



Doubling Farmers' Income in India: Progress, Gaps and Futuristic Approaches

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Abstract: In India, the agriculture sector is constantly improving its mechanism to maximize output and ensure food security. However, a large population is leaving farming practices because of the low-income generation. As a result, in 2016, the government of India formed an inter-ministerial committee for the evaluation of existing problems and then recommends feasible strategies to accomplish the mission of 'Doubling Farmers' Income by 2022'. In this review, we have discussed the concept of doubling farmers' income, its present standpoints, challenges and the role of the Indian government in mitigating the same. Further, the innovative approaches to meet the aforementioned goal have also been highlighted. The Indian government has supported various development programs, implemented a large number of schemes and recently, additional income transfer under the PM-KISAN scheme to double farmers' income. Innovative agricultural approaches like advanced farming methods, smart agriculture, diversification and commercialization, climate smart agriculture and nutrition farming if implemented at Pan India level will definitely result into income generation. Despite tremendous efforts by the Indian government, some challenges still exist in the agriculture sector and this study gives valuable recommendations that would act as pillars in the policymaking to achieve the 'doubling farmers' income initiative.

Keywords: Agriculture sector, Farmer's income, Current progress, Gaps, Future approaches

The Indian agriculture sector is one of the major contributors to India's economy, providing about 17.1% of the country's Gross Value Added (GVA). Agriculture is successfully providing livelihood to about 70% of rural households in India (Balkrishna et al 2021). The production of cereals, oil crops and pulses was recorded in the year 2019 at 324.3, 64.8 and 21.5 million tonnes respectively, as against 296.01, 58.7 and 20.0 million tonnes in the year 2014 respectively (FAOSTAT 2021). Similarly, the productivity of other major crops of India has also registered a significant increase. It also includes trade and market economy, through which developed nations have established their dominance over other countries. Agriculture plays a vital role in creating employment and livelihood options which bring development which is two to four times as effective as any other developing alternative. Thus, making it a powerful tool to address the underlying issues of poverty in Indian communities by developing a rich nutrition reservoir in India as well as in the world (Gills and Sharma 2021). With the emergence of the Green Revolution, traditional farming practices were improved, more land was purchased for irrigation, agricultural mechanization in North India, increased use of fertilizers, pesticides, high-yielding seed varieties, institutional support policies were introduced for example subsidies for fertilizers, groundwater extraction, MSP

(Minimum Support Price), purchase of food grains (mainly rice & wheat) and public distribution (Tilman et al 2001, FAO 2003). Ultimately India becomes the second-largest producer of both wheat and rice in the world. However, even after more than six decades of the green revolution, the condition of our farmers remains destitute as they are forced to grow high-cost crops instead of more nutritious and low-cost crops like pulses and millets (Swaminathan and Kesavan 2017). The reason behind this farmer's economic crisis is the need to produce more than the limited natural resource base, which is shrinking over time, affecting the production capacity as well as the ecosystem. Not only this but other factors are affecting the income of farmers in India, including market price distortions, climate variability and extreme events such as droughts, floods and cyclones, innovations, changing consumer preferences, and labor migration (Jayaraman and Murari 2014, Acharya 2020). Recently, the COVID-19 pandemic has forced farmers to stop their farm work as well as restrict their access to the market due to the lockdown. Although the farmer had a market surplus, procurement was hampered with irregular collection from the farm due to inadequate labor and logistics. The plight of providing availability and accessibility to safe and healthy food to the vulnerable 15% of the population is very real and painful.

Past trend in farmers' income: In the past, the agriculture sector in India has primarily focussed on increasing agricultural output and boosting food security for doubling the farmers' income. Indian agriculture sector during the period 1965 to 2015, was successful in multiplying its food production by 3.7 times with a 2.55-fold increase in the population (Chand 2017). According to the NSSO 70th survey (2002-03 to 2012-13) and NABARD financial inclusion survey (NAFIS) (2016-17), in spite of an increase in the farmers average monthly income from ₹6,426 (2012-13) to ₹8,931 (2015-16), this income turned out to be lower than not only the fixed minimum wages for unskilled workers in agri-sector but also less than 20% of the country's average per capita income (NSSO 2013, NABARD 2016, Dalwai 2018). Moreover, the ratio of the income farmer concerning the population working in the non-farm sector was also reported to be 3.12 for the year 2011-12, which was the sole reason for the deteriorating disparity

between the two (Chand and Parappurathu 2012). The further distressing fact is that out of 90 million farm households, 61 million have ≤ 1 -hectare agriculture landholding with a net negative monthly budget. These were the outcomes of the existing severe issues of high indebtedness, recurrent crop failures, adverse terms of trade, uncertain and erratic returns of the produce at the marketplace, supply of substandard and spurious inputs, and the associated crop losses (Romanenkova et al 2008). All these reasons were enough to understand that progressing with the existing strategy would lead to detrimental effects on the overall Indian agricultural economy. In 2016, the government of India formed an inter-ministerial committee for the evaluation of existing problems and then recommends feasible strategies to accomplish the mission of 'Doubling Farmers' Income by 2022'. Possible sources for enhancing the farm income growth rate are listed in Table 1 (Chand 2017).

