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Cropping pattern and crop diversification in India

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Abstract

Traditionally, agriculture diversification referred to a subsistence kind of farming wherein farmers were cultivating varieties of crops on a piece of land and undertaking several enterprises on their farm portfolio. Diversification at the farm level is supposed to increase the farm income at the country level, diversification is supposed to increase the extent of self-sufficiency for the country. This study aims to assess the impact of crop diversification and cropping pattern on Indian agriculture.

Keywords: Cropping pattern, crop diversification, non-agriculture occupations

Introduction

“Crop diversification has emerged an important alternative to attain the objectives of output growth, employment generation and natural resources sustainability in the developing countries. The recent experience in Asia, particularly southeast Asia, Middle East and North Africa indicates that policy makers and planners are increasingly focusing on crop diversification to promote agricultural development”

Background

Agriculture, especially, farm production is important mainstay of the Indian economy which provide live hood about 60% of population which are involve in farm activities. Indian, being the seventh largest country in the world in terms of geographical area, it occupies second position in terms of arable land and ranks at first in terms of irrigated area and being located geographically in tropical and subtropical regions, it is gifted with various climatic conditions and soil types which are suitable to cultivate different types of crops. Agriculture with its allied sectors contributes about 17.6 percentage of GDP in 2014-15 which has sharply declined from about 57.7 per cent during 1950-51 and 44.8 per cent in 1973-74. However agriculture's share in total employment has declined only marginally from 73.9 per cent in 1973-74 to 56.5 per cent in 2006-07, with 56.5 per cent of work force producing 18.5 of GDP.

Agriculture sector ensures food security to the whole nation and the security and prosperity of a country is closely linked with the performance of agriculture that ensures food security, likewise, agriculture sector plays a signification role in earning foreign exchange as well. Thus it is undisputed fact that the agriculture is the sector which dictates the general pattern of growth and distribution in Indian economy. Therefore it is fully realized that the concept of inclusive growth which has been the political agenda in India, would be materialized only if agriculture sector grows at least at four percent per annum. However the troublesome issue regarding to Indian agriculture is that the gradual declining share of agriculture to GDP which is not being followed by the dependency of people on agriculture. The per capita GDP of workers in agriculture is only about one fifth of those in non-agriculture occupations and is continuously declining. The increasing gap between average incomes of the workers engaged in agriculture and non-agriculture occupations should be a matter of grave concern for the policy makers. This shows the falling per capita income of the people depending on it. Therefore, presently, the major problems of Indian agriculture is that the stagnation in production, productivity levels and decline in net sown area hence the growing threat of food in-security which has been the debating topic in all the political and academic forums. In this back drop, it is vital important to study the various aspects of cropping pattern changes in India especially during the reforms period in which Indian economy was fully liberalized and integrated with global economy.

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Crop diversification

Traditionally, agriculture diversification referred to a subsistence kind of farming wherein farmers were cultivating varieties of crops on a piece of land and undertaking several enterprises on their farm portfolio. Household food and income security were the basic objectives of agricultural diversification. In the recent decades, agricultural diversification is increasingly being considered as a panacea for many ills in the agricultural development of the country. Diversification at the farm level is supposed to increase the farm income; the utility of diversification as risk management practices however, remains. At the country level, diversification is supposed to increase the extent of self-sufficiency for the country. At the regional level, diversification is being promoted to mitigate negative externalities associated with mono-cropping.

