UNIT 16 AGRICULTURE LINKAGE WITH OTHER SUB-SYSTEMS

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16.0 OBJECTIVES

After going through this unit, you will be in a position to:

• describe the agricultural production processes;
• explain special characteristics of agriculture and their implications for planning agricultural development;
• identify the sub-systems linked with agricultural development and their interrelationships; and
• critically comprehend as to how each sub-system operate and affect the agricultural development process.

16.1 INTRODUCTION

Agricultural production, more specifically increasing agricultural production on sustainable basis over a wide geographical area, is a complex and baffling task. It is complex because a large number of conditions have to be created and/or modified by different people/agencies working together, and without a conscious effort they may not necessarily all be working in unionism. It is baffling because the spirit of people—farmers is also involved. Agricultural production technologies, though important, is/are not enough. They have to be combined with other
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conditions and used with intelligence, imagination, experimentations and continuing hard work. Agricultural development in a geographical area is depending on how effectively people/agencies work together and with farmers, individually and collectively. See Israel, working in a relatively resource poor situation, they have brought transformation, a very good example of technologies, people and agencies working together.

If you carefully look around and scan through the available literature, you may see the agricultural development, increase in production and productivity, has occurred in past as well. Farmers unconsciously experiment and try new ideas. They try new crop varieties, frequently with no other encouragement than seeing them grow in neighbour(s)' field. Farmers have been doing seed selection. For example, they keep bigger maize cobs carefully for using next year as seed, while they consume the grains of smaller cobs. This has been going on since long. What is new in that now, there is a conscious effort by specialized agencies in this direction. This is needed for sustainable agricultural development over a wide geographical area.

Now research specialists are consciously developing new varieties with desirable traits and are trying to discover improved practices appropriate to the new variety/variety in order to be able to optimally exploit its/their production potentiality. Engineers are producing improved implements. Plant Pathologists and Entomologist are developing means to control crop diseases and pest with as little additional expenditure as possible and with minimum damage to the ecology. Agricultural Economists are testing the cost data on economic anvil to see whether or not the new technology(s) is/are cost effective as well.

It is not all. Merchants and businessmen are also developing better methods of handling farm produce brought to the market and are trying to find out better and cheaper ways of transporting them. Governments are adopting new pattern of landholdings, taxation and price policies that encourage individual/group investment(s) and make adoption of better farming practices more profitable.

We are often misled by the success of a few outstanding farmers into believing that the task of agricultural development is easy. Individual farmers may accomplish outstanding result due to favourable conditions, i.e., location of farm, soil/land conditions, availability of irrigation sources, nearness of market, sudden emergence of new demand due to special conditions, the farmers own personal skill and aptitude, etc. It is not possible that all-farmers of an area would change for the better automatically.

Our task is to help you to examine the great variety of factors/conditions that positively affect agricultural development process and help you identify agencies that could create directly/indirectly those conditions that increase agricultural production and productivity and contribute to agricultural development. As agriculture is primitive and progressive, depends partly on knowledge, skill and diligence of farmers and partly on facilities made available by the nation to the farmers as a whole.

As the farmer still constitute about 60 per cent of our population and they need to be cared. And agriculture contributes to about 22 per cent of our Gross Domestic Product that makes farmers and agriculture important. Agricultural development is needed for another reason also. For industrialization we need raw materials;
cotton, jute, soybean, hides, etc. Also industries earnings is dependent on market
for their produce. Larger the market more is need for industrial products. If
farmers income remains low they would make few purchases and this will reduce
demands of industrial products resulting into retarded growth in demands of
industrial products. This would retard the growth of industries.

Since agriculture is important as discussed, let us identify the factors/conditions
that may promote agricultural development over a wide geographical area and
agencies that may help to create the desirable conditions. If agriculture is a
system, as it is, let us call them (other agencies/organizations) as sub-systems for
convenience of our discussions. They are not being called as Sub-System because
they are small; they are being called so because our current focus is agriculture
and agricultural development and the other systems (sub-systems hereafter) are
important players in helping achieve the same.

