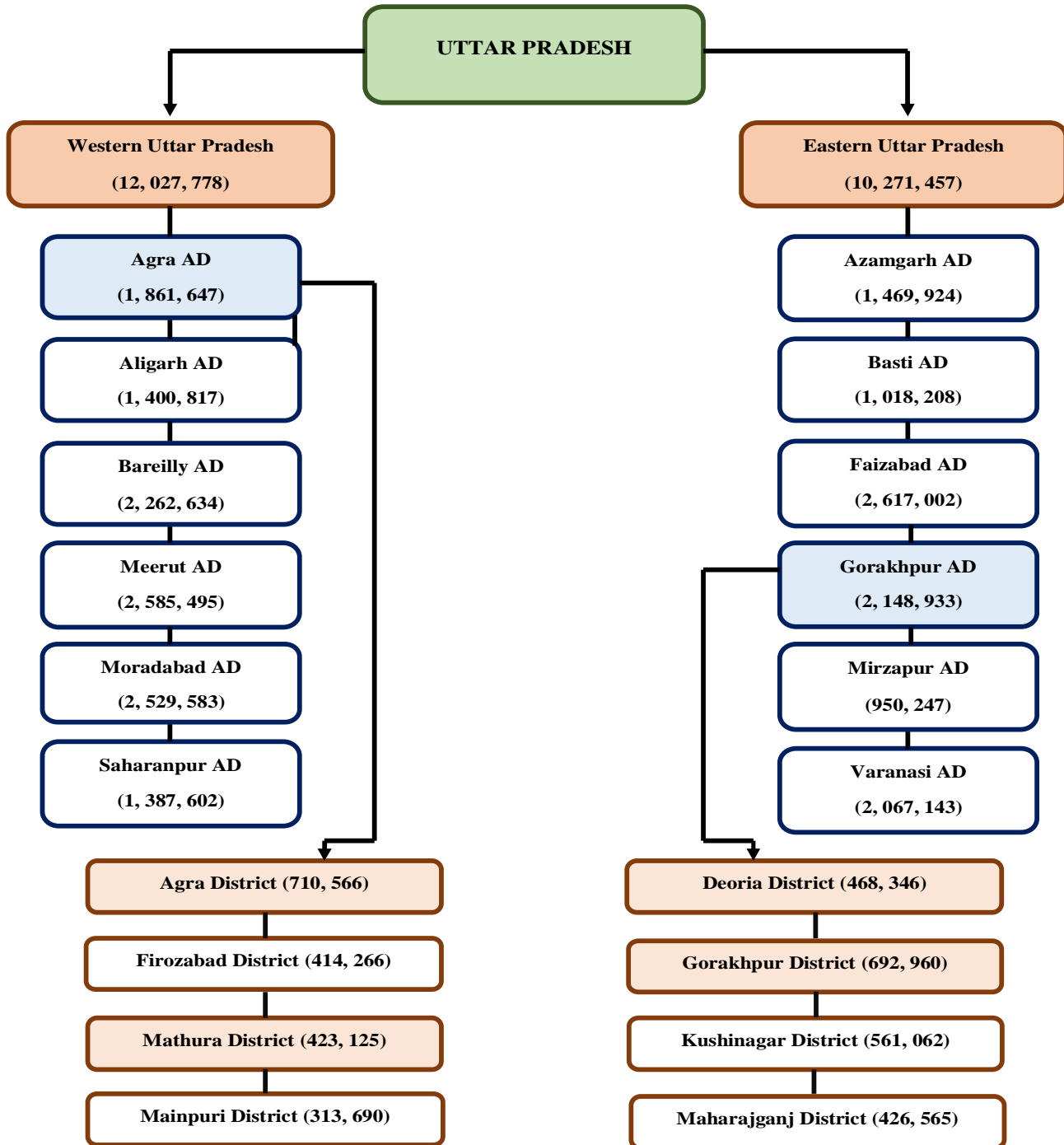
29	Foster	2005	National Center for Biotechnology Information		
30	National Geographic	2014	National Geographic		
31	Government of India	2013	Planning Commission Report		
32	Guinn & Hamrick	2015	World Public Health Nutrition Association		
33	Himanshu	2013	Asian Development Bank		
34	HIVOS	2016	hivos.org		
35	Indian Brand Equity Foundation	2016	iebf.org		
36	Independent Evaluation Department	2013	Asian Development Bank		
37	Indian Food Banking	2013	India Food Banking		
38	Ilona, K	2010	ilonakickbusch.com		
39	Ingram	2011	Wageningen University		
40	International Panel of Experts of Sustainable Food Systems	2015	ipes.org		
41	Jain, S.	2016	International Journal of Sustainable Development		
42	John	2013	Springer Link		
43	Kattumuri	2011	Asia Research Centre		
44	Kaur	2014	International Journal of Multidisciplinary Management Studies		
45	Kendell, H. & Pimentel, D.	1994	Ambio		
46	Kulkarni, et al.	2014	International Journal of Innovative Research in Science, Engineering and Technology		
47	Martinez	2010	United States: Department of Agriculture		
48	Meybeck & Redfern	2014	Food and Agriculture Organization		
49	Mitra	2014	Importantindia.com		
50	Mohanty, B.	2013	CGIAR		
51	Mukherjee	2008	Asian and Pacific Centre for Agricultural Engineering and Machinery		
52	Nagarajan	2016	Times of India		
53	Nawani	1994	Food and agriculture Organization		
54	OXFAM	2013	OXFAM		
55	Patel, A	2014	indiamicrofinance.org		
56	Porter & Xie	2014	Intergovernmental Panel on Climate Change		
57	Pritchett	1996	World Bank		
58	Radhakrishna & Reddy	2016	Planning Commission		
59	Roberts	2015	Horizon Magazine		
60	Saxena, et al.	2014	UK aid		
61	Singh	2002	Food and Agriculture Organization		

62	Smyth	2015	Cell Press Journals		
63	Stiegert	2009	Food System Research Group		
64	UMICH	2009	UMICH		
65	United Nations	2016	United Nations		
66	Upadhyay, R.P., & Palanivel	2011	Iranian Journal of Public Health		
67	USCB	2016	Census		
68	World Bank	2011	World Bank		
69	Zelman	2011	The Huffington Post		

ANNEXURE 2

HOUSEHOLD COMPOSITION

AD: Administrative Division



Data Source: Census 2011

ANNEXURE 3

Determination of the sample size based on finite population correction

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)}$$

Where,

n' = sample size with finite population correction,

N = Population size

Z = Z statistic for a level of confidence (1.96)

P = Expected proportion (in proportion of one), (0.5)

d = Precision (in proportion of one) (0.05)

$$n' = 385 \approx 400$$