CHAPTER III
CONCEPTUAL FRAMEWORK: AGRICULTURAL INVESTMENT PORTFOLIO
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Conceptual Framework: Agricultural Investment Portfolio

3.1 Introduction
This chapter throws lights on the underlying concept of agriculture portfolio diversification available exclusively for farmers who are conventionally not aware of the investment alternatives. Generally, farmers being the retail investor must be investing their surplus or hard-earned money into other avenues to recoup the returns over the years; here, the present study is delimiting into the diversification strategies available for farmers. Holistically, this chapter briefly covers the meaning of investment, agricultural investment and portfolio attributing to Markowitz theory, agrarian diversification - classification, reasons & determinants of diversification. Finally, it narrows down to the cropping methods and diversification with special focus only on crops.

3.2 Investment
Technically, investment means using the money for purchasing assets with the hope of generating income in the future or for increasing its value over a period. Investment is the sacrifice of certain present value for the uncertain future reward (Ball, 1982). Investment, in other words, is forgoing consumption in the present to pursue a higher level of income in the future. It includes the purchase of stocks, shares, bonds and securities, the purchase of real property like residential, agricultural or other commercial lands, real estates, machinery, equipment, and transport for commercial purposes.

Accordingly, investment can be understood as the activities that result in the accumulation of capital that is capable of yielding a stream of returns over a period. In economic growth theory, initiated seventy years ago by Harrod and Domar, investment is merely a change in capital stock or fixed inputs used in a production process (Domar, 1946; Harrod, 1939). From the 1940s to the present, the authors’ growth formula has been greatly adopted and used for calculating target rates of investment in economic planning and development. Robinson (1956) states that investment is an addition to capital, which occurs when a new house or a new factory is built. Thus, the investment indicates making an addition to the stock of goods in
existence, and it is the part of production not merely replacing past sales but is conducted to increase the rate of output in the future. In official national accounts, investment is primarily connected to as Gross Fixed Capital Formation (GFCF), a macroeconomic concept. This concept does not make any adjustments to exclude the consumption of fixed capital (depreciation of fixed assets) from the investment figures. Regarding land, GFCF includes only the value of land improvement as a net addition to wealth. Investment is mostly about changes in produced financial assets, the stock of which can be progressed through economic activities.

Investment is an agreement of current outflow of money for some period in expectancy of a future inflow that will pay off for the changes in the purchasing power of money and the uncertainty associating with the inflow of funds in future (Goyal & Sharma, 2014). Investment objectives cannot be the same for all levels of investors. It is on the basis of investment made by the person, who is an individual investor or an institutional investor (Theron & Vuuren, 2018). They are specific to the individual investor depending upon the level of the risk, tolerance, return to be generated, age, time horizon, and other associated elements.

3.2.1 Investment Motives or Goals
The goals of an individual are circumscribed by their physical, emotional and other needs. But the aim of an institution generally stems from their source of funds and promises they have made to the providers of the fund. The desire to postpone current consumption for higher consumption in future manifests in many ways. In the views of Barber, Odean, Barber, & Odean (2013), the investment motives divide investors into two class, individual and institutional investors.

3.2.2 Investment Goals of Individual Investors
- Buying a new house
- Financing children's education
- Saving for independence in old age
- Saving for a trip abroad
- Saving now to start a venture later.
3.2.3 Investment goals of the institutional investors

- To generate at least the promised return for the investors
- To create a maximum possible return for all the subscribers.

Agriculture is a core theme on the development agenda in developing economies as it is a key to trigger economic growth, a panacea for solving the problems of poverty, food insecurity and scarcity, employment menace and ultimately meeting environmental goals (Barber et al., 2013; Sahan & Mikhail, 2012).

3.4 Agricultural Investment

Agricultural Investment is mainly involved with investing funds in agricultural and allied activities by government, public or private investors to generate incomes leading to capital formation in the sector. At the universal level, there is growing evidence that productive investments in the agricultural sector, especially of the developing countries can substantially lessen poverty and famine. Agricultural investments can cause a wide variety of developmental benefits to people in both rural and urban areas guaranteeing an all-encompassing growth. Many elements like availability of land, finance, quality labour and other agro-infrastructure; the legal and institutional framework prevailing in the country; the terms and conditions of the investment and the socio-economic conditions in the investment area determines the growth of this sector. Agricultural development to a great extent depends on the synchronised growth of farm-level production and productivity and the value chains linked to it. Value chains comprise of a wide array of small- and large-scale activities that involve supplying farm inputs, processing, storing, distributing, wholesaling, retailing and exporting farm products. These activities can be referred to collectively as ‘agro-industries’. In the dynamic globalised and liberalised socio-economic scenario, there is a need to look at both farm-level investment, as well as investment in agro-based industries for ensuring a smooth and steady agricultural growth.