Diversification was historically construed as the opposite of concentration' increase in area under the high value commodities is being referred as agricultural diversification in the recent period. The high value commodities refer to a group of commodities wherein trade was liberalized in the nineties' and difference between domestic and international prices was very high during the initial period of trade liberalization in the country. The above difference in price tapered-off for some commodities and the concept/term 'high value' was not very relevant for few commodities in the subsequent period. The high value usually refers to fruits, vegetables and many agricultural exportable commodities. The fruit and vegetable led diversification in the recent period has been presumed as a precondition for achieving the four percent rate growth in agriculture. Considering the multidimensional importance of agricultural diversification, it is important to understand the drivers of agricultural diversification in the country. Agricultural diversification in most of the above studies is concentration ratios; whereas agricultural diversification is increasingly being referred as increase in the production of high value crops. The present study has considered both versions of agricultural diversification in the analysis. The first version of diversification is illustrated by the Simpson index often referred as diversification indices. Whereas, the second version of diversification in the present analysis includes the concept of high value agriculture. Several researchers have considered the value of fruits and vegetables in high value agriculture, though commodities other than fruits and vegetables are at times considered as high value (Haque 1995). The present investigator further argues that some of the items being considered as high value may not remain so after a period of time if supply matches demand for the commodity. This study therefor aggregates the percent as area under non-food grain crops in percent (NFPC). This aggregation is also important in the light of the recent concerns that area under nonfood crops is increasing at the cost of food grain in the country (Jha 2008).

The Meaning of Cropping Pattern Cropping pattern means the proportion of area under different crops at a particular period of time. A change of cropping pattern means a change in the proportion under different crops. It connotes the crop-mixed grown in a particular area in an agricultural year. The Government of India for Economics and statistical purpose gave the definition of cropping pattern as the proportion of area under various crops at a particular time in a given area. Therefore there have been changes in the cropping patterns due to the following causes-development

of high yielding and short duration varieties in main crops, development of production technology to grow them, Central and State Governments spread of innovation in irrigation technology, Government special programmes enhancing the production of particular crops.

Generally, there are two concepts in which resources are diversified from low value enterprises to high value enterprises, one is crop specialization and another is crop diversification. In crop specialization resources are diverted towards a few crops while crop diversification is a different aspect. The pattern of agricultural diversification shows a shift from crop production to livestock production. It implies a shift from single crop farming to multiple crops farming; from subsistence farming to commercial farming or from low value food crops to high value food or non-food. However, it is hard to define the crop diversification; it is not a concept in which the resources shift from one crop to other crop, low value crops to high value crops, non-commercial crops to commercial crops. It is a whole process, in which the agricultural resources particular lands are diversified towards low value enterprises to high value enterprises. It may be one crop to another crop, non-commercial crop to commercial crop, one enterprise like (cropping rising) to another enterprise (say livestock).

Review of literature

Saraswati *et al.*, (2011) a study on the nature and extent of crop diversification in the Karnataka State of India done by Saraswati (2011) revealed that crop diversification was determined by a number of infrastructural and technological factors and that crop diversification influences production. The findings on the study suggested that the creation of basic infrastructural facilities like sustained supply of irrigation water, markets, fertilizer availability, proper roads and transportation was an essential pre-requisite for creating enabling conditions for fostering the process of agricultural development and crop diversification, as most of these parameters were found to influence the nature and extent of crop diversification. This study looked at secondary data for a period of 26 years from 1982-83 to 2007-08 and the data was analysed using the Composite Entropy Index (CEI) and a multiple linear regression analysis. The CEI for different crop group showed that almost all the crop groups had higher crop diversification index during post-World Trade Organization (WTO) (1995-96 to 2007-08) than during pre-WTO (1982-83 to 1994-95) period, except for oilseeds and vegetable crops. The study also noted that there was a vast increase in diversification of commercial crops after WTO. Kumar and Chattopadhyay (2010) on crop diversification by poor peasants and the role of infrastructure in West Bengal India studied intensively the nature and extent of crop diversification for the period of 1970 to 2005 in West Bengal, a rice growing state. They computed the Herfindahl index, Simpson index (SID), Entropy and Modified entropy indices for all the districts of West Bengal for the years 1970-1973, 1979-1982, 198-1992 and 2002-2005. Thereafter, a ranking of the districts on the basis of the computed values of these indices was done so as to understand the spatial pattern of diversification. In an effort to check whether the ranking pattern of the spearman's rank correlation coefficient was done by taking the pairs of different indices and testing their level of significance. Here, the rank correlations were observed to be positive and significantly high for each pair of observations. This

