
UNIT 8 DIVERSIFICATION TRENDS OF INDIAN AGRICULTURE

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8.0 OBJECTIVES

After reading this unit you will be able to:

- outline the concept of diversification of agriculture;
- indicate the need for diversification in the agricultural sector;
- discuss the two main approaches for agricultural diversification;
- explain how diversification can be instrumental in transforming the agricultural sector making it a commercially viable modern enterprise;

- identify the constraints in the process of diversification of agriculture; and
- suggest policy measures required for strengthening the process of diversification.

8.1 INTRODUCTION

The contribution of Indian agriculture and its allied sectors to the GDP is nearly 15 percent with about 50 percent of the population currently dependant on agriculture for their livelihood. Agricultural output, however, depends on monsoon as nearly 60 percent of area sown is dependent upon rainfall. Further, majority of small and marginal farmers mainly cultivate low value, subsistence crops. Due to this, they are facing various problems like: low productivity, low income, low investment and capital formation, low prices, high production costs, low purchasing power, infrastructure deficits, etc. To overcome these difficulties, agricultural diversification is often suggested as a means of improved farm productivity and income. The concept of agricultural diversification basically refers to a shift of resources from low value crop mix to relatively high value crops and farm products. In this unit, we shall study issues of diversification like determinants, approaches, constraints, strategy, etc. We shall, however, discuss to begin with the: (i) principles of optimal utilization of resources; and (ii) meaning, need and significance of diversification in agriculture.

8.2 PRINCIPLE OF OPTIMAL UTILIZATION

One of the basic universal economic principles is to ensure the optimal utilization of any given resource whether natural or man-made. The theory of optimal utilization, particularly of natural resources, has two important aspects.

- The first aspect is that while utilizing any resource we should assure the insurance of its renewability. This means, if any factor of production has a renewable property, then its conservation and regeneration potential must be given utmost priority. In other words, it should not be unsustainably used but its use should be proportional to its renewable potential. Otherwise, it will be like killing the goose that lays golden eggs in order to have all the eggs at one time instead of remaining satisfied with one golden egg every day for a long time.
- The second aspect of optimal utilization relates to deriving optimum benefit from a given resource. For instance, in case of agriculture, land is such a factor. It is a natural gift of nature with full potentialities of renewability. But this natural resource is scarce in comparison to demand from human population for which reason land is intensively used. However, the intensive use of land, without regard to its fertility regain consideration will be against the principle of optimal utilisation.

A mid-path between the two needs of optimum utilization and renewability, is to go for 'diversification of agriculture'. As said above, agricultural diversification implies shifting of resources from crops and farm activities with low productivity to relatively high value crops and other farm products. Sustainability of land and water resources is also an important consideration in agricultural diversification. Diversification of agriculture is a response to changing demand for agricultural

products with the rise in incomes and the growing global integration of agricultural markets. It is thus a challenge as well as an opportunity.

8.3 PROCESS OF DIVERSIFICATION

Agricultural diversification is a wide-ranging process. In a general sense, diversification of agriculture may mean:

- i) Diversification between agriculture and allied activities like animal husbandry, fishing, etc.; and/or
- ii) Diversification in cropping pattern.

The second category may be sub-divided into:

- a) Diversification between food crops and non-food crops;
- b) Diversification between cereals and non-cereal food crops;
- c) Diversification between traditional crops and horticulture; and
- d) Diversification between low productivity or low value crops to high value crops.

Alternatively, crop diversification can be divided into two categories:

- i) Horizontal Diversification; and ii) Vertical Diversification.

i) **Horizontal Diversification**

The commonly understood mechanism is the addition of more crops to the existing cropping systems (i.e. multiple cropping), which is in a way broadening the base of the system. This method of diversification has special significance under small-holder production systems and has proved beneficial to production increases due to increased cropping intensities.

ii) **Vertical Diversification**

The other type is vertical crop diversification, which reflects the extent and stage of industrialization of the crop production. Practicing of enterprises like agro-forestry, dry-land horticulture, medicinal and aromatic plants and other economic shrubs and livestock come under this. Note that crop diversification takes into account the economic returns from different crops. In light of this, it is different from the concept of multiple cropping. Both types of diversification (i.e. multiple cropping or horizontal diversification and agri-business or vertical diversification) will be essential to improve crop yields and income generation at local, regional and national levels.