Table 1. Various sources for increasing farm income in the agriculture sector

Inside agriculture sector	Outside agriculture sector
<p>Improvement in agricultural productivity</p> <ul style="list-style-type: none"> 2000-01 to 2013-14, both the aggregate crop productivity and the required input productivity increased by the same rate of 3.1% annually. The rate of generation of total farm income would increase to 16.7% by 2020-21 and 25% by 2023-24 as compared to 2013-14. livestock productivity was sought to increase by 10.8% and 16.6% by 2020-21 and 2023-24 (increase the total farm income to 27.5% by 2020-21). 	<p>Repositioning cultivators from farm to non-farm occupations</p> <ul style="list-style-type: none"> In 2011-12, the worker productivity in the rural areas accounted for ₹62,235 per worker (64% farm sector workforce) and ₹1,71,587 per worker (39% non-farm sector workforce). Between 2004-05 to 2011-12, NSSO has revealed that there has been a sharp decline of 34 million individuals. The agricultural workforce is expected to fall to 55% by 2022-23, including a 13.4% reduction in cultivators.
<p>Improvement in total factor productivity</p> <ul style="list-style-type: none"> NITI Aayog policy report TFP in the Indian agricultural sector heightened to 2.62% during the period 2004 to 2012 and with this rate, the farmers' income is expected to grow to 26.3% by the year 2022-23. 	<p>Advancement of trade terms for farmers</p> <ul style="list-style-type: none"> NITI Aayog policy reports the farmers' income during 2011-12 to 2015-16 suffered a major setback due to crucially lower growth in constant prices of value-added agricultural products and also due to 50% higher increase in CPIAL than the increase in farm gate process of agricultural produce. Two major changes: <ol style="list-style-type: none"> Online trading as market reformation Opening markets to traders outside the mandi as a unified national agricultural market would bring a remarkable change in increasing the farmers' income considerably.
<p>Increase in cropping intensity</p> <ul style="list-style-type: none"> Low crop intensity is supposed to be the inaccessibility to sufficient water for proper irrigation Pat rate of 0.7% for an increase in cropping intensity in the country, the farmers' income can be significantly increased by 3.4% by the year 2022-23 and 4.9% by the year 2025-26. 	
<p>Diversification towards high-value crops</p> <ul style="list-style-type: none"> 2013-14, 77% of the gross cropped area of staple crops produced only 41% of the total crop output, while just 19% of the gross cropped area. The crop output can easily increase to 1% each year, leading to 5% increase in the farmers' income by 2022-23. 	

Source: <https://www.niti.gov.in/>

Current progress: After evaluating the trends and identifying the gaps, the Government of India proposes various programs and schemes as solutions for the development of the agriculture sector. Agriculture in India is supported by the respective state governments, where they are responsible for its development by implementing these programs and schemes. Keeping in view the increase in crop productivity, remunerative returns, and income support, the Ministry of Agriculture and Farmers Welfare implemented several initiatives (Fig. 1) for the welfare of farmers in 2020 (Minister of Agriculture and Farmers Welfare 2020). The initiative is primarily focused on increasing the income of farmers and with this, the government has supported various development programs, schemes, reforms, and policies, which include higher budgetary allocation, corpus fund creation through non-budgetary financial resources and additional income transfer under the PM-KISAN scheme. Taking into account all the commodities and sectors in agriculture, a pathway has been formulated for the implementation of the mission of doubling farmers' income by 2022 (Sendhil et al 2017a, Sendhil et al 2018, Verma et al 2019).

Irrigation is supposed to be the best insurance against drought. Thus, to improve irrigation technology, the states have been propelling towards 'per drop more crop'. The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is focussing on the expansion of farm-level micro-irrigation with regularly tracking of 99 priorities over 7.6 million ha land and work

towards more crop per drop as a national mission to improve crop productivity.