ensured that without any loss of generality, any one of the indices could be used to describe the intensity of diversification. Moreover, to find out the impact of different factors on the level of diversification over time in different parts of rural West Bengal, a multiple regression was used. The findings revealed that marginal and small farmers played a positive role in determining crop diversification and that it has been supported by the growth of various infrastructure networks during the period under consideration. Besides that, relatively advanced districts always maintained their relative positions in terms of diversification, due to better availability of agricultural and supporting infrastructure, availability of fertilizer along with expansion of irrigation and agro-implements that assisted in raising the yield of crops. Agricultural infrastructure was found to be crucial in promoting diversification of crops and ensure sustainable income and employment of the farmers. In their conclusion, they noted that policies towards the expansion of infrastructure like road network, irrigation facilities through different modes wherever possible, marketing and storage facilities, power supply especially to the minor irrigation setups, availability of fertilizer and facilitating or empowering those, especially, the poor farmers were the important preconditions for the diversification of crops across the districts. As the poor farmers took the leading role in diversification, markets and other infrastructure were supposed to be fair and competitive for their rational use. However, many of the poor farmers suffered from lack of capital, and thus provision of capital through cooperative and regional rural banks needed to be well warranted.

Chand Ramesh, S.S. Raju, Pandey L.M. (2007) [4], Economic reforms initiated in India during 1991 has put Indian economy on a higher growth trajectory. Annual growth rate in total gross product has accelerated from below 6 percent during the initial year of reform to more than 8 percent in recent years. The approach paper to eleventh five year plan find that 8.5 percent growth in GDP is possible during the next five year. Agriculture which accounted for more than 30 percent of total GDP in beginning of reform failed to maintain its pre-reform growth or keep pace with growth in the non-agricultural sector. On the contrary it witnessed a sharp declaration in growth after the mid-1970. This is fact that agricultural productivity in most of the states was quite low and there was a lot of scope. In Indian five year plan, there is always a high target of increase the food grain production but almost it is fail to find the target. In 9th five year plan 1996-97 to 2001-02 India has been targeting a more than 4 percent growth rate in Indian agriculture, but the actual growth rate has not turned out to be even half of this target. The poor performance of agriculture against the back ground of an impressive growth of the overall economy having serious implications. The slow growth of agriculture would not have caused an increase in disparities. More than 50 percent of work force depends on agriculture for income and live hood, slow growth in agriculture in putting them in distress. The GDP of agriculture increased annually at more than 3 percent during the 1980 which was considered a reasonably satisfactory performance of the sector. During 1991 the country changes in regulations fiscal policy role of market force and others. The impact of these changes and various others factor was a small during the first six years of reforms. The growth rate of GDP in agriculture and allied

sectors turned out to be 3.64 percent during the 1990-91 to 1996-97 which was 0.5 percentage points higher than previous decade.

Dhawan B.D. (1983) investigates whether irrigation mitigates instability in agricultural production through the case study of Tamil Nadu. He measures the stabilization role of irrigation by comparing the irrigated output an un-irrigated output i. e. rain fed output. He found that irrigating in Tamil Nadu does not reduce stability, because monsoon is the important determinant of irrigation infrastructure in Tamil Nadu. Although the growth in food grain seems to have improved because of the impact of new technology, the growth performance has not been smooth. The instability in food grain output has increased in the post green revolution period and even within the post green revolution period; the instability in the last decade (1978-79-198-89) was higher. However this increase in instability cannot be attributing to new technology. Rather this instability arises from adverse agro climate condition in which the technology is used. (Rao, 1989). Ray (1983) found that (1) the major cause for change in the pattern of growth and instability were due to an increase in the variability of rain fall and (2) the new technology had made crop production in India more spective to variation in rain fall. Thus for a given variability in rainfall, the instability in output would be greater. However when the new technology is applied under assured irrigated conditions, the increase in output would be stable, i.e. the responses of high yielding varieties of seeds to modern output like fertilizers are considerable enhanced when field are properly drained, and water from irrigation sources are provided in controllable manner at the right times.

