

# **Strategy for Transformation of Indian Agriculture for Doubling Farm Income and Improving Farmers Welfare**



**NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, NEW DELHI**

**December 2016**

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## Preface

Indian economy is in transition and undergoing through several structural and policy reforms. The relative importance of different sectors in terms of their contribution to the national income and employment is changing rapidly. Agricultural sector though still important for livelihood of majority of rural population, its relative share in the national gross domestic product is declining. The contribution of agriculture to reduction of poverty and promotion of inclusive development are also significant. Therefore, Indian agriculture must modernize and transform itself into an efficient and sustainable system. This process has already begun but it needs acceleration. This transformation shall essentially be led by technology, policy and institutional innovations, mainly driven by demand-side factors. In order to deliberate on these critical issues a strategy workshop was held on 3 June, 2016 at NASC, New Delhi.

This strategy paper deals with the pathways and areas of transformation in Indian agriculture. The fundamental change shall be driven by a shift in policy to increasing farm income and farmers welfare. Therefore, innovations to improve the productivity, profitability and sustainability of agricultural systems in all categories of farmers must be strived for. This should be supported by innovations in servicing the agricultural sectors like input and product markets, public services like R&D and financial reforms. Another notable feature of the transformation process shall be institutional reforms, essentially dealing with delivery of farm services and regulations covering entire canvas of agriculture. The roles of public, private and farmer organizations shall undergo significant change for better synergy in delivery of services and effectiveness of various programs. The sectors likely to witness major transformation in this aspect are livestock, fisheries, and horticulture.

Another notable feature of the transformation process is role of rural non-farm sector in reducing pressure on agriculture and generating surplus. Therefore, capital, skill and infrastructure development for this area also deserve priority. The recommendations made in this paper are based on a consultative process of experts from different disciplines and other stakeholders like policy makers, bankers, representatives of private sectors and farmers. I am sure that the readers will find this paper useful and the recommendations shall help in implementation of their agenda for transformation of Indian agriculture. Academy thanks all the eminent experts, progressive farmers, entrepreneurs, vice-chancellors, DDGs and Directors for their participation in this consultation meeting and providing valuable inputs to the discussions. Grateful thanks are due to the conveners Dr Suresh Pal, Dr P.K. Joshi and Dr Anjani Kumar for their initiative in organizing the strategy consultation. The editorial support extended by Dr K.K. Vass and Prof V.K. Gupta is thankfully acknowledged.