Present gaps and interventions: The history of agricultural reforms carried out in India since independence begins with the green revolution, followed by the introduction of various acts such as Agricultural Produce and Livestock Marketing (APLM), Agricultural Produce and Livestock Contract Farming and Services for promotion and facilitation of agriculture industries, e-NAM and 'Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM -AASHA)'. The need to maintain the supply chain that was provoked during the Covid-19 lockdown and the prevailing circumstances, the government announced three ordinances on farm bills which were eventually passed as three farm laws in the year 2020, to institutionalize agricultural reforms through legislation. These three laws were 'The Farmers Produce Trade and Commerce (Promotion and Facilitation) Act 2020', 'The Farmers (empowerment and protection) Agreement in rice Assurance and Farm Services Act 2020' and 'The essential Commodities (Amendment) Act 2020' (Dev 2020). The above-stated three laws have enormous potential to attract investments and entrepreneurship development among young and educated individuals with innovative intellectual abilities (Ashrit 2021).

Innovative Agricultural Approaches

Advanced farming methods: Urban and peri-urban agriculture has been recently gaining attention due to its sustainable nature, as it uses urban trash, reusable natural

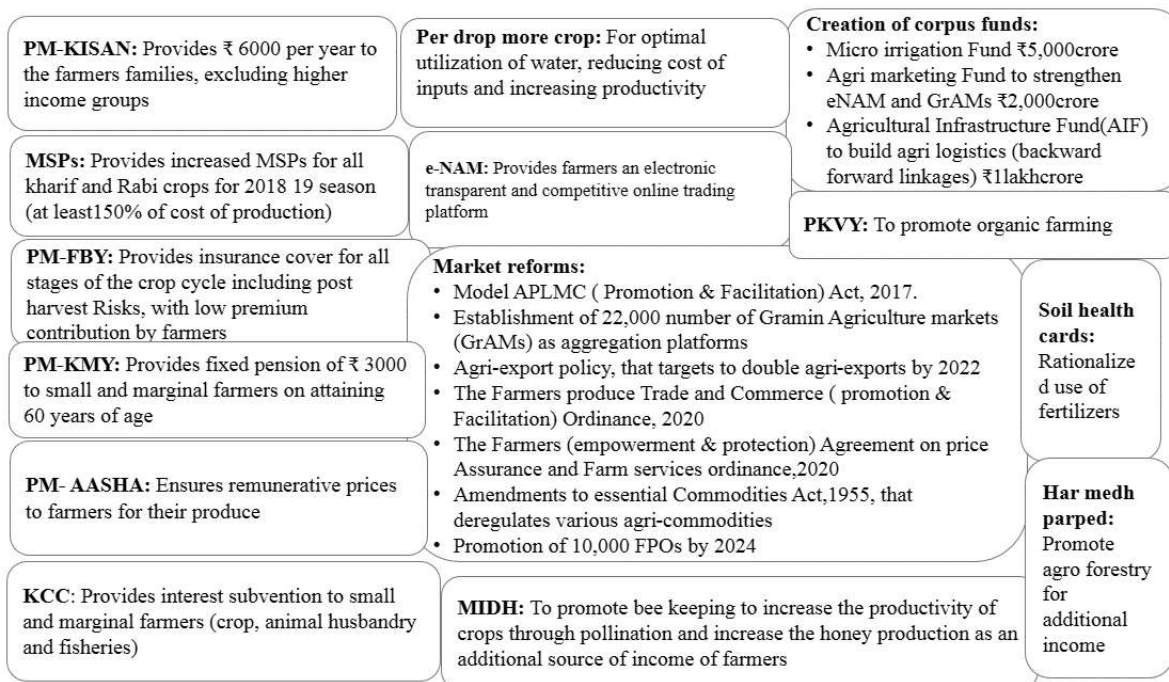


Fig. 1. Indian government's recent initiatives toward doubling of farmers' income

resources, and waste for production, processing and marketing of agricultural produce. (Antonio 2017, Ebel 2020). Some of the types of urban and peri-urban agriculture include allotment gardens (medium size vegetable garden in the municipal area), vertical farming (vertically inclined planes, vertically piled stratum & another plant-growing substrate integrated), fertigation, aeroponic and aquaponic (Jain and Janakiram 2016), a community garden (single or combination of multiple small pieces that has been planted), educational gardens (development of urban agriculture in an educational institution), micro-gardens (intensive cultivation practice) and aquafarming (farming of aquatic in wastewater), etc. Organic farming is another method of crop cultivation which is become important due to its huge advantages on income generation and eco-friendly (IFOAM 2009, Balkrishna et al 2021). It is considered an environmentally friendly technique because it restores carbon and other necessary nutrients in the soil (Srivastava et al 2018).