I would like to start by acquainting you with the agricultural production process
and some special characteristics of agriculture. This knowledge may help you to
appreciate our subsequent discussions/presentations.

### 16.2 AGRICULTURAL PRODUCTION PROCESS

If we take industrial analogy, which most probably you may be in a better position
to understand. I may mention that plants are the primary factories of agriculture.
Carbon Dioxide (CO$_2$) from air and water and minerals of soil are major inputs.
Plants take CO$_2$ from air through their leaves, they take moisture (water) and
needed minerals form soil through their roots. And in presence of sunshine they
(plants) make fruits, seeds, fibres, oils, etc., that man can use with/without processing.

Livestock are important secondary factories of agriculture. They depend on plants
for their food. They eat different parts of plants that man does not use. They may
also eat plants of certain species which as man we do not and cannot use directly.
They (animals) then transform these plant and plant parts into such products as
meat, milk, hides, wools, etc., which we can use.

The growth and development of plants and animals have gone in nature since their
inception on this planet initially without human being’s participation. Thousands of
plants and animals have evolved over time in different parts of the globe as a
result of differences in sunshine, temperature, soil, available moisture, etc. Each
plant has its own requirements. For example, we have broad-leaf plants in tropics,
thin to very thin leaf plants in water deficient regions. We have salt tolerant plants
in areas with saline and alkaline soils and flood tolerant plants in flood-prone
areas. We have apples in temperate areas and mangoes in tropics and plains.
Such examples are numerous. You may like to identify annual and perennial plants
grown/growing in temperate, semi-temperate, tropical, drought-prone areas.

The plants that grow in a particular area/region often determine what kind of
animals, birds, etc., live there. We see camels in desert, fishes in ponds, cows and
buffaloes in grass lands. Similarly we have cranes in cold regions and peacocks in
warm plains and ducks in areas with abundant water.

Thus, it is clear that as a result of differences in climate, soil and water conditions
different combinations of plant and animals are found in different parts of the
globe. Agriculture arose when men started exercising control over the growth of
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plants and animals. The difference between primitive and scientific agriculture, the two poles of a continuum, lies in the degree to which this control has advanced. In most primitive agriculture, men accept and grow crops and rear animals suited to local soils, climatic conditions, etc. As he moves a little ahead, he tries to foster the growth of the chosen ones by eliminating, to some degree, competition of other plants for available sunshine, moisture and soil borne plant nutrients. He also protects the crops from insects and pests as he moves a little more forward.

In a scientific agriculture, men apply their scientific knowledge, skill and understanding to exercise greater control over different factors and conditions that affect plant and animal growth and production. They have provided with irrigation facilities, specific method depends upon the availability of water and crop’s requirements, added plant nutrients, etc. New varieties with specific plant characteristics of higher yielding capacities and more resistances to diseases and pests have been developed. Some are resistant/tolerant to flood/deep water conditions, while others are more tolerant to drought conditions. Similarly man has prepared specific feed and breed animals with specific capabilities. In poly-houses, they control temperature, humidity, moisture and even sunlight conditions. It is now technically feasible to grow temperate vegetables in summer in poly-houses. People are actually growing high value low volume crops in poly-houses all year-round.

16.3 SPECIAL CHARACTERISTICS OF AGRICULTURE

Notwithstanding modern man’s capacity to control a great many factors affecting plant and animal growth and production. Certain things need to be taken into note in any planning for a large scale agricultural development over a big geographical area. These differentiate agriculture from industry. They are:

i) agriculture would remain widely dispersed;

ii) agriculture would vary markedly from place to place;

iii) the timing of farm operations must be fitted to weather conditions;

iv) the time and climatic factor calls for diversification in agriculture;

v) farmers must have comparatively a wider variety of knowledge and skill vis-à-vis factory workers;

vi) each change in a farm practice may require additional change(s) in other practices;

vii) a progressive agriculture is always changing;

viii) in India, there are many times farm managers is also factors manager and the farmers education and other backgrounds will vary more widely;

ix) on an average, the farmers capacity to take risk is and will remain lower than those of industries; and

x) a modern farmer has to deal with much larger number of agencies/sub-systems.
Check Your Progress 1

Note: a) Use the spaces given below for writing your answers.
     b) Check your answer with those given at the end of the unit.