3.4.1 Investment for On-Farm Agricultural Capital Stock

The low productivity of agriculture has resulted in insufficient food production leading to persistent poverty and food insecurity in many backward and developing economies worldwide. For any investment to impact production and productivity positively, it must contribute to the capital formation at the farm level. The low
productivity of agriculture is an indicator of low per unit output of factors of production. Land and labour are the prime factors of production in agriculture. Low labour productivity, or Lowland productivity, or the pooled effects of both are responsible for the low productivity of agriculture. Agricultural products are outcomes of tamed natural processes that take place on land, and this is achieved with human labour. The land has to be worked to generate agricultural outputs. Land and labour are indispensable primary elements of the farming sector. Land, as a non-produced asset, is fixed in supply whereas labour is inherently variable. Depending on the population or on workers’ preferences, the labour force or the amount of time worked can change. Agriculture on the aggregate level is an industry characterised by a combination of fixed land with variable capital. This combination is typical of low-productivity agriculture in which land size has natural limits, and the agricultural labour force is expanding. For the economy as a whole, there is a little possibility to augment the spread of agricultural land, particularly when apprehensions for the environment are mainstreamed into economic activities. Growing numbers of people taking refuge in agriculture for their livelihoods is a fact of life in developing economies. As such, the model of agriculture pertinent to this analysis is characterised by fixed land and variable labour, which are determined by environmental, socio-economic, political and demographic factors that lie outside agriculture.

According to economic theory, a fixed tract of land combined with increased labour produces increased output at a decreasing rate, as it is bound to face inescapable diminishing returns to labour. Productivity increases from the land decline as the land are accomplished with more labour force. Furthermore, land loses its fertility as soil nutrients get extracted through frequent cropping. A model of fixed land with increasing labour and declining fertility loss through time approximates the reality of backward agriculture. This reality will not change unless a compensating mechanism is put in place in the form of land improvement and fertilising. Indeed, underdeveloped agriculture is delineated by the low level of compensating mechanisms to offset fertility loss. The set of offsetting mechanisms is part of a broader concept called land-augmenting technology (Thodaro & Smith, 2003) which is the application of a specific form of capital that enhances the productivity of the land. That form of capital consists of newer methods and newer technologies for
doing things. Raw agricultural labour is the human expenditure of energy to do useful work.

There are natural limits on the amount of energy an individual worker can exert. The natural limit of raw human labour can be extended with tools and mechanical implements. However, agricultural labour is not simply an application of physical force. In working the land and in dealing with natural forces, knowledge and skill guide the physical labour that is augmented by the use of tools and implements. Tools, implements, skill, and knowledge are all factors of production that constitute a form of capital that enhances the productivity of labour. It can be referred to as labour-augmenting capital. Literature makes a clear distinction between capital and technology. However, empirically it is challenging to separate technology and capital. Also, the ultimate rationale for the use of technology in combination with capital is to enhance labour. For these reasons, it is unnecessary to expend effort in distinguishing between capital and technology. The use of capital fused with technology may be conceptualised as labour-augmenting capital in the same way that there is land-augmenting capital. In a developing country, agriculture, advanced skills, knowledge, tools and implements are rudimentary which lead to high productivity.

An expanding agricultural workforce with basic skills, knowledge, tools and implements creates a situation where output per worker (agrarian labour productivity) declines. It is the result of a combination of two factors: a growing number of farm workers and inadequate working capital. The possible combinations of raw-labour, land, capital-augmented labour and capital-augmented land provide a range of possibilities for productivity. The lowest level of productivity (traditional agriculture) arises from the combination of raw-labour and land. The highest productivity (modern, developed agriculture) results from the combination of capital-augmented labour and capital-augmented land (Syed & Miyazako, 2013).