**S. Ayyappan**  
President



# Strategy for Transformation of Indian Agriculture for Doubling Farm Income and Improving Farmers Welfare

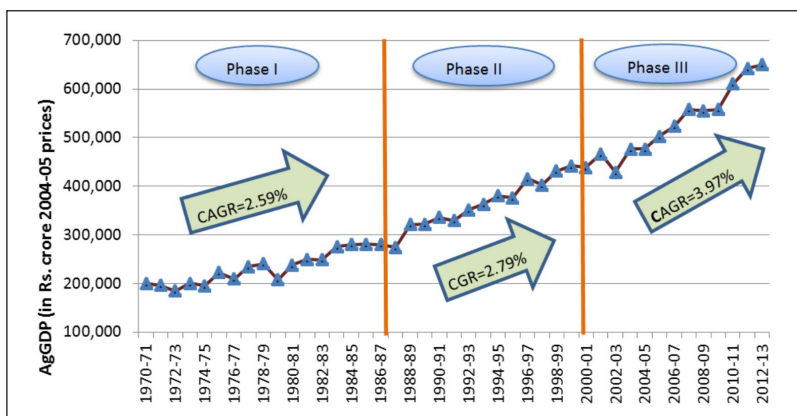
## INTRODUCTION

Transformation of agriculture entails structural changes in the growth pattern, production mix, inputs use and institutions serving the sector. The share of agriculture in national gross domestic product and labour force employed in agriculture declines and the production systems become more knowledge and technology intensive, with greater use of modern inputs. Within agriculture sector, share of high value and processed product increases and the system serving agriculture (markets and public services) are also replaced with well-organized, professional entities with greater participation of private sector. This transformation is a continuous process and Indian agriculture has come from a stage of subsistence to transition to a commercial agriculture, which began with the Green Revolution and subsequently reinforced by advancements in other sectors like livestock, horticulture, fisheries, etc. Indian agriculture now needs to reach where the North American and European agriculture is today in terms of technology penetration, production structure and market orientation. This is in consistent with global development processes but challenges and transformation pathways may vary (World Bank, 2008). This transformation has to be completed within a short period of time, a timeframe much shorter than what developed countries have taken to transform their agriculture. The event like deficit monsoon during the last two years slows down agricultural growth process, which needs to be accelerated for sustainable and inclusive development. Also, the focus should shift to doubling farm income during the next five years and include small farmers and other rural workers in the growth process. This target will require increasing crop productivity, savings on costs and a shift towards high income generating activities like dairy, floriculture, special products like organic food etc. Addressing binding production constraints to higher yields, value addition through processing and realization of economies of scale are other options. How can these changes be achieved? Even if farm income is doubled, will it be adequate to sustain farm family and attract youth to agriculture. The brainstorming session organized by the Academy discussed these issues and this paper summarises the main conclusions, which emerged during the discussion.

## PATTERN OF AGRICULTURAL GROWTH

The major growth trends analysed since 1970s indicate that Indian agriculture grew close to 4 percent per annum during the last decade or so. This growth rate was much above

the growth achieved during the green revolution (2.6 percent) and during the post-green revolution, *i.e.* late eighties and the nineties (2.8 percent, Fig 1). In 2013-14, the country had the highest ever food grain production (265 million tonnes). Most of this growth came from the states where productivity was low. As a result, there is greater convergence in agricultural (land) productivity (Balaji and Pal, 2014). As seen subsequently, much of the higher growth could be attributed to higher public investment in agriculture, better price incentive and improved delivery of agricultural inputs. All signs indicate that this growth trend will continue in future also.



**Fig 1: Growth trends in Indian agriculture**

Another major characteristic of agricultural growth is that this was largely driven by livestock and horticulture sectors. Both these sectors now contribute more than half of agricultural gross domestic product (AgGDP). Both the sectors are dominant in arid and semi-arid regions and, therefore, growth in these sectors has contributed to regional convergence. It may be noted here that because of urbanization and income growth, demand for horticultural and livestock products have risen, which has provided better incentive to farmers to respond to the demand growth. Of course, technology, inputs and institutional developments have provided opportunity to the farmers to enhance their productivity and link their produce with markets. As a result, there is acceleration of growth in the total factor productivity of crop and livestock sectors (World Bank, 2014).

The present growth trends are likely to continue in future but there are other concerns which need to be addressed. The first concern is about sustaining productivity growth of small holders, which often lack resources and future agriculture is going to be capital intensive. The East Asian experience has shown that high productivity growth can be achieved on small farms, provided there are adequate investments in infrastructure and technology. But whether higher productivity growth would translate into an income level adequate to sustain a farm household? Therefore, improved resource use efficiency, higher productivity

and transfer of labour force to other sectors are important for increasing rural income and thereby reducing rural-urban income disparity. This transformation process needs to be stepped up. The strategy for agriculture transformation should entail proactive policy, technology and institutional support, and investment in development of farmers' knowledge and skills. The following could be major areas of interventions.

## PRODUCTIVE CAPACITY

First and foremost requirement for increasing the productivity is investment in agriculture and priority areas are irrigation, rural infrastructure, research and development (R&D) and agro-processing. There was significant increase in public investment for irrigation and other rural infrastructure since the mid-2000s, but it slowed down in the recent years (Fig 2). As a result, the share of public investment in the total public expenditure on agriculture reduced to 20 percent, a level that was in 1990s when the public investment growth was low. This trend should be corrected and growth in the public investment for agriculture must be sustained. However, a positive aspect of public investment is that its allocation across the regions has been quite equitable and the states with low productivity received adequate resources as per their area share and economic contributions. The private investment in agriculture is rising but farm household investment may not be sustained because of decline in share of term loan in total lending to agriculture. This trend must be arrested. Also, the sectoral priorities need to be translated into regional priorities. The experience of attracting corporate investment in other sectors can also be useful. Business sector investment in agro-processing and development of market infrastructure will be helpful in increasing farm income.