1) Why increasing agricultural production over a wide geographical area is complex?

2) What specialists are doing to improve/increase agricultural production and productivity?

3) Enlist two important characteristics of agriculture that differentiate it from industries.
   a) 
   b) 

16.4 SUB-SYSTEMS LINKED WITH AGRICULTURE DEVELOPMENT

In the agricultural development process farmer is one factor and farmers as a community constitute one Sub-system. Working alone they could hardly achieve/create all conditions for sustainable agricultural development. For agricultural development, farmers have to depend on a number of other sub-systems/agencies/groups of agencies which collectively could help to achieve sustainable development. This I am saying because modern agriculture is quite different from the traditional and primitive agriculture in which farmers were mostly produce for the consumption of family members in which the cropping pattern and technology mostly remained same year after year. A modern agriculture, on the other hand, is the one in which:

i) the technology and efficiency of farming are continuously being improved;

ii) the kind of commodities produced are changing (at least in their proportion) in response to changing market demands and cost of production;
the quality of lands, the competence of labour, types and quantities of inputs used get steadily upgraded; and

number and type of agencies, private and public, that are being involved in the agricultural production process are changing and their roles are being adapted to serve the emerging needs.

The major conclusions, therefore, is that for agricultural development and modernization we need to have a number of agencies (henceforth called sub-systems). For convenience, based on activities and proximity of activities, they may be grouped under the following six heads (Sub-systems):

i) Agricultural Research;
ii) Farm Output Management;
iii) Farm Input Management;
iv) Agriculture Extension and Education;
v) Farmers; and
vi) Govt. Agencies/departments dealing with policies and programmes related to Agricultural Development.

Each of the six sub-systems may have a number of agencies within them, depending upon the specialized roles they play, services they render and activities they perform.

A brief discussion of their characteristics, roles, activities, services, etc., associated with each of six sub-systems and relationships among them is necessary for further understanding of agricultural development and modernization process.

An attempt has been made to roughly describe the relationships among them in Fig. 16.1. A detailed discussion about each shall follow thereafter.
16.4.1 Agricultural Research

Increased agricultural production and agricultural development comes from, *inter alia,* new technologies put into practice on millions of farms. It is simply not possible to get much increase year after year by using the same old plants and animals and caring them in the same old ways. Here agricultural technology means new seed, package of practice, etc. It includes the breeding of animals and the way they are reared. It also includes enterprise combinations by which farmers seek to make the best use of their land, technologies and labour.

For agricultural development to proceed, the technology must be constantly changing and get upgraded. When they stop changing, agriculture becomes stagnant. It may even decline due to decrease in soil fertility and/or increased damage by pests and diseases.

This does not mean that every practice, every item of farm practice, must change every year. Usually change in one may bring some change. But usually when a new ‘package of practice’ is introduced, the change may be larger and impact greater. It has been seen that when a new improved seed is introduced, yield may increase by 20 to 25 per cent. But when a new package of practices is introduced the yield may go up by 50 per cent or more. The National Demonstrations and other demonstrations programme of Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) clearly demonstrate this.

To be effective a new practice, it must show a substantially increased return *vis-à-vis* the old ones. Usually bigger the demonstrated results higher the chance of it being accepted. The reason for this is that there is uncertainty as how effective the new technology will work on his farm. Only the promise of a large additional return can overcome the wise conservative farmer.

The sources of new technology are, (i) practices of other farmers, (ii) introduction from other regions, and (iii) result of purposeful experimentation.

Currently, in India, the agencies associated with new technology generations and identifications are the network of Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs). A few private and nationals/multinationals associated with one or other inputs are also engaged in the development and identification of new technologies. A few State Governments also have agricultural research units.