3.5 Agricultural Investment Portfolio

An investment portfolio means a collection or combination of assets owned by an individual or by an institution. It is a classification of financial assets such as bonds, commodities, currencies, stocks, and cash equivalents, as well as their fund
equivalents, including mutual, exchange-traded and closed funds. A portfolio can also consist of non-publicly tradable securities, like real estate, art, and private investments. Investing in agricultural Portfolios in the study signifies the various combinations of funds used by investors and controlled by financial professionals and money managers to mitigate risks and maximise returns in agricultural activities. Investors should construct an investment portfolio as per their investment objectives, cost, risk tolerance, and return. Investors can also have multiple portfolios for different purposes. (Williams, 1938) Williams observed that the future dividends of a stock or the interest and principal of a bond might be uncertain. He said that, in this case, probabilities should be accredited to various possible values of the security and the mean of these values used as the value of the security. Finally, he assured readers that by investing in sufficiently many securities, the risk could be virtually eliminated

Markowitz, (1952) in their book explained that on the basis of Markowitz (1952), called the father of modern portfolio theory (MPF), but Roy (2001) can claim an equal share of this honour that abridges the contributions of both. An article on portfolio selection proposed expected (mean) return, E, and variance of return, V, of the portfolio as a whole as conditions for portfolio selection, both as a conceivable hypothesis about actual behaviour and as a saying for how investors ought to act:

1) The expected gains on the weighted average of the expected returns on individual securities, and

2) The variance of return upon the portfolio is a particular function of the deviations of, and the covariance’s between, securities and their weights in the portfolio.

**Issues in the General Portfolio Selection**

For the case in which one and only feasible portfolio that minimises variances among portfolios with any given expected return that illustrated the set of efficient portfolio is piece-wise linear (Markowitz, 1952). It may be traced out by starting with the unique point (portfolio) with minimum feasible variance, moving in a straight line from this point, and then perhaps, after some distance, moving along a different straight line, and so on, until the efficient portfolio with the maximum expected return is reached. He explained that the present formulas for the straight lines that make up the set of efficient portfolios. Tobin (1958) involved with the demand for money as distinguished from the other "monetary assets." Monetary assets, including cash, were
defined by Tobin as "marketable, fixed in money value, free of default risk" money will be the only other monetary asset. The next-to-last section of the article was on "multiple alternatives to cash" (Sharpe, 1964). In his study, the capital market equilibrium is based on two critical assumptions: all investors able to borrow or lend funds on equal terms with a common pure rate of interest & homogeneity of investor's expectation. Two major contributions of Sharpe's are the single factor model and the Capital Asset Pricing Model (CAPM). He also pointed out that the first one deals with a supply-side model of how returns are generated; the latter one is a demand-side model. The models can hold independently, or separately, and both are used in practice. Lintner (1965) discussed the problem of selecting optimal portfolio by risk-adverse investors who have the alternative of investing risk-free securities with a positive rectum and who can sell short if they wish. He developed different crucial equilibrium properties within the risky asset portfolio. He examined the complications introduced by institutional units on amounts that either individuals or corporations may borrow at given rates by rising costs of borrowed funds and certain other real-world complications.

Mossin (1966) developed a theory of market risk premiums and also discussed the risk price idea and showed that general equilibrium implies the existence of so-called market line relating per dollar expected yield and standard deviation of the yield. He further discussed the concept of the price of risk in terms of the slope of this line. In general, these models do not take into account simultaneously uncertainty and environmental issues.

**Modern Portfolio Theory – Mean-Variance Optimization**

To decide the role of agribusiness assets in a mixed-asset portfolio model, the modern portfolio theory (MPT) of mean-variance optimisation is used. Using the basic premise that most investors require higher rather than lower returns, and prefer lower risk to higher risk, (Markowitz, 1952) showed that different assets could be combined to produce an 'efficient' portfolio that will give the highest level of portfolio return for any given level of portfolio risk, with risk measured by the variance or standard deviation. Alternatively, an adequate portfolio gives the minimum level of portfolio
risk for a given level of portfolio return. These portfolios can be connected to create what is known as an 'efficient frontier'.

**Figure No: 3.1**

![An efficient Frontier](image)

**Source:** (Johnson, Malcolm, & O’Connor, 2006)

An example of an efficient frontier that characterises the extent of the risk/return set of asset combinations. The frontier is a plot of all the efficient portfolios along the spectrum of risk levels (standard deviation) and returns levels between the minimum risk portfolio (A) and the maximum return portfolio (B). Inefficient portfolios are those under the efficient frontier that could improve their return without raising the risk or lower risk for the equal level of return (Johnson et al., 2006)

On the efficient frontier depicted in Figure 3.1, by letting $W_i$ be the weight of the portfolio in any asset in the number of assets, $R_i$ the forecasted annual continuously compounded rate of return, $P$ the day-to-day stock price and $t$ the period, the expected rate of return on the portfolio is given by:

$$E(R_p) = \sum_{i=1}^{n} w_i R_i$$

where:

$$R_i = \ln \frac{P_t}{P_{t-1}}$$

That is, the anticipated return of the portfolio is just the weighted mean of the return on each asset forming the portfolio. Likewise, the variance of the return of a portfolio is the weighted mean of the variances of each asset making up the portfolio and can be calculated using this formula (Johnson & Connor, 2006).
Despite recent poor financial performance in agriculture, returns to the best performing agricultural operations in Australia have roughly matched those from other sectors of the economy. Because these returns move relatively independently of another asset.