Check Your Progress 1 [answer in about 50 words in the space given below]

- 1) Do you agree that ‘diversification of agriculture’ is a mid-path between the two essentials of the ‘principle of optimal utilisation’?

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2) What are the four sub-categories of ‘diversification in cropping pattern’?

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3) How is ‘crop diversification’ of agri-business type different from ‘multiple cropping’?

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8.4 AGRICULTURAL DIVERSIFICATION IN INDIA

Agriculture sector is prone to high levels of risks which include uncertain events like droughts/famines, floods, cyclones, hailstorms, frosts, cold/heat waves, etc. Besides, diseases related to plants and animals, and insects and pests also have adverse effect on agricultural output posing losses or risks. The agricultural sector is also subject to uncertainties by environmental, technological and economic factors which impact seriously on the demand and supply dynamics of agricultural products. Such fluctuations, in turn, adversely affects the potential of agricultural trade. Agricultural diversification is also a method of minimising some of these risks by resorting to protective practices.

8.4.1 Determinants of Agricultural Growth/Diversification

Agricultural growth is a function of the level of technology, government policies, cropped area and production portfolio. Temporal change in agricultural growth (i.e. changes in output levels of agricultural products over time) is, therefore, the cumulative effect of changes in all these components/variables. A well informed policy formulation to promote the agricultural growth/output ideally requires a decomposition of the effect of each one of these components on output. For national accounting purposes, the value of gross output from agriculture (minus the value of inputs) is considered as a measure of income from agriculture. For empirical purposes, crop yields are used as proxy for the cumulative effect of variables like government policies, gross cropped area, change in production–portfolio (i.e. crop substitution) for agricultural diversification, etc. While these are exogenous (i.e. independent) factors which influences the decision on agricultural diversification, as individuals farmers take certain factors into consideration before deciding on bringing about changes in their cultivation habits. These, therefore, could be counted under endogenous (i.e. dependent) factors.

How do farmers change their cultivation practices or what motivates them to do so? Farmers, being rational economic agents, would change their cropping pattern only when they expect an economic gain from such a change. Various determining

factors, from the farmers' angle, for the adoption of agricultural diversification would therefore be: profit margin of new system, availability of market for produce, risk coverage, availability of technology, alternative incentives, and other compelling reasons to shift for a new system, etc.

8.4.2 Progress of Diversification in Indian Agriculture

India is currently producing more than 275 million tonnes of food grains every year. The first Green Revolution (GR) during 1960s helped India in achieving the record agricultural produce. Green Revolution was essentially supply-driven. Large incentives were provided to increase production and enhance supply of essential foodgrains. The techniques developed by the Green Revolution are: (i) extensive use of chemical fertilizers; (ii) irrigation; (iii) use of heavy machinery; and (iv) use of pesticides. The GR substantially increased rice production in India using a package of new seeds, fertilizers and irrigation. The first stage of GR in agriculture was followed by 'White Revolution' (i.e. milk production in which with 90 million tonnes of milk production a year, India is among the highest milk producers in the globe), Blue Revolution (in fisheries) and Yellow Revolution (in edible oil, especially mustard/ rape seed oil). Besides these achievements, India also ranks at a high position in the production of fruits and vegetables. While all these are some major strides taken in diversification of Indian agriculture, these are no longer adequate for India whose population is projected to touch 140-150 crores by 2025. Further, associated with increase in income levels, there is also a change in the pattern of consumption (or demand) of consumers. As we already noted in unit 7, our import of food items have exceeded the exports. Due to all these factors, there is a compelling need to infuse modern methods in agriculture to make the Indian agriculture not only more self-sufficient in all farm products but also become leading food producer in the world. In short, there is a need for a second GR. In recent years, genetic engineering techniques have been used to further enhance some of the GR advances. For instance, many commercial crops have been treated with herbicide tolerance so that their application have eliminated weeds leaving the crops unaffected.

The second GR is expected to follow a strategy distinctly different from the first. Whereas the first GR mainly focused on popularization of high yielding varieties (HYV) and crop varieties to overcome food shortage, the second GR is likely to be driven by changing consumer preferences which are increasingly in favour of high value farm products. The response will be based on harnessing a bouquet of new technologies drawn from the advances made in space, Information Technology (IT) and Bio-Technology (BT) areas. It will, therefore, focus not only on traditional farming but on aspects of commercial farming like: horticulture, floriculture, sericulture, aquaculture, medicinal/aromatic crops and linkages with agro-processing. In all this, one of the main components would be launching an action plan for massive crop diversification.