16.4.2 Output Management

Agricultural development results into increased output of farm products or production of one or more new high value crops. There must be market for these products and prices for them should not only be high enough to repay the farmers the cost and efforts incurred in production but a little more. Following things are necessary for efficient agricultural output management:

i) A demand for produce/increased produce;

ii) A system/agency through which to sale the farm produce;

iii) A price regime which would motivate farmers to produce/increase production; and

iv) Farmers confidence in the working of the marketing system.
There cannot be sustained agricultural development and sustained increased production without growth in demand for the farm produce within the country itself. The increased demand may arise because of increased industrialisation and more individual consumption. Industrialisation creates demands for raw materials and creates more employment which in turn creates more demand for farm products.

There are a number of countries in which industrialization has enlarged domestic market for farm products. As more and more people are employed and their income increase, they not only buy more but also better food, more fruits, vegetables, meat and milk.

Also if a country is particularly suited to grow a crop for which there is a strong international demand. This may provide a basis for increased production of the said item. In many countries, export of agricultural produce make up a large part of total export i.e., Rubber in Malaysia, Coffee in Brazil, Tea in Sri Lanka, Palm oil in Malaysia and Indonesia, Animal products in New Zealand and Denmark.

There is a need to develop a marketing system as very few farmers can sell their own products in large city market(s) and/or abroad. He usually does not have means of transport, market information, facilities for post harvest processing, storage, sorting and grading, etc. Further the volume of produce may not be large enough to justify performances of these operations by farmer (s) himself/themselves. An efficient marketing system provides for all these and such other services as financing, managing of entire marketing operations. A good road network and means of cheap transportation is an important marketing requirement.

Farmers produce in order to meet the needs of their families and themselves. For marketable surplus, therefore, they must get remunerative prices. An assured remunerative price regime motivates farmers to make investments and increase production. We have an example in our own country itself. Once the system of minimum support price and provision of purchase of all surplus foodgrains brought to the market was introduced in late 1960's, foodgrain production increased substantially in less than a decade.

Last but not the least is the farmers confidence in the marketing system itself. In a number of countries, even though farmers know that other crops may fetch higher return, they still grow crops for home consumption for the simple reason that the market is undependable and system is unreliable. There are several ways for building farmers confidence. The official guaranteed price of farm produce is the one. Another factor is the record of performance of marketing system in past. The third is the predictability of the system. The farmers also need to be educated that essential marketing services rendered by merchants and market managers like transportation, storage, grading/sorting, processing, etc., cost and they are to be paid for. Often, due to lack of proper awareness, farmers feel that their share in consumers' money is less because some body is indulging in unethical activities. This should need to be clarified.

16.4.3 Input Management

Most of new technologies that will increase agricultural production and productivity require the use of new inputs (i.e., seeds, fertilizers, plant protection chemicals, etc.) and equipment(s). For agricultural development, therefore, arrangements for
the supply of required inputs at the time and in quantities as required may be arranged so that those who want them and are ready to pay for may get them conveniently.

Fortunately, except a few, most inputs are manufactured locally. These are a few like chemical fertilizers and plant protection chemicals that may not be conveniently manufactured locally. Prudence calls that the establishment of manufacturing capacities for key agricultural inputs should get preference in the process of industrialisation.

Seed is a key input. Fortunately we took an early step in sixties to establish the National and State Seed Corporations and later on permitted private players to play role simultaneously with creation of an independent mechanism and system to ensure availability of quality seed. At every step, namely production of nucleus, breeder, foundation and certified seeds, there is statutory provisions of check and certification.

Similarly there are mechanisms for testing of fertilizers and plant protection chemicals, etc. Creation of fertilizer manufacturing capacities should get precedence in the process of industrialisation. This we did in India.

Simultaneously establishment of local testing facilities for all critical agricultural inputs should get preference, for if farmers feel betrayed even once, they may think several times before trying it/ them again.

### 16.4.4 Agriculture Extension and Education

People learn from own experiences. They also learn by seeing others doing certain “new” things and observing their impact. Such informal learning takes place throughout one’s life. And for such learning one need not be formally “educated”. Such learning, however, is slow. Formal arrangements, on the other hand, accelerate the process of learning. Education also helps to transmit accumulated knowledge and experiences of other people, living and dead.