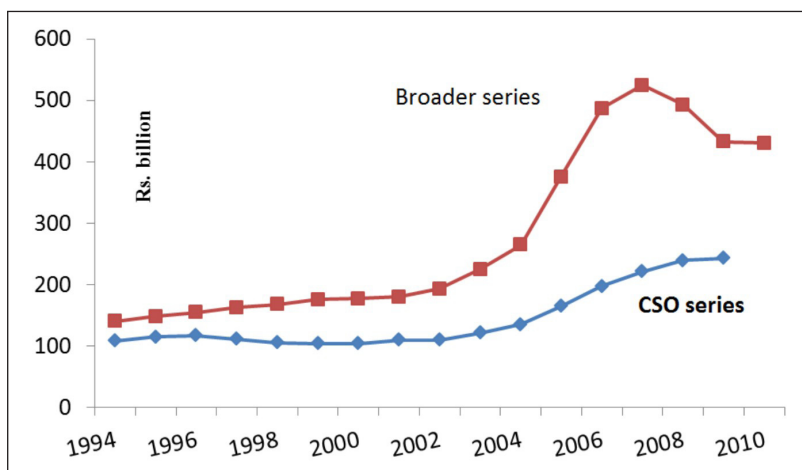


Fig 2: Trends in real public investment in agriculture (in Rs. Billion)

Source: *Division of Agricultural Economics, IARI*



The second important aspect of sustaining productivity capacity has been investment and policies for sustainable use of natural resources, particularly irrigation water. With the increase in benefits of irrigation, competition and use of irrigation water, particularly groundwater, is increasing, which has led to higher cost of extraction and unsustainable use of groundwater. Therefore, with the scarcity of water resources cooperation among water users, *i.e.* farmers for its sustainable use should be encouraged. This may involve use of technology increasing water-use efficiency like micro-irrigation and providing incentive like subsidy on water saving practices and technology. As regards surface irrigation, water harvesting in low to medium rainfall areas, water transfers and improved irrigation method should be encouraged. Surface water management assumes greater importance in the context of climate change and, therefore, its management should be given high priority. Inter-year and inter-season regulation of river flow, inter river basin water transfers and improved management of water distribution infrastructure (canals and minors) are also equally important to improve water use efficiency in irrigation. Since water harvesting and use require interventions by all the farmers in the target or command areas, participation of farmers in maintenance of water structures and sharing of irrigation water are helpful in sustainable management of water resources. It is found that degree of participation and cooperation of farmers increases in water scarce areas (Joshi *et al.*, 2003). The participation is also effective when size of the farmers group is manageable and homogenous, and there are democratic traditions to manage the farmer user associations (Gandhi, 2011).

IPCC (2014) has brought out likely impacts of climate change on ecosystems and agricultural productivity, which are enormous if suitable corrective measures are not taken by the global community and the impact would be far more serious in tropical regions. The Academy has discussed at length this concern (NAAS, 2013) and made suitable recommendations. But this concern goes beyond economic impacts and impacts on poverty reduction and income inequality could be equally challenging. Therefore, there should be incentives and institutions to influence peoples' actions to follow the practices, which build resilience and promote climate smart agriculture. The incentives should encourage conservation agriculture, promote water and energy use efficiency, carbon sequestration and improve flow of ecosystem services like contribution to ecological foundations, green-house gas reductions, etc. The mechanism of carbon trading has not picked up to the desired level and this mechanism along with direct transfer of benefits to farmers should be explored.

## INSTITUTIONAL CHANGE

There is a major shift towards commercialization of agriculture and now 60-90% produce is sold in the market. There are institutional changes in both input and product markets. The size of operation is increasing and there is greater participation of multinational companies, especially in provision of inputs and agro-processing. This trend will continue in future also, but

can these innovations ensure inclusiveness of small farmers? Another important dimension is attracting participation of organised private sector in agricultural markets and regulating private organizations in a cost-effective way (World Bank, 2014). These regulations should facilitate markets, reduce cost of compliance and protect interest of small farmers.