Malik *et al.*, (2002) in India. This study used the Herfindahl Index in order to measure the extent of crop diversification amount smallholder farmers in the state of Harynan. The study revealed that crop diversification was a necessity for economies based on agriculture especially in Haryana, a region where staple foods cereals were grown. It acknowledged that cereals alone could not support the process of economic development and growth. Their study concluded that most of the districts that did diversify towards vegetables, fruits and flowers, was because of availability of markets. While districts that did not diversify was due to lack of proper markets, amount of risks involved and lack of availability of irrigation facilities. In other districts, diversification was due to the introduction of sprinkler-irrigation system.

Ashfaq *et al.*, (2008) Study on crop diversification carried out in Pakistan revealed that factors affecting crop diversification included size of landholding, age of respondent, education level of respondent, farming experience of respondent, off farm income of respondent, distance of farm from main road, distance of farm from main market and farm machinery. In their study, entropy index was used to measure diversification and thereafter a multiple regression model to determine the factors that were affecting crop diversification.

Ibrahim *et al.*, (2009) on crop income diversification among farming households in a rural area of north-central Nigeria reported that crop and income diversification were strategies that were essential for reducing rural poverty and raising income. The study used Simpon Index of Diversification and Ordinary Least Square regression to analyze the data. The results revealed that diversification into a number of income sources and crops grown were very high among the

farmers. The study identified the determinants of income diversification as the number of adults 60 years old, number of children less than 12 years old, distance from local market and availability of electricity in the household whilst the determinants of crop diversification as age of household head, level of education of the household head, number of extension visits, availability of tractor hiring services and returns from crop production.

Kankwamba *et al.*, (2012) in this study on the determinants of crop diversification in Malawi and they used the Herfindahl Index. Their study acknowledge that the agricultural sector in Malawi was highly undiversified, with maize and tobacco being the dominant staple and export crops respectively. Despite this, the government had since the 2005/06 cropping season implemented the Farm Input Subsidy Program aimed primarily at increasing maize productivity and output. In fact, they found that although crop diversification had deteriorated nationally and regionally, beneficiaries of the subsidy program had indeed become more diversified. Their study concluded that while various policies in Malawi all encourage agricultural diversification in broad terms, there was a lack of strategic thinking around how exactly it can be achieved, and more importantly, how crop diversification could be promoted among different types of farmers with the aim of contributing to economic growth, risk reduction and nutrition security.

Bhattacharyya (2008) on crop diversification as a search for an alternative income of the farmers in the state of west Bengal in India showed that the agricultural sector of West Bengal was gradually diversifying towards high value commodities, such as fruits, vegetables and flowers. The research also revealed that most of the diversification came through individual efforts of the small farms with little support from the government. This was so because food security issues were still critical in the state as well as the government policy was still obsessed with-sufficiency in cereals. The major determinant of this change was the demand side factor which had induced farmers to shift towards production of high value crops. Other than that, the development of roads and the technology absorption have been a key determinant in this respect. Also, the study used the Simpson Index as the dependent variable in a simple regression equation so as to determine the separate effects of each individual independent variable on the dependent variable. Furthermore, the study revealed that crop diversification was more prominent in rainfed areas than in irrigated zones, and the rainfed areas were seen as becoming the hub of non-cereals due to their low water requirement and abundant labour supply. The study did reveal also that the cost of crop cultivation was relatively low and that the high value crops were becoming popular among the small farmers who could not afford the cost of high investment like irrigation. However, proper institution support was lacking and hence the speed of diversification was affected. It was therefore necessary to provide proper financial resources, guidance, encouragement and training for nursery raising on the part of the government to attract the farmers of the state towards the high value crop cultivation.