Smart agriculture: The smart farming system is the need of the hour due to a decrease in soil productivity, increase in climate change, and adverse environmental impacts. This includes implementation of advanced technologies such as the Internet of Things (IoT) with automated and connected devices, in the existing food production system (Balkrishna et al 2020) and act as a way of the temporal and spatial application of capital-intensive and hi-tech modern Information and Communication Technologies (ICTs) such as (artificial intelligence (AI), machine big data analysis, learning, etc.) in on- and off-field activities. For instance, high precision sensitive gears called sensors, which can detect minute changes in light, moisture, and temperature have found their application in various agricultural activities like weather monitoring, information system, and precision agriculture, IT-based post-harvest produce handling, etc. Other AI-based applications include smart harvesting, smart irrigation, smart greenhouses, quality-controlled processing, mechanized grading, price forecasting, etc (Gill and Sharma 2021). Smart agriculture can pave a way to enhance agricultural productivity, address issues in the supply chain, and most interestingly can virtually interconnect the farms make them intelligent in decision-making. This can be executed using AI-based drones, sovereign tractors, robotic artilleries, etc (Gill and Sharma 2021). Thus, using machine learning and artificial intelligence can provide a smart way of the food production system, thereby having a direct impact on poverty alleviation and increasing the farmers' income.

Diversification and commercialization: Agricultural products with high-value yields in low volumes can be an effective way of reducing farmers' income distress and

creating a sustainable economic impact of the agriculture sector in India (Meena et al 2018, Deogharia 2018). Diversification is essentially important to meet the changing dietary demand with nutrition awareness (FAO 2004, Joshi et al 2004). Chand (1996) stated that agricultural diversification can be prompted by diverting farming from a single crop to the cultivation of multiple crops or livestock. This can include the cultivation of flowers, honeybees, fisheries, mushrooms and exotic vegetables, etc (Basantaray and Nancharaiah 2017). Overall, crop husbandry and crop-based product development is an innovative technique to not only increase farmers' revenues but also provide them with an extensive range of options for utilizing their agricultural lands that would conserve the environment and create employment opportunities (Maggio et al 2018). Therefore, with increased productivity, reduction in the cost of production, and increased risk-bearing against yield loss from climate change, the income of farmers can be increased substantially. Another commonly used method for crop diversification is crop rotation, which is also used for farmers' income generation even with erratic climates (UNFCCC 2009, Smith et al 2008). Crop rotation is the suitable arrangement of consecutive crops in a pattern that promotes the facilitation of different plants to pull nutrients in different magnitudes from various levels (Rahman 2009).

Climate-smart agriculture: With extreme changes in global climatic conditions, the food and nutrition crisis has also intensified to a great extent (World Bank 2019b). Climate-smart agriculture (CSA) is an integrated advanced agriculture approach that focuses on addressing agricultural challenges related to climate change (FAO 2010, Olorunfemi et al 2019). In the socio-agricultural scenarios, the terms adaptation and mitigation play an important role in managing climate change (CIFOR 2011, FAO 2012a). Climate adaptation is the ability of a production system to identify and take advantage of opportunities to cope up with climate variability and extremes, as well as to deal with the costs and consequences of human-induced climate changes (Pan and

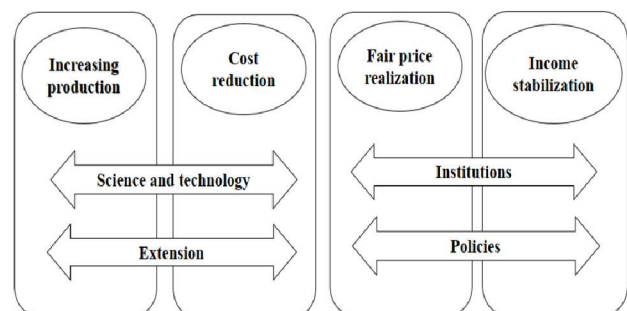


Fig. 2. Framework for implementation of the mission of doubling farmer's income by 2022