## Inputs use

There are some major changes in inputs markets for agriculture. First major change is rising share of purchased inputs in the cost of cultivation. In particular, there is tremendous growth in the use of quality seed since the mid-2000s. There is also significant growth in use of chemical fertilizers per hectare as it has risen more than 50 percent since 2001, except last two years when it was either stagnant or declined, which is a temporary phenomenon. Seed, fertilizers, pesticides, electricity, farm machinery, etc. now form larger share of the total cost. Secondly, most of these inputs are supplied by private agencies and also embodied improved technology, and, therefore, share of these inputs in the total cost is rising fast. Thirdly, production of these modern inputs like fertilizers, pesticides, farm machinery, etc requires higher use of commercial energy. This coupled with increasing use of electricity and diesel for irrigation and post-harvest operations increase the share of energy-based inputs and consequently energy-use intensity of agriculture is rising rapidly. As seen from Fig 3, use of commercial energy has risen very fast during the last decade or so and agricultural output-energy ratio has shown a steady decline since the green revolution period. It is estimated that energy requirement will double within next decade or so, and this will rise very fast if the low productivity states “catch up” with the states like Punjab, and there is faster growth of agro-processing sector (Jha *et al.*, 2012). The rise in energy demand is faster because of farm mechanization and given rising trend in agricultural wages and higher share of wages in the total cost, pressure for farm mechanization will be greater, requiring more

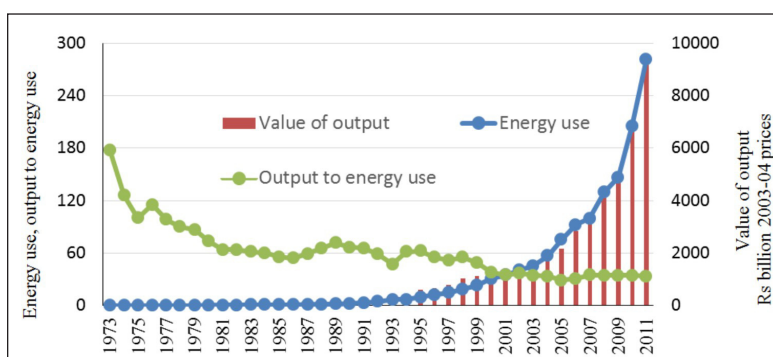
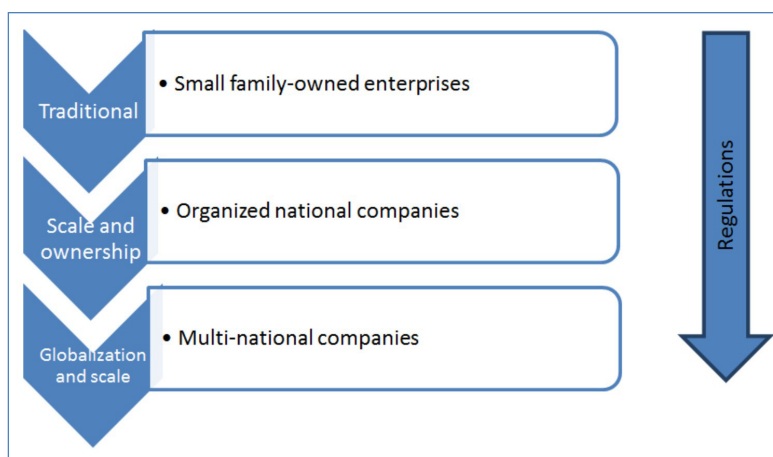


Fig 3: Structural change in use of inputs and energy

Source: Jha et al (2012)

commercial energy. Thus, use of inputs and their delivery are going to transform rapidly with advancement in technology and commercialization of agriculture.

The role of private sector will rise in delivery of agricultural inputs and services and marketing of produce. Consequently, input markets will be more organized and diversified with continuing role of public sector in some of the areas. This process of diversification and transformation to more organized markets will be seen with some marked differences (see the box). Firstly, there shall be increase in size of operation along with shift in ownership of private agencies serving agriculture. As the participation of larger companies including multinational companies increases, there shall be larger scale of operation and globalization of their business. This will be a greater departure from small scale business to multinational companies. Also, in order to govern these companies and inputs and services they supply, more formal (legal) regulations shall be required. These regulations shall be related to ease of entry and exit barriers, protection of trade interest, intellectual property rights, dispute settlement, competition laws, quality assurance, consumer protection and many more (Pal *et al.*, 2016). Therefore, enactment of these regulations and their enforcement will be critical for market transformation process.