3.6 Building an Agricultural Portfolio

The above analysis shows that the returns from agricultural investment are determined by aggregate rainfall and commodity prices, and also farm management and asset appreciation. The first two factors are not within investors’ authority and are unpredictable. It implies that the associated risks are best handled through diversification so that investments are selected to spread funds across regions and sectors where returns are unlikely to move down together. Thus, the first step in making an agricultural investment portfolio is to find regions where rainfall is uncorrelated and sectors where commodity prices are uncorrelated. The other two factors driving agriculture returns – farm management and asset appreciation – are specific to each investment and require selection of top-performing projects (Coleman, 2007).

The next step towards making a diversified portfolio is to use perform a cluster analysis to find the strength of relations between returns across different agricultural sectors. As locations and commodities are ranked so that the closeness of cells in the table is a degree of their relationship, the table should be occupied with quality projects spread across the cells (Coleman, 2007). The result is a portfolio of agricultural investments that are naturally hedged against the risks from uncertainty in rainfall and commodity prices. Its long-term return equals the weighted average return expected from individual projects. Although diversification reduces the uncertainty in returns, the expected return is determined solely by the performance of investments. Thus, the selection of individual projects is critical and should be based on sound fundamentals. These include good management, a secure supply chain and favourable performance and pricing.

Studies by Johnson & Connor (2006) in Australia and overseas Hardin & Cheng (2002) confirm that relationships between returns from listed agricultural firms and
other asset classes are usually well under 0.5. As a result, adding investments in agriculture to a traditional portfolio can lessen its risk. Returns to the best-performing agricultural operations in Australia have roughly matched with those from other sectors of the economy. In agriculture, about one-third of investment returns are specific to projects, so these need to be selected based on comprehensive fundamentals and favourable assessments. Another third of returns arise out of exogenous factors that bring risks from the ambiguity of climate and goods markets but can be naturally hedged by a suitably diversified portfolio.

**Figure No: 3.2**

**Building an Agricultural Portfolio**

![Diagram](image)

*Source: Developed by Author*

### 3.6.1 Meaning and Concept of Agricultural Diversification

The growth of Indian agriculture sector is in a steady decline which is a matter of more anxiety before the policy makers of India. The retardation in agriculture, the first sign observed in the mid-1990s was mainly because of the reduction in the public investment in the agriculture sector, while with the late 1990s sign became adverse. The compound annual growth rate of food production has shrunk from 2.9 percent to 1.7 percent annually in the 1980s and 1990s respectively (Mohanty, 2010). For the period from 2000-01 to 2008-09, it recorded stagnation in growth (2.3 percent per annum) (Anwer, 2010; Government of India, 2010)
Furthermore, the growth rate of agriculture and allied sector lowered from 4.9 percent to 1.6 percent annually in 2007-08 and 2008-09 respectively (Anwer, 2010). Moreover, agriculture sector is also suffering the number of constraints such as; decreasing total factor productivity (Shivay, Singh, & Rahul Anshu, 2010), fragmentation of land, rural indebtedness (Dwarkanath, 2010), irregular rainfall, extraordinary and uncertain whether states, weak agro-based industry, illiteracy, lack of training, host of disease and pest, and reduction in investment in agriculture sector (Harzra, 2001), shortage of infrastructure such as; inadequate cold storage and processing infrastructure, road network, transport, (Birthal, Jha, Joshi, & DK, 2006), deterioration of soil health, depleting of water table, ineffectiveness in transfer of technology, lack of investment in post-harvest technologies, drop in the gross capital formation in agriculture sector (Pratap, Birthal, JOSHI, Sonia, & Harvinder Singh, 2008), inadequate power supply, depressed rural credit scenario (Patel & Amit, 2010) and evaporation of markets caused by the increasing global integration. In addition to many arguments developed as the cause of stagnation in agricultural growth including technology and policy fatigue, incomplete agricultural transformation and a higher level of specialisation (high dependence on wheat and rice farming) and declining public support (Deshpande, Menta, & Shah, 2007) have made agriculture an uninviting and loss-making venture.