8.4.3 Merits of Diversification

The merits of diversification are many. These may be stated as follows.

- i) Different crops require different types of soil fertility. A combination or rotation of crops is expected to utilize more fully all the properties of the soil than does concentration, year after year, on one crop. For

instance, cereals use a great deal of nitrates, cabbages more of sulphates, clovers take a lot of lime and root crops make heavy demand on phosphates. If different crops are grown in successive years, it will be possible to restore the elements which one crop uses up before the same crop is planted again sometime later.

- ii) Rotation of crops facilitates reduction of weeds as it permits cleaning operations at different times. It thus minimises any type of weeds from nourishing and spreading year after year.
- iii) Diversification makes it possible to grow more than one crop in a year in the same field where it would be impossible to plant and harvest the same crop twice. It also facilitates breeding of live stock which feeds on the residue of crops/grasses. It, therefore, provides additional source of income to the farmer in the form of meat, milk, wool or fuel.
- iv) Diversification permits more even demand for labour throughout the year due to different crops grown.
- v) Diversification makes it possible for farmer and his family to consume a variety of food that is grown.
- vi) Diversification enables the farmers to spread his risk. If one concentrates on one crop/product, a harvest failure or a price collapse may ruin him. It is very unlikely that all crops/products fail simultaneously in the same year.
- vii) Diversification enables the income of the farmer to be more regular as the crops and animal products will be sold evenly throughout the year.
- viii) Diversification increasingly assumes switching from low value crops to high value crops and helps not only to meet the changing demand for farm products but also increase farmers' income.

Check Your Progress 2

- 1) Fill in the blanks.
 - a) India is currently producing more than million tonnes of food grains every year.
 - b) The first green revolution used a package of,, and
 - c) The wheat production at present in India has increased from million tonnes to million tonnes.
 - d) Diversification of Indian agriculture has successfully encompassed other products/areas like,, and
- 2) Mention some examples of alternative areas for commercial farming on which the second green revolution is expected to lay its thrust/focus.

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- 3) Do you agree that ‘diversification helps an Indian farmer to spread his risk’? State the rationale behind this contention.

8.5 APPROACHES FOR DIVERSIFICATION

It is clear from the above that in the modern era, agricultural diversification is very essential for economic growth. The approaches to diversification should be based on economic considerations helpful in minimising losses or maximising profits. The two considerations can be exemplified by delayed transportation of perishable items which causes losses to the farmer and assured market/price for products grown under terms of ‘contract farming’. The approaches for diversification would thus be based on the following considerations.

8.5.1 Location Specific Programme

Location specific diversified farming system could be adopted for minimising losses of perishable items. Cold storage facilities and agro-processing will minimise losses. Diversification into high value crops and high value products like dairy, poultry etc. would be essential. Large areas of Eastern India, which are prone to water logging, can, *inter alia*, be put under profitable aquatic farming system for products like Makhana, Singhara, Swamp-taro, etc. as well as fisheries.

8.5.2 Contract Farming

Contract farming is another innovation that has been introduced in many states and could accelerate diversification. Indian farmers are constrained in taking to high value crops due to lack of cold storage and ready marketing facilities. India’s laws on agricultural land do not allow corporate bodies to purchase land and operate large scale farms due to a national policy to prevent displacement of a large number of small farmers. Under this situation, corporate buyers who can cater to domestic/export markets, or operate enterprises in agro-processing, can engage in ‘contract farming’ to produce high quality produce. Under this scheme, buyers select area suitable for the crops they are interested in and organize farmers to produce these crops under contract. They provide planting material of the right quality and technical expertise. The process enables the farmers to eliminate their marketing risks while the corporate buyer is assured of quality supplies. The development of agro-processing, based on contract farming, will thus spur agricultural diversification. However, contract farming requires: (i) providing suitable incentives for diversification for which formulating attractive policy initiatives are essential; and (ii) increasing public investment in irrigation, water, rural roads and rural electrification, etc. These infrastructure facilities in turn would attract private investment.