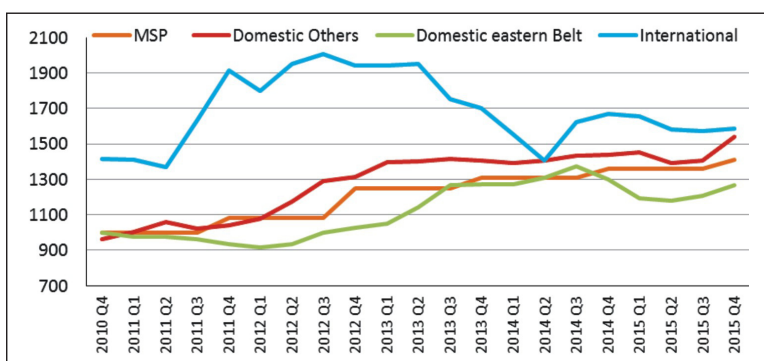


**Box 1: Transformation of agri-input and service sectors**

### ***Linking farmers with markets***

Agricultural marketing is primarily regulated by the APMC Act which prohibits purchase of farm produce outside the regulated markets. However, a model act is proposed to liberalize this, which allows products like fruits and vegetables to be transacted outside the regulated market. The market reforms are also directed to attract private investment in market infrastructure and enhance value creation, so that there is greater competition facilitating improved marketing efficiency and price discovery. The progress in terms of

market reforms is, however, mixed across the states and the same holds true for their impacts (Niti Aayog, 2015). In successful examples of market reforms, supply chains are getting shorter by the elimination of those intermediaries, which do not add any value. These institutional innovations reduce the marketing cost, link production with consumption and improve the overall efficiency. In the process, as noted above inefficient value chains and institutions are replaced by the better ones. Most of these innovations have been for fruits, vegetables and livestock products, which are largely handled by private sector. For institutional viability of these innovative business models three things are important: (a) farmers' access to information on prices, etc, (b) the model with adequate institutional and technological support, and (c) preferably, desirability of having farmers as partners in the value chains for increasing their share in value distribution. One of the important concerns is to serve smallholders who now occupy more than 44 percent of agricultural lands. There are a few examples which suggest the possibility of inclusion of smallholders. These are mostly high value products where size of operation is rather small, but amount of turnover is high. Notable examples are high value vegetables, floriculture, poultry and milk. However, capital requirement, technology and access to public services like extension are needed for inclusion of small farmers in value chains. In addition, small marketable surplus, limited access to markets due to remoteness and limited information restricts smallholders' participation in modern value chains (Reardon *et al.*, 2009; NAAS, 2015). There are efforts to promote farmers organizations, which are very thin and likely to be more successful in high value, commercial products, and products with high price volatility. Therefore, institutional support required for linking farmers with markets is critical. In fact, small farmers will have limited access to the markets of field crops like paddy, wheat, cotton, pulses and oilseeds because of size of their marketable surplus and local traders shall continue to play role of aggregator, albeit comparative lower prices realized by farmers. This is more visible for paddy in eastern India where prices realized by farmers are much lower than the minimum support prices (Fig. 4).



**Fig 4: Trends in MSP and market prices of paddy**  
(in Rs per quintal), source: CACP

There are some successful examples of contract farming where farmers are contracted by a processing industry for supply of products of a particular quality. Also in such cases, supply of products is in short of their demand. The models are quite successful but transaction cost of dealing with small farmers is high. Some local arrangements like appointing farmer supervisors, etc., and better control of small farmers on product quality can address this constraint to some extent. Contract farming is successful because of incentives to farmers in terms of better price, better access to inputs and advisory services (Joshi *et al.*, 2007), but it needs legal protection or a mechanism for dispute resolution when industry defaults procurement. Despite success of contract farming in different regions, its large scale application is limited, which is possible when the business model meets the requirements amenable to scaling up, financial sustainability and better economic efficiency.

## Technology

Technology will continue to be a dominant driver of agricultural growth and, therefore, it must be paid due attention. There are four issues which need attention for bringing a transformative change in production systems. These are: (a) application of existing stock of knowledge to harness productivity potential, (b) access to proprietary technology, (c) farm mechanization for higher input use efficiency, and (d) technology for agro-processing. There are some technologies, especially related with resource and crop management, which have not reached farmers. These need focus on adaptive research and transfer of technology in partnership with the state line departments. On the other hand, there are technology gaps relating to stress tolerance varieties of pulses and oilseeds, farm mechanization, etc. How these gaps will be addressed in the emerging innovation systems is a matter of applied research and technology transfer in partnership with state agencies and private sector. There is also a need to prioritize crops which are likely to experience a technical change similar to that observed in maize (single cross hybrid), cotton (Bt for bollworm resistance) and hybrids in vegetables and flowers and implementation of programs in 'mission mode.' Along with such technological innovations, last mile delivery of technology, skill development and information flow to farmers should be strengthened.