In this circumstance, this calls for the alternative opportunity that is agriculture diversification has arisen as a significant tool to lessen the farmers’ suffering. Diversification should be used as way of not only getting the course of commercialization by increasing the markets of agricultural items on account of the permanency and change in the relative benefits of crops over time (Anwer, 2010; Deshpande et al., 2007) but also, to realise the objectives of output growth, to expand the farm income, employment creation opportunities (Barghouti, Kane, Sorby, & Ali, 2004) and natural resources' sustainability (Chand, 1999), alleviate poverty, export promotion, refining productivity of scarce resources (eg.water) , loyal food security, improving ecologically sustainable farming system through the preservation and enrichment of natural resources and preserve valuable soil and water resources (Chand, 1996; Joshi, Gulati, Birthal, & Tewari, 2003; Vyas, n.d.). Agriculture diversification in support of horticulture and livestock products is required to increase
farm employment and income, cut the differences across space and time, check degradation of natural resources and boost exports. (Weinberger & Lumpkin, 2007).

Moreover, “diversification of agriculture will curtail the contrasting effect of the system of current crop specialisation and monoculture or sole cropping for better soil condition, nutrient recycling, reduction of risk uncertainty and improved resource use and also it can be an efficient mechanism for exhausting the effect of risk on farmers' well-being (Jorge, Quiroz, & Valdes, 1995). It will also insulate better economic feasibility with value-added products and even improvement of ecology” (Jana, 2006b). Many economists uphold that the diversification is a tool which involves moderating price risks and production risks of falling output and the risk management. This is an involving strategy doing more than one activity at any given time. However, the agriculture sector shows diversification as an alteration, in terms of area, income, uses, production, and shift of resources from one crop (or stocks) to large mix of crops and stocks, or from one initiative to another, and it also encompasses moving away from farm to non-farm production like agro-processing. Keeping in view the changing nature of risks and anticipated returns from each crop/livestock activity and arranging it in such a way that it leads to the well-made portfolio of income. Agricultural diversification assumes the transformation in crop-mix, enterprises-mix and activity-mix at the household level and it is regarded as a shift of resources from monoculture to a broad mix of crops and livestock. Based on these descriptions, the nature of diversification can be broadly termed as:

1. A shift from the less profitable agriculture (crops and livestock) to the high-value Agriculture (Fruits, Vegetables, etc.).
2. Diversification among cereals to non-cereals food crops.
3. A resource shift from farm activities to non-farm activities; like animal husbandry, fishing and poultry etc.
4. Use of resources in a broader mix of diverse and alternate activities within the agricultural sector (Joshi et al., 2003).
5. Diversification between the low productivity to high productivity crops. As the share of agriculture in GDP, is declining this means to a greater extent diverted resources into non-agrarian section especially the labour force. Developing and advanced countries workforce share in agriculture sector declining and gaining force in secondary and tertiary sectors. Thus, the inside
diversification in agriculture sub-sector is taking place in terms of a move away from crop production to additional agricultural activities. The area under inside commercial crops is increasing, while that under the inferior cereals is decreasing (Vyas, n.d.).

3.6.2 The Concept of Agriculture Diversification
Different authors convey the idea of agriculture diversification in different ways. It is a movement of resources, generally out of agriculture to industry and services also a kind of structural transformation in agricultural performs like cropping pattern, nurturing livestock or in a farming enterprise. Higher completion in farm activities, high would be the enormousness of diversification, and the lesser competition leads towards specialisation (Singh, Kudrat, Jain, & Pandey, 2011). Diversification within the agriculture sector is a shift from a less remunerative traditional cropping pattern to high value-added diversified agriculture. Diversification, in other words, involves the changes in product portfolio from low-value commodities like milk, meat, egg, vegetables, and fish by the market demand that creates the new horizon for the rural income source (Mukherjee, 2012).

3.6.3 Classification of Agricultural Diversification
The process of diversification mainly classified into horizontal diversification and vertical diversification.

3.6.3.1 Horizontal Diversification
One of the most common spectacles in India is the horizontal type of diversification. Under this approach, diversification takes place by adding more crops to the existing cropping system as means of improving the overall productivity of a farm or a region of farming economy, or a shift from the subsistence farming to high-value crops.