8.6 CROP DIVERSIFICATION AS A STRATEGY FOR NATIONAL COMMITMENT

Crop diversification can be helpful in addressing some of the national problems like: (i) alleviation of poverty and ensuring food security and (ii) ensuring sustainable agricultural development. It can also help in balanced regional development by focussing on area approach to agricultural planning. In fact, the achievements of the past six decades goes to confirm this.

8.6.1 Poverty Alleviation and Food Security

The agricultural growth rate of around 2.7 percent per annum in the post-independence period was much higher than the negligible growth rate of 0.3 percent per annum in the first half of the 20th century. It is not only in the areas of food grain production but also in the production of commercial crops like cotton, oilseeds, sugar cane, fruits and vegetables as well as livestock products and fisheries that we achieved significant increases since independence. This achievement has contributed to significant reduction in poverty. For instance, the incidence of poverty declined from 54.9 percent in 1973/74 to 27.50 percent in 2004/05 i.e. by exactly half or 50 percent. The National Agenda for Governance of the present government has, therefore, given top priority to doubling food production in the next ten years. This includes rice, wheat, coarse cereals, pulses, oilseeds, sugar, fruits and vegetables, meat, milk, and fish. The Action Plan envisages a detailed strategy with specific problems of productivity identified and addressed so that substantial increase in the supply of various food items can be so achieved that the demand for such items for the entire population is not only met but some exportable surplus also remains available. The development strategy to be pursued in the medium term has been consciously interwoven with the country's food security concern. If there is a completely market-driven diversification without regard to national priorities there is likely to be threat to food security. For instance, shifting of area under food crops to commercial crops like 'jatropha' for bio-diesel may upset food security. Therefore, caution should be exercised in agricultural diversification.

8.6.2 Natural Resource Management for Sustainable Agricultural Development

It is a known fact that there is little scope for further expansion of the net sown area (142 mha) and that land scarcity will become an acute feature of the rural economy. Water is a precious national asset and there are several concerns regarding water resources in the country. Therefore, a judicious use of land and water resources will be the central theme for sustainability of agricultural growth. There has been a growing concern in recent years about the deteriorating conditions of soil and water resources due to improper management and pollution. The deterioration has been in the form of land degradation, water-logging and decline in water table. There is a greater need to have an integrated approach in the management of plant nutrients, chemicals and taking effective measures to deal with the overall pollution problems. There are several possible technologies and alternatives to reduce the use of chemicals in agriculture. These alternatives are not perfect substitutes to chemicals but adoption of these can substantially reduce the adverse impact on environment. Proper land and water management policies would

reduce environmental degradation. Community and village institutions are envisaged to be encouraged to participate in protecting the natural resources from degradation. Under this, programmes for regeneration of land and water resources will be strengthened.

8.6.3 Area Approach to Agricultural Planning

A new approach to agricultural planning - the Agro Climatic Regional Planning (ACRP) was put into action in 1988. This was a holistic approach which explicitly recognized the local resource endowments and constraints of the agro-climatically homogeneous regions which quite often cut across different states. The ACRP was a bridge between the resource base and decentralized planning which aimed at providing a scientific support to planning for attainment of sustainability with due regard to basic resources and the local needs. The project was initiated by regionalizing the country into 15 zones/regions, later divided into 73 sub-regions. The principles used for this sub-regionalization were intrinsically related to the character of the agricultural economy like soil, climate, rainfall, etc.

The above brief account has spelt out the various steps taken in the past, and being taken now, to address some of the national issues like poverty alleviation, food security and sustainable/balanced regional growth through diversification of agriculture. In the next section, we shall see what constraints specifically lie in the path of crop diversification.

8.7 CONSTRAINTS AND PROSPECTS IN CROP DIVERSIFICATION

Crop diversification in the recent years is taking the form of increased area under commercial crops including fruits and vegetables. However, this has gained momentum in the last decade favouring increased area under vegetables and fruits and also to some extent on commercial crops like sugar cane, cotton and oilseeds, especially soya-bean. The major problems and constraints in crop diversification, with varied degrees of influence, are primarily the following .

- i) Over 117 mha of the cropped area in the country (63 percent) is completely dependent on rainfall.
- ii) Sub-optimal and over-use of resources like land and water have caused a negative impact on the environment and sustainability of agriculture.
- iii) Inadequate supply of seeds and plants of improved varieties.
- iii) Fragmentation of land holding working against modernization and mechanization of agriculture.
- v) Poor basic infrastructure like rural roads, power, transport, communications, etc.
- vi) Inadequate post-harvest technologies and inadequate infrastructure for post-harvest handling of perishable horticultural produce.
- vii) Weak agro-based industry.
- viii) Weak research-extension-farmer linkages.