V. Kalaiselvi (2012) Patterns of crop diversification of modern agricultural technology, especially during the period of the Green Revolution in the late sixties and early seventies, there is a continuous surge for diversified agriculture in terms of crops, primarily on economic

considerations. Indian agriculture in increasingly getting influenced more by economic factors. This need not be surprising because irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimizing the role of non-economic factors in crop choice of even small farmers. What is liberalization and globalization policies are also going to further strengthen the role of price related economic incentives in determining crop composition both at the micro and macro levels. Obviously, such a changing economic environment will also ensure that government price and trade policies will become still more powerful instruments for directing area allocation decisions of farmers, aligning thereby the crop pattern changes in line with the changing demand-supply conditions. In a condition where agricultural growth results more from productivity improvement than from area expansion, the increasing role that price related economic incentives play in crop choice can also pave the way for the next stage of agricultural evolution where growth originates more and more from value-added productions.

Chiwele and Simananu, (2004). Find in the study that the income of the monoculture farmer can be reduced as a result of a slump in the market value of a particular crop thus leaving the farmer in ruins. On the other hand, if farmer's diversify, they can reduce over dependency on maize and they can avoid the risks associated with it. By diversifying, their crop output will be able to increase thereby improving nutrition by providing for their families and enhancing food security. Furthermore, with the increase in demand for food every day due to population increase, diversification can provide for the population hence fighting hunger, poverty and reducing malnutrition levels, which is still as issue of national urgency thus meeting the key Millennium Development Goals of reducing hunger and preserving natural resources and the environment for future generations.

Joshi *et al.*, (2007) [7]. In the studies on crop-acreage response; infrastructure, technology and institutions are important non-price factors that influence acreage under a crop. Though there are numerous infrastructures, that affect acreage under a crop, network of road is one of the most important factors. Technology has different dimensions among which intensive agricultural practices is the most important while assured irrigation is important for the adoption of intensive practices. The range of institutions that affect acreage under crop is wide and varied; structure of land holding and institutional credit facilities are important as well. In this study also found that urbanization is the most important factor behind the growth of high value crops. Domestic demand therefor, remains important.

Ndhlovu (2010) did a study that analyzed how fertilizer subsidies to maize production in Malawi affects farm households' crop choice, cropland allocation and crop diversification level. The analysis was based on a three-year household survey data collected in 2006, 2007 from six districts across Malawi; two of the districts were in the central region while four districts were in the southern region. Crop choice and cropland allocation patterns were examined using the generalized least square (GLS) model. Empirical results indicate that farm households, access to fertilizer subsidy was associated with a decrease in the cropland allocation to maize and pulses while there was an

increase in cropland allocation to groundnuts, roots-tubers and tobacco. In terms of crop diversification, the study findings suggested that farm households' access to fertilizer subsidies to maize positively contribute to promoting farm households' crop diversification levels through intensified maize production and that crop diversification enhanced stability of household incomes through the mitigation of price and crop production risks and shocks.

Hassan and Inderjeet, (2010) have evaluated the relationship between canal irrigation and land degradation in Haryana. The study found that rapid expansion of irrigation, mainly by canals in the state has led to wheat and rice of wheat and cotton predominant cropping pattern which led to state's crop pattern from diversified to specialized. They further observed that extension in canal irrigation and consequently changes in cropping pattern have resulted in serious amount of ecological destruction through water-logging and accumulation of salts in the soil profile.

Ishtiaq and Kibaemi (2003) have examined the land use pattern and sustainable agricultural development in Nagaland. They found that very recently a section of Naga tribes turned to plantation and horticulture resulting in diversification of agriculture, thus making it sustainable.

Singh, (2006) ^[3] in his study "Crop diversification in Bari-Doad Region of Punjab" has concluded that patterns of crop diversification and variations in relief are positively correlated. He further observed that areas with unfriendly physiography have high magnitude of crop diversification as compared to featureless central uplands of the study region. He has also found that due to diffusion of agricultural innovations, the magnitude of crop diversification has declined, whereas the cropping pattern has become specialized.

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