3.6.3.2 Vertical Diversification
In the case of vertical diversification, for the addition of value in the current cropping system through the activities like processing, packaging, and branding or other efforts to improve product value (Jana, 2006a)
3.6.4 Reasons for Agricultural Diversification

Various factors give rise to the agriculture diversification in India. The agricultural output, approximately 60 percent of the sown area, depends upon the erratic rainfall due to the gamble of monsoon. Apart from this, the majority of Indian farmers belong to small and marginal farming category and cultivate low-value survival crops like; wheat and paddy. This subsistence agriculture system has led to severe economic, social and ecological problems such as deceleration in productivity growth, a decrease in agricultural self-employment, overexploitation of groundwater resources and a decline in soil productiveness (Chand, 1999).
Moreover, Indian farmers suffer from low productivity, low capital formation and weak investment, low prices, deprived infrastructure, and dramatic incidence of two sets of natural disasters such as flood and draught which seriously affect the gross cropped area; resulted in farmers’ distress. Low per capita income, low purchasing power and high production cost which all led to a high number of farmers’ suicides in many states of the country. On the other hand, After China, India is the largest populated country in the World. Therefore, the constant rise in population with limited availability of land is a dominant challenge for the policymakers that how this limited land can be used for the feeding of the rapidly expanding population. Hence, the agriculture diversification is required for the proper land use planning for food security, risk coverage; rural employment opportunities, sustainability of production system, mono-cropping high risk, etc. (Anwer, 2010; Punam, 2008).

3.6.5 Determinants of Agriculture diversification
Various factors like physical, economic, social and governmental determine the agriculture diversification which are vital to control the agricultural practices in any region to help in knowing the suitability and the competition among crops. The driving forces leading to the farming diversification in a particular socio-economic set up are the educational qualification of household farmers, technological know-how, and easy access to the markets nearby (Jha, 1996). These factors broadly categorised into natural factors, institutional factors, and public interventions.

Natural Factors
Physical and natural factors involving the soil, temperature, rainfall, humidity, drainage and slope of the agricultural land are radically modifying the cropping pattern. Modification by any effort of these physical and natural conditions to introduce a different cropping pattern may prove, in most of the situation, somewhat tricky and also economically non-viable. But in some other circumstances introduction of technology can modify these conditions.

Institutional Factors
The institutional factors are the unavoidable factors which determine and control the market. The main objective of agriculture diversification is to maximise profit and also to respond to the price fluctuations in the market. Market infrastructure and
institutional arrangements are equally important to the market. Besides the market, there is one more set of factors which regulates agriculture diversification.

Public Intervention
Public intervention is another set of factors which influences the nature of the cropping pattern and extent of diversity and stress given by the policymakers on food security by producing food grains within the country. The result of these whole series of policy intervention like price, credit, research and development were sketched and favoured for the production of food grains to meet the needs of the country. But the country ones reach the food security threshold which remains growing more food grains. One of the major factors of income stabilisation in Southeast Asian countries is to direct public policies for the rapid diversification of the rural economies. But in the Indian context, this factor is one of the few factors prompting us to accelerate the pace of diversification (Vyas, n.d.). These include increasing small holding incomes, fuller employment generation in farm households, seasonal stabilisation of farm income and also the conservation and enhancement of natural resources.

3.6.6 Stages of Agriculture Diversification
The agriculture diversification may pass mainly through four stages as given below

- Cropping system shifts from monoculture to multiple cropping at the first stage, generally this is a phenomenon that occurs in the developing countries and most of the third world countries come under this category.
- Farmers start more than one enterprise at the second stage, for example, crop and animal husbandry besides the number of more crops in a year more than one.
- The initiation of mixed farming is the third stage.
- In the last stage diversification activities which are blended beyond the agricultural domain such as adding the value through the processing, packaging and also producing by-products examples like pickles, jam, etc.

3.6.7 Strategies for Improving Agriculture Income
Strategies for improving agriculture income through the suitable system of crop diversification portfolio or combination of the different cropping system. Improving
agriculture income guarantees the practice of agriculture is linked up with components of soil, seed, nutrient provision, irrigation, protection from weeds and proper harvesting and also storage facilities consideration

Figure No: 3.4

Source: fao.org

3.7 Crop Diversification

The notion of crop diversification in agriculture points to a "paradigm shift from one crop to another crop, causing an acceptable change in the existing cropping pattern towards more symmetrical cropping system to meet ever-increasing demand for cereals, pulses, oilseeds, fibres, fodders and grasses, fuel etc.it tries at improving soil health and agro-ecosystem," (Jana, 2006a).

Furthermore, it indicates the use of resources in the large mix of diverse crop group having parallel activities within crop sector and shifting of resources from less value crop to high-value crops. This description of diversification needs to be distinguished as the transfer of production-portfolio or resources from low-value commodity group (crop and livestock) to high-value commodity group (crop and livestock). And, it is specifically the transition to high-value agriculture that indicates yet another way to augment income, besides the traditional forms of enhancing yield, area or cropping intensity.
Crop diversification is a policy for guaranteeing food and nutritional security, alleviation of poverty, natural resource management for sustainable agricultural development and proper agricultural planning for different regions with varied resource bases" (Joshi, Gulati, Birthal, & Tiwari, 2004). Many economists deemed crop diversification as a tool for risk management.