Besides the “School” system of formal education there is another “formally informal”/“out-of-school” system of education which is called as “Extension Education”. This is for people of all ages and this method of learning is increasingly being used to educate/train farmers about new agricultural technology by using “learning by doing” technique.

In fact, following four types of education are needed for comprehensive agricultural and rural development:

i) Elementary and secondary school education.

ii) Farmers education for development (Extension Education).

iii) Training of agricultural technicians.

iv) Urban education about agricultural development.

Formal school education helps to prepare children for life. It also helps to develop capacity among farmers children to think scientifically about what they are doing, acquire new knowledge, develop new skills and capacities to solve their problem(s) individually and, if needed, collectively. For a long term agricultural development, provision of both formal and informal education system is necessary.
Since the increased abilities of farmers to do farm operations more scientifically is crucial for rapid agricultural development, as discussed, a special programme to facilitate farmers education has been developed. And this informal and out-of-school system of education is called “Extension Education” which is basically an adult education programme. To be effective it has to be different vis-à-vis formal system of education in the following ways:

i) It must go to farmers where they are;

ii) It must be specific to farmers present needs and interests;

iii) It must be fitted into time when farmers are relatively free. Its duration and timing should fit their (farmers) convenience;

iv) The subject of instruction should be new practices of crops/animals being raised by farmers;

v) It must be accompanied by opportunities to practice/try what is being told;

vi) Each new practice must be technically sound and economically profitable; and

vii) It should encourage farmers to experiment or try new ideas being “taught”; etc.

Usually Farm and home visit, Method and/or result demonstrations, Group meeting, Visit to other’s farm(s) and to Exhibitions and Fairs etc., are methods used for this systems of education. Now even computers could play a big role.

16.4.5 Farmers Sub-system

The basic difference between wild vegetation and wild life on the one hand and agriculture on the other is the presence of a farmer. He exercises control over the production processes of selected plants and animals by breeding, feeding and management to serve his needs better.

In the operation of his farms, each farmer has multiple roles - as an individual, a member of a family, a member of a community, a farmer and a manager of his farm business.

As a farmer he takes care of plants and animals in order to get useful products, grain, fibre, meat, milk, hides, etc. These tasks were there in past as well. What is new is that these are new being done using science and technology so as to get more per unit with as less expenditure as possible.

As a manager he has to take a decision or make a choice between alternatives. The decisions each farmer usually makes include choosing among different crops and/or animals and how to use the resources at his disposal on various activities so as to get maximum return. As his farm becomes market oriented his managerial functions get complicated.

Besides being a farmer and a manager of the farm and family business, he is also a member of a family and a community. This both enhances and limits his options. He has to take the interest of his family while observe the societal norms regarding types of crops and animals to rear and manage.
It must, however, be accepted that he is engaged in farming not out of “love”. He is engaged in it to meet his own as well as his family needs. He sees it as a better alternative or he feels that there is no other “worthwhile” alternative. He is also not conservative per se. He often refuses to jump over a new idea because his capacity to take risk is low. Further his expectations from the new one is not very high. The success of the high-yielding varieties programme with respect of wheat and rice in particular show that if the new technology promises and demonstrates capacities to bring substantially high yield/return, he is keen to adopt it/them. Also if other “Sub-Systems” are ready to create favourable situations, he is more likely to change and go for a new technology and/or “package of practices”. Left alone, he may be reluctant to change.

One important factor often lost sight of is the capacity of farmers as a group to think and act upon. Some group actions are informal like helping each other in farm operations, local distress, disease and pest management, etc. Some may be more formal like arrangements for inputs and marketing of outputs through cooperatives, construction and maintenances of field channels and minor irrigation that would ensure equitable and scientific use of water, etc. Often both formal and informal sharing of successful experiences may go a long way in modernizing agriculture. Acting together they may also form “pressure groups” to make Central/State Govt.(s) to take decision(s) which will facilitate agricultural development.