- ix) Inadequately trained resources compounding the persistent and large scale illiteracy among farmers.
- x) Host of diseases and pests affecting most crop plants.
- xi) Poor database for horticultural crops.
- xii) Decreased investments in the agricultural sector over the years.

8.7.1 Globalization and Crop Diversification

With the advent of WTO, the scenario of the agricultural sector has changed and will further change very much. Trade liberalization and market access for agricultural products between the different countries has compelled the promotion of a more vibrant diversified agriculture. But there are limits to trade and diversification. For crops on which we have substantial area and production, specially food-grains, the import market has to be insulated through increased productivity which gives us a kind of comparative advantage and also a level playing field so that large scale importation is contained and farmers' interests are protected. The crops which are traditionally exported like basmati rice and spices and condiments also need to be supported in terms of area expansion and quality improvement. More opportunity for both production and post-harvest handling needs to be established. Accelerated growth in fruits and vegetables production is also required for improved nutrition of the country's population. With improved living standards along with increased purchasing power, more and more people will seek nutritional and quality food which call for greater crop diversification. There are some production areas such as food crops, plantation crops, poultry, dairy, sugar, cotton and oilseeds in which India has made its mark. There are some in which its emerging strength is evident like sericulture, marine and inland fisheries. No country grows such a wide range of fruits, vegetables, and flowers and in such abundance as India and yet it has no record worth mentioning in horticultural exports. The rich variety when processed and marketed, can help India take care of the health needs of its population becoming a major exporter of these commodities.

8.7.2 Emerging Technology and Crop Diversification

The agriculture of the twenty first century will increasingly be dependent on farmers' entrepreneurship. This demands harnessing technologies to optimize returns from land and investments made on it. Biotechnology and genetic engineering in crops with focus primarily on productivity and quality is expected to give significant boost for many important crops/plants. With the advent of emerging technologies and consequent scope for increased economic returns, diversification in favour of such crops would have to be the future focus. Many other related technologies and their adoption will also inject an added dimension in crop diversification. Decision support systems, governmental policies, geographic information system, application of information technology leading to market information, etc. will also lead to crop diversification primarily on economic considerations.

8.7.3 Research and Development Support for Crop Diversification

Future agriculture will be much more knowledge and skill based. In the wake of globalization and opening up of the markets, there will be much more opportunity

for entrepreneurship development in agriculture. This calls for paradigm shifts in research and technology development and also transfer of technology for successful crop diversification. The research system not only needs to be vigilant in the areas of emerging technologies but also create a cadre of scientists through continuous upgrading of skills and human resource development. It also needs to popularize the technologies, impart knowledge and skills to the extension functionaries for the transfer of technologies to the farmers. This knowledge-based farming will call for much more interaction between the researchers, extension workers and farmers. The fruits of the innovative technologies should reach the farmers at the earliest and also spread it in the quickest possible time.

8.7.4 Institutional and Infrastructure Development for Crop Diversification

To sustain and operationalise crop diversification, institutional support is required to the two thirds of the country's crop area which is dependent on rains. Crop diversification in terms of reducing the risk of rain-fed farmers is vital to a country like India where two- thirds of the farmers are resource poor. The National Agricultural Research System with its Crop and Commodity based Institutions, Natural Resource Management Based Institutions and State Agricultural Universities are jointly addressing the issues connected with crop diversification. The government has also developed a counter support mechanism through the establishment of Crop Directorates for each of the major crops and groups of crops like Oilseeds and Pulses with technology transfer as its focus on each of these crops and commodities. These directorates act as a coordinating agency between the research and development activities and technology transfer including promotional activities.

Check Your Progress 3 [answer in about 50 words in the space given]

- 1) What are the two main approaches advocated for agricultural diversification? Which one of these 'minimise economic losses' for the farmers?
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- 2) Which are the two main areas in which greater attention is required to be paid in order to make 'contract farming' approach for diversification function well?
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- 3) Fill in the gaps.
 - a) Agricultural growth has increased from per cent per annum (p.c.p.a.) in the pre-independence period to p.c.p.a. in the post-independence period.
 - b) Agricultural growth has contributed to reducing poverty from percent in 1973-74 to percent in 2004-05.