One of the important policy instruments in India has been sustained public funding for agricultural R&D. As a result, an uptrend in the funding has been seen since 1960s, but a sharp trend is visible after the late 1990s, attaining an expenditure intensity ratio of 0.52 percent of agricultural gross domestic product in 2011 (Pal *et al.*, 2012). Earlier most of the funding was used for the public institutions, but subsequently funding reforms were directed to attract a broad range of actors, including private sector for a diversified research system. Besides infrastructure and basic research support, incentive in the form of protection of intellectual property has become more important for attracting private sector in R&D. Therefore, effectiveness of new IPRs regime on technology development, spillovers, and

partnerships are becoming increasingly important. A suitable strategy to use IPRs to evolve a diversified innovation system and to realize their potential of IPRs to access improved technology should be followed. The evidence available so far about impact of strengthened IPRs regime in India show that there is no major shift in research priorities of public and private sectors, but organizations from both the sectors are participating in protection of their intellectual property like plant varieties (Venkatesh and Pal, 2013). Patenting activity has also geared up in India and an increasing proportion of patent applications are filed by foreign private companies, especially in chemical technology. There is increase in technology spillovers through patents in the area of pesticides, vaccines and tissue culture. All these developments indicate greater access of farmers to improved technology, albeit at a higher cost (Kandpal *et al.*, 2015). Cost-effectiveness of R&D regulations, including those of biotechnology shall, therefore, affect participation of private sector. This is more visible from a concern relating to regulation of licensing of proprietary technology which has come up recently, and this concern should be addressed without compromising interest of farmers.

As regards transfer of technology, greater concern should be diversity of institutions and partnerships in delivery of extension services. Private sector will now be an important player and delivery of proprietary technology, usually embedded with farm inputs (*e.g.* seeds and chemicals) and machinery, shall be effective as the private sector has incentive to promote commercialization of these technologies. Similar technology from public sector can also be disseminated to farmers in partnership with private sector or public extension system. But transfer of resource conservation, crop management and other sustainability promoting technology shall be a challenge. New initiatives like establishment of Agricultural Technology Management Agency and increase in number of *Krishi Vigyan Kendras* are welcome steps, but these agencies have to work more closely with the state line departments, who are responsible for implementation of agricultural development programs. These institutional innovations should be backed with more investment in extension, manpower training and increasing information flow to farmers.

Farm mechanization is another method to promote resource use efficiency and reduce cost in view of rising farm wages. There are states like Punjab which have significantly mechanized agricultural operations. This began with investment in tube-well irrigation for higher productivity and use of tractor for farm operations. Now combine harvesters and threshing machines are becoming common in these areas. Some farmers are also investing in the equipment like laser land leveller, indicating an increasing trend towards farm mechanization. As a result, machine charges as shown by the cost of cultivation data, which were less than 4 per cent of the operational cost in 1970-71, rose tremendously to 24 per cent in 2009-10 in the case of wheat. In Tamil Nadu, the share of machine labour in the cost of rice cultivation has risen to 11 per cent during 2000s as compared to only 2 per cent

in 1980s. Moreover, farmers even in the poorer states depend more on farm machines. There are several farm operations like cotton picking and rice transplanting, which can be done mechanically. The demand for farm mechanization will increase with the shortage of labour and rising agricultural wages, but concerted efforts shall be needed to develop and popularize farm machines for small farmers. Several of these machines are already in use in other countries and these will find their way in India as the presence of private sector increases. Access of small farmers to these machines can be facilitated by custom hiring of these machines. However, financing of long-term loan for purchase of these machines must be scaled up. Also, there shall be greater pressure on improving availability of energy, mainly diesel and electricity, to utilize them optimally.

Increasing focus on farm mechanization will change the structure of energy consumption in Indian agriculture. There is already a huge shift from animal and human labour towards tractor for different farming operations and electricity and diesel for irrigation. The share of these energy inputs in agriculture has undergone a drastic change. Energy consumption per hectare of net as well as gross cropped area has increased over time and therefore, as seen above, output per unit of energy use has declined (Fig. 3). This shows that Indian agriculture has become more energy-intensive and this trend will continue in future also. It is likely that demand for commercial energy for agricultural purpose will almost double in the next decade or so (Jha *et al.*, 2012).