3.7.1 Intercropping
Intercropping is a good agriculture practice of the cultivation of two or more crops in the same place at the same time. It is the commonly used old cropping practice, which aims to match the efficiency of crop demands to the available growth resources and the labour. The main advantage of this type of cropping is the production of exceptional yield on a given piece of land in the way of making more efficient use of the available growth resources. The mixture of crops of different rooting ability, height, canopy structure and nutrient requirements based on the appropriate utilization of growth resources are ensured by the component crops.

Moreover, this type of cropping system improves the fertility of soil through biological nitrogen fixation with the use of the legumes; soil conservation increases through greater ground cover than sole cropping. This type of crops often reduce the pest incidence and improve feed quality by way of increasing crude protein yield of forage. Intercropping also helps to provide insurance against crop failure or the unstable market prices for a given commodity, especially in the areas where extreme weather conditions like landslides, drought, flood, etc are anticipated. Thus, it offers excellent financial stability instead of single cropping, which becomes convenient for labour-intensive small farms.

Besides all these, intercropping allows to reduce requirements of fertiliser and pesticides use through the lowering inputs, thus a chance of minimising the environmental impact of agriculture. In the words of Andrews intercropping also referred as polyculture or mixed cropping is the agriculture practice of cultivating two or more crops grown in the same space at the same time (Andrews & Kassam, 1976)
3.7.2 Crop Rotation
It is the practice of planting a sequence of crops in the same field. This practice is used for the management of pests, plant nutrition, crop scheduling and so on.

Benefits of Crop Rotation
- Build soil fertility.
- Preserve the environment.
- Boost economic returns.
- Aid control of weeds, diseases, and harmful insects.
- Add to crop and market diversity.

3.7.3 Mixed Cropping
Mixed cropping is a type of agriculture system that involves planting two or more plant simultaneously in the same field. It is also called Inter-cropping or co-cultivation. Generally, the theory is that planting multiple crops once will allow the crops to work together. The possible benefits arise from this type of cropping are to balance input and outgo of soil nutrient, and to keep down weeds and insect pests, resist from an extreme climate like wet, dry, hot, cold to suppress plant disease, and to increase the overall productivity. Based on the study results of agronomist revealed that mixed crops have had mixed results determined by the yield difference can be attained with mixed versus monoculture crops. The overall result measurably appeared to be a sound effect, if the right combination of crops is cropped together.

The mixed farming system can be classified based on mainly land size, crop types, animals, geographical distribution and market orientation. Major three categories in mixed farming distinguished are given below:
- On-farm versus between-farm mixing
- Mixing within crops and animal system
- Diversified versus integrated farming system.
On-farm mixing refers to the mixing on the same farm, and between-farm mixing refers to exchanging resources between the different farms. In the case of on-farm mixing, particularly occurs where individual farmers will be taken to recycle the resources they have on their farm. Between-farm mixing frequently occurs in countries such as the Netherlands, it is used to mitigate the waste disposal problems of specialised farming. Between-farm mixing also befalls at the regional level in the store cattle systems of the United Kingdom and the United States, where animals are raised in one area to be crammed in another area where plenty of grain is available. In the tropical countries, manure could be transported from livestock farms to farmers and vegetable cropping areas where manure is in short supply.

### 3.7.4 Diversified Farming

Diversified farming is a practice of growing more than one crop or enterprise in any year to increase the financial and biological stability of the farm.

### 3.8 Crop-wise Analysis

The study is based on twelve major cultivated crops such as rice, coconut, tapioca, rubber, cashew nut, areca nut, pepper, cardamom, tea, coffee, banana and ginger during 2011-12 to 2016-17.
Table 3.1
Production of major crops in Kerala during 2011-12 to 2016-17