- c) The developmental strategy to be pursued in the medium term has been consciously interwoven with the country's concern.
- d) Proper and management policies would help reduce environmental degradation.
- e) The 'agro-climatic regional planning' (ACRP) approach was a bridge between and Further, the principles used for this were intrinsically related to the character of the agricultural economy like,,, etc.
- f) percentage of total cropped area in India is totally dependent on monsoons.
- g) In the emerging 21st century Indian agriculture, and in crops with focus primarily on and considerations is expected to give significant boost for agricultural diversification.

8.8 STRATEGY FOR PROMOTING AGRICULTURAL DIVERSIFICATION

In the modern era, agricultural diversification is an important strategy for agricultural development. The process of agricultural diversification is largely demand-driven in contrast to the supply-driven process of Green Revolution. In a country like India, there is a greater role to smallholders in agricultural diversification in future in contrast with the rich farmer-driven Green Revolution of the past. There is also greater participation of the private sector especially in marketing and processing. Agricultural diversification for meeting the demand for high value commodities need incentives, institutions and investments. The direction for policy support and emphasis for agricultural diversification, already indicated in the previous sections, is once again reiterated below as suggestions for strategy for agricultural diversification in India.

- 1) Integrated policy such as research, production, post-harvest management, processing and marketing, etc. should be taken under one umbrella.
- 2) Public sector investment in agricultural sector which has witnessed a major decline in the past two decades should be rejuvenated.
- 3) Emphasis on integrated farming system comprising of farming, pisciculture, horticulture, rearing animal, poultry, piggery and goat, etc. to be laid.
- 4) Location-specific diversified farming system to be adopted.
- 5) Measures to conserve and efficiently manage water resources to be facilitated with technological and extension services.
- 6) India's great potential in the field of fruits and vegetable, floriculture, pisciculture, horticulture and animal husbandry, etc. to be harnessed for optimum utilization of the available resources.
- 7) Post-harvest management, storage and marketing facilities to be emphasized. These are critical areas in which the weaknesses should be removed.

- 8) Availability of institutional credit to be enhanced.
- 9) Through attracting and retaining youth in farming, agricultural diversification can be taken to its potential heights. A policy for this to be crafted and implemented in full earnestness.
- 10) The export basket is varied and full of opportunity. Thrust on export of agricultural products which tends to rise agricultural diversification to be duly promoted.

8.9 LET US SUM UP

Crop diversification means moving away from growing a single crop to a number of crops. Such a move towards crop diversification helps in: (a) better use of available land, labour, water and other resources; (b) reduce risks arising out of crop failures, yield losses and market failures; and (c) help realize quicker/regular returns to farmers. However, these advantages of diversification are not without costs as: (i) crop diversification demands higher level of managerial input from the individual farmer; and (ii) small surpluses of various agricultural commodities create difficulties in efficient handling and marketing of the produce. Effective policy and public investment are needed to reduce these inherent weaknesses in Indian agriculture. Indeed, crop diversification has been recognized as an effective strategy for achieving the multiple objectives of food/nutrition security, income growth, poverty alleviation, employment generation, judicious use of land and water resources, sustainable agricultural development and environmental improvement.

8.10 KEY WORDS

Diversification of Agriculture : Refers to the re-allocation of productive resources into new activities.

Vertical diversification : Diversification by way of multiple cropping in which a production enterprise moves into a different level of the supply chain.

Horizontal diversification : Refers to diversification of agri-business type in which a business enterprise develops or acquires new products that are different from its core business.

8.11 SOME SELECT REFERENCES

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World Bank, *Poverty and Hunger: Issues and Options for Food Security*, Washington D.C. 1998.

8.12 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

- 1) See Section 8.2 and answer.
- 2) See Section 8.3 and answer.
- 3) See Section 8.3 (ii) and answer.

Check Your Progress 2

- 1) (a) to (d): see section 8.4.2 and answer.
- 2) See section 8.4.2 and answer.
- 3) See section 8.4.3 and answer.

Check Your Progress 3

- 1) See section 8.5 and answer.
- 2) See section 8.5 and answer.
- 3) (a) to (c): see section 8.6.1 and answer; (d) see section 8.6.2 and answer; (e) see 8.6.3 and answer; (f) see 8.7 and answer; (g) see 8.7.2 and answer.