16.4.6 Government Policies and Programmes Related to Agricultural Development

As you know, policies, programmes and actions of Governments have profound effects on the rate of agricultural development. These policies, programmes and actions may be of many types and in many areas, viz., related to land ownership, tenancy, and consolidation of holdings, taxation, domestic prices and tariffs, public investment on agricultural/rural development activities, promotion of private investments, support to agricultural research, education and extension services, credit, market regulations, etc. Several Central and State Government Departments/Agencies are associated with them. Complications are more because constitutionally agriculture is a “State” subject. But we have central agencies/organizations as well and their number is large.

We have the National Planning Commission. It often decides/suggests what the Central and/or State Government should do and how the resources are to be distributed on carrying out different programmes and activities. We have State Planning Boards to do same at the state levels.

We have the central/state agencies related to agricultural researches and education, seed production, fertilizer and agro-chemical production and distribution and quality control, etc. We have States Government Departments dealing with land ownership, tenancy, consolidation of holdings. We have another departments for road network construction and maintenance and yet another for construction and maintenance of irrigation facilities.

It must, however, be clear that notwithstanding the Government (Centre and/or State) potentiality to play crucial role in agricultural development, the actual production or increased production is to be brought about by individual farmers based on his/their own perceptions. He not only decides what to grow but also what technology to use in the production.
Notwithstanding prevalence of this situation, it should also not be lost sight of, is the fact that Government through its regulatory mechanism and system of incentive and disincentive do affect individuals decisions.

Considering the agro-ecological diversity, agricultural planning has to be regional. But while planning at the local level, we should not ignore national and international situations. In the days of globalizations, the State's roles have to grow in free economies as well. But no matter what we plan and in the planning, we must be clear that farmer is there in the business for his own and his family welfare. The State's role is to educate, motivate, guide and support rather than to order or direct. This is particularly so in agriculture in India.

Check Your Progress 2

Note: a) Use the spaces given below for writing your answers.
    b) Check your answer with those given at the end of the unit.

1) Name two broad groups of Sub-systems associated with agricultural development.

2) Name the two major agricultural research organizations of India.

3) Write any two conditions/situations are necessary for efficient agricultural output management?

16.5 LET US SUM UP

Modern agriculture/agricultural development is a complex and baffling task as, apart from the spirit of farmers themselves, a large number of agencies (called sub-system here) are involved in the process of creating conditions for optimum
realization of agricultural development potentiality of an area. This is particularly so because (i) agriculture deals with a large number of living organisms (plants and animals, etc.) each having its own life cycle and they survive and thrive under specific agro-ecological conditions, and (ii) total control over the condition affecting agricultural development of an area by individual farmers is not possible. Besides, the very specific characteristics of agriculture in India make total control by any one agency/organization almost impossible.

On the basis of experiences, agricultural development specialists have identified six groups of Sub-Systems (based on their functions/functional proximity) associated with agricultural development of an area they are, Farmers, Agricultural Research, Agricultural Extension & Education, Input Management, Outputs Management, Government Departments/Agencies dealing with formulation and implementation of agricultural policies and programmes. The complex nature of interrelationships among them makes their coordinated and synchronous functioning difficult. A proper understanding of roles of each Sub-System and interrelationships among them, however, is essential for all associated with agricultural development.

16.6 KEY WORDS

Diversification : Raising of more than one crop/enterprise is called diversification.

 Marketable Surplus : Total production minus family and farm requirements of the farmer.

Primitive Agriculture : The old system of agriculture in which farmers were mostly producing for the consumption of family members.

Sub-system : It is a part of the complete system. As in the process of production, input management is a sub-system.

16.7 SOME USEFUL BOOKS/REFERENCES


Check Your Progress 1

1) It is complex, because a large number of conditions have to be created and/or modified by different peoples/agencies working together.

2) Developing specific irrigation methods, adding plant nutrients, developing high yielding varieties and plant protection techniques.

3) a) Agriculture world remain widely dispersed.

   b) Agriculture would vary markedly from place to place.

Check Your Progress 2

1) Farm Output Management and Farm Input Management.

2) Indian Council & Agricultural Research and State Agricultural Universities.

3) Demand for produce and system/agencies through which to sale the farm produce.