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</table>

Source: Department of agriculture and statistics of Kerala, Economic Review

From the above table, it is grasped that there is a tremendous decline in the cultivation of paddy, cashew, tapioca, coconut, ginger, pepper and tea. The area of cultivation of crops like areca nut, banana and rubber have shown a small increase. The field of coffee cultivation is without any changes from the previous years. The contribution of these crops in percentage to the total production also showed a downward trend. This is not because of the decrease in the area of the cultivation of these crops but, due to the reason that the nearest states Tamil Nadu, Karnataka, Andra Pradesh also started large-scale farming of these crops. For instance, the area under coconut and its production have recorded an expanding trend here, but the percentage contribution of production of coconut in Kerala is just 45% in contrast to 75% for twenty years back. The same condition is in the case of rubber also, still, now Kerala is the biggest producer of rubber in India. The area under the crops paddy, cashew, tapioca have been declining consistently here. The main reason is the unattractive price of the produces.
Table: 3.2
The Productivity of significant farming crops in Kerala

<table>
<thead>
<tr>
<th></th>
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<td>4421</td>
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</tr>
</tbody>
</table>

Source: Department of agriculture and statistics of Kerala, Economic Review.

The cropping system of any region depends on various demographic and natural factors like monsoon, natural setting of the different areas, climatic variation, land utilisation pattern, irrigation, drought condition, availability of market, infrastructural determinants, demands of commodity, labour availability and also other physical, economic and governmental factors.

In Kerala, the climate, rainfall, reverted areas, greenery etc. provides a suitable eye-catching picture to agriculture. But the natural setting is entirely different from the other Indian State. Because of the undulating topography serve as three land setting like Highland, Midland and Lowland. Consequently, all district is almost varied from others, and the regions also entirely different in soil, monsoon, humidity, and climate. Crops are cultivated only based on these geographic conditions. A Lowland region is suitable for the cultivation of coconut, paddy, and vegetable, whereas the Midland is found suitable for the cultivation of tapioca, cashew, and pepper and the Highland mainly consists of hilly areas and Valley; therefore, plantains crops like tea coffee cardamom etc. are the prominent growing crops of that region. The region of Malabar
includes this three-natural division of Highland, Midland, and Lowland. Wayanad district is in the Highland area, majority areas of Palakkad district come under Midland region. Malappuram district is covered by these all three settings. Some part of the district is in the Lowland and majority of the hilly area and a tiny piece is in the Midland region. Kozhikode district falls mainly under the Lowland region.

### 3.9 Suitable cropping system of Malabar Region

Depending on this natural condition, the cropping system of the region is also entirely different from one to another district. Based on the result the study analysis, it is evident that the growing trend of different crops cultivated in this area has shown the suitability of the cropping system for each region as depicted in the Table below:

#### Table: 3.3

**Suitable cropping system in Malabar Region**

<table>
<thead>
<tr>
<th>District</th>
<th>Suitable Cropping System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palakkad</td>
<td>Paddy, Tapioca, Sugarcane, Vegetables, Banana</td>
</tr>
<tr>
<td>Malappuram</td>
<td>Coconut, Areca nut, Rubber, Banana, Vegetables</td>
</tr>
<tr>
<td>Kozhikode</td>
<td>Coconut, Areca nut, Cashew, Pepper, Banana</td>
</tr>
<tr>
<td>Wayanad</td>
<td>Tea, Coffee, Ginger, Cardamom, Vegetables</td>
</tr>
</tbody>
</table>

*Source: Developed by Author*

### 3.10 Summary

Agriculture is the prime source of the economic development of the country. Agriculture and its allied sector contribute to a major share of the GDP of India. For ensuring the economic development of the nation, proper investment is needed in agriculture sector considering the elements that directly or indirectly influence. Investment means an addition to the stock of goods in existence. (and it is the part of production not merely replacing past sales but is directed to increasing the rate of output in the future). In official national accounts, investment is primarily referred to as Gross Fixed Capital Formation (GFCF), a macroeconomic concept. This chapter is
mainly trying to discuss the investment, agricultural investments, considering factors, and also how to build an investment portfolio based on the good combination of crops using the methods different cropping system for ensuring a good return with low risk.

In this study, the term Investing in agricultural Portfolios signifies the various combinations of funds used. Investors should create an investment portfolio by their investment objectives, cost, risk tolerance and return. Investors can also have multiple portfolios for different purposes. The chapter has concluded with the various practices of cropping which lead to the improvement of the agriculture sector through proper selection and combination of the crops and cropping systems based on the appropriate tropical regions concerned. Moreover, this chapter discussed the various alternative methods like agriculture diversification, crop diversification, crop rotation, mixed cropping, intercropping, integrated farming, etc. that will lead to attain best risk-return trade-offs.
Chapter-III

Conceptual Framework: Agricultural Investment Portfolio

Reference


Chapter-III

Conceptual Framework: Agricultural Investment Portfolio

Econometrica, 14(2), 137–147.


https://doi.org/https://sci-hub.tw/10.1002/nav.3800030110

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