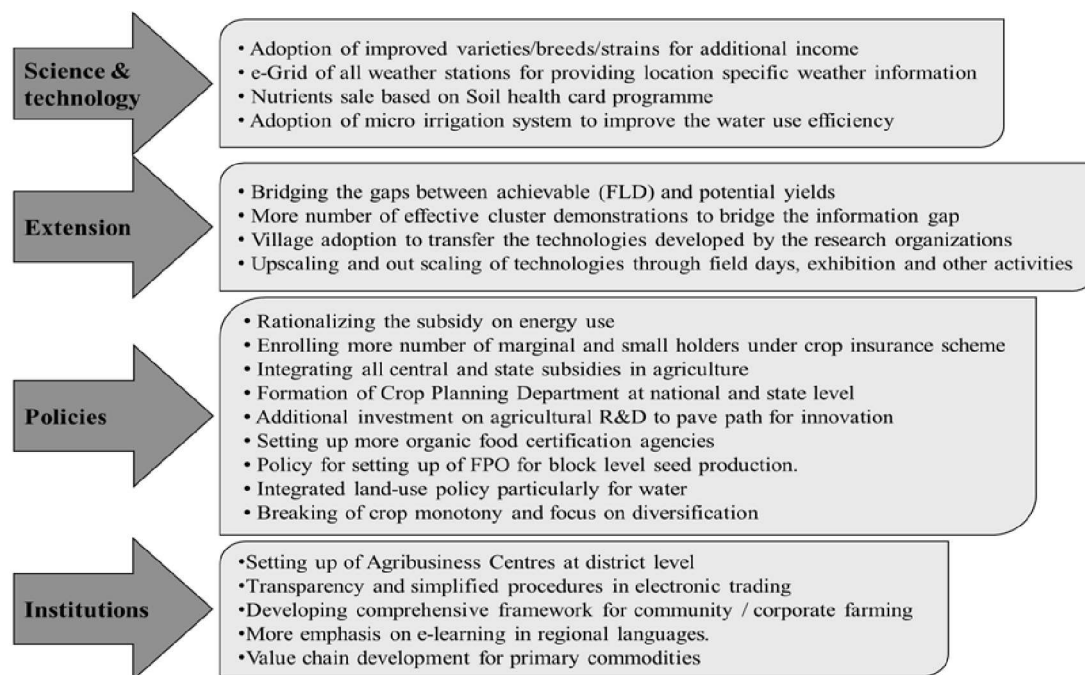


Fig. 3. Potential strategies to increase annual farm income

Zheng 2010). The effort to eradicate or diminish the long-term risk and perils of climate change to human life, living components, and any property of the production system, is recognized as climate mitigation (Lu 2013, Duguma et al 2014). With the extent of climate change in the present scenario, the adaptation strategies have become as important as mitigation plans (Campillo et al 2017, OECD 2018, UNFCCC 2019), because of the harm that has been done to the environment, especially in terms of increased temperature, the mitigation efforts and strategies won't be able to prevent the increasing temperatures till the year 2100 (OECD 2018, Vogel and Meyer 2018).

Nutrition farming: Nutrition-sensitive agriculture is based on the principles of increasing availability and accessibility of the food, encouraging sustainable and diverse production, increasing nutritional content and making food more nutritious (FAO 2014, Nagarajan et al 2014). For this purpose, nutri-farms or nutri-gardens have attracted much attention in nations targeting nutritional security. Nutrition farming requires an integrated approach with the cultivation of high nutrient density fruit and vegetable crops and biofortified crops (Bouis et al 2013, Bouis and Saltzman, 2017) that is carried out following good agricultural practices for higher productivity and improved soil quality. Thus, nutritional farming fulfils the two essential objectives of providing essential nutrients and additional income through crop diversification and the low cost of cultivation (Jaenicke and Virchow, 2013). In India, National Agricultural Research

System (NARS) in hand with the international crop organization has established various breeding programs to enhance the nutrient quality of crop production, also known as biofortified crops. So far, biofortification has imparted a positive increase in the nutritional quality of various crops, including iron-biofortified pearl millet (Finkelstein et al 2015), zinc-biofortified wheat (Rosado et al 2009, Singh and Govindan 2017, Sazawal et al 2018).

CONCLUSION

In India, farmers form a major proportion of both producers as well as consumers. Thus, improving crop production and productivity, along with efficient and profitable farming, as a part of a pioneering growth strategy, can contribute significantly towards reducing hunger and poverty. Various countries have already set an example of agricultural development through small farmers and have shown that agricultural development is twice as effective in rural income generation as the development from other sectors. And using agriculture for economic development, especially in agriculture-based countries like India, requires continuous evaluation of smallholder farming practices to increase agricultural productivity. Agricultural productivity can be increased with science and technology interventions, government policies of extension services and institution-led reforms. Simultaneously, there should be a defined path and a time frame to work on such interventions and achieve a set goal within the time frame. As per the vision of the

government, the target of doubling the income of farmers by 2022 is not an easy yet very laudable goal. But, relentlessly working on gaps and loopholes with concerted efforts, as per the action plan suggested in mission mode, with special emphasis on the welfare of our farmers, can bring about the necessary changes for overall agricultural development for national economic development with a special emphasis on the welfare of our farmers, who are solely responsible for fulfilling our needs for desired foods.

AUTHOR CONTRIBUTIONS

All authors have made a substantial and direct contribution to the work.

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