Development of agro-processing sector needs lot of investment from business sector, availability of required infrastructure like road and electricity and technology suitable for Indian raw material. The Government has improved foreign direct investment in this sector, but the progress is rather limited. There are some successful examples like potato, tomato and mango where processing and entire value chain has gone significant transformation. This success should be replicated to other products to create value and reduce losses, particularly in fruits and vegetables. The progress to some extent is constrained by delay in implementation of APMC reforms by the states, allowing private sector to buy directly from farmers. Promotion of organized food retail chains will further increase demand for processed products and thereby promote food-processing.

### **Livestock and fisheries**

Issues discussed above are also relevant for livestock and fisheries, but these sectors also have some specific needs. First and foremost is that the growth should be driven by innovation and technology to enhance productivity per animal unit rather than population growth of animals. In livestock, about 70 percent of cattle and 82 percent buffaloes are non-descript (NAAS, 2016). Therefore, conservation of germplasm and promotion of pure breeds should get high priority. This should be followed by maintenance of pure breeds on



livestock farms, and indiscriminate cross-breeding of cattle should be checked. Achieving higher coverage and success rate of conception in Artificial Insemination (AI), reduction in puberty age in dairy animals, namely, cattle and buffalo, and greater focus on nutrition, bio-security and health management can significantly increase the productivity of animals. Participation of private sector in the delivery of reproductive and other technologies, and inputs can accelerate the rate of growth and transformation in livestock sector. Another important area where private sector can take lead is modernization of milk, egg, fish and meat value chains. Presently, most of these products are in unorganized sector, and the situation demands that this pattern should reverse by 2030 when 75 percent of this should be in the organized sector. This transformation should be facilitated by availability of capital, processing technology and entrepreneurship, and, therefore, there is role for R&D, and financial and private institutions. For providing health and AI services and increasing productivity of milch animals, infrastructure, manpower and resources at the district and block level should be strengthened, and there could be need-based outsourcing of some of the services to private sector. In fisheries, freshwater aquaculture is one of the fastest growing sub-sectors of agriculture registering a 5.1% rate of growth per annum in last 60 years. In order to maintain its sustainability we need to ensure availability of quality seed in desired quantity that is the precursor for accelerated growth. Adding value to surplus fish production can be thrust area for micro and macro enterprises in aquaculture industry. The challenges in years ahead will be to harness the appropriate marketing channels and mapping links in chain. We need to fine tune existing policies and support leasing out of various types of water bodies for fish farming, allocation of water for aquaculture and streamlining the technology delivery mechanism. Thus fishery sector has great potential to contribute significantly to farmer's income, improve his welfare and promote fish-based entrepreneurship in value addition, processing and modern marketing as well. Therefore, transformation of dairy, fish and poultry sector shall provide nutritional security, increase farm income and help to reduce poverty significantly, as a large proportion of livestock population is owned by small farmers and landless labourers. Similarly these small holder farmers can, in an integrated model, produce fish from small size ponds in their farm that are created as water holding structures to irrigate their crops.

## FARM AND NON-FARM LINKAGES

Transformation of agriculture would certainly increase productivity and farm income, but this income will not be adequate to reduce urban-rural disparity and sustain a farm household. Farm income and wage earning of agricultural workers have grown but these could not keep pace with the growth in income of non-agriculture workers (Chand and Saxena, 2015). Recent NSSO survey (70<sup>th</sup> round) indicates that average annual income of farm household was Rs.77,112 in 2012-13 and only 60 percent of this income was from



agriculture and rest from non-agricultural wages or business (NSSO, 2014). Therefore, transfer of workers to non-agricultural sector and promotion of other sources of income should be promoted in rural areas. Some of these rural non-farm activities may be driven by agricultural development. As seen from Table 1, this process of transfer of workers from agriculture to non-agriculture sector has begun but this is more for agricultural labour and the notable states are Gujarat, Maharashtra, Karnataka and Tamil Nadu. The number of workers self-employed in agriculture has decreased largely in Haryana, Jharkhand, and Kerala. Most of these workers are engaged as wage earners in non-agricultural sector and their share in work force has increased from 28 percent in 2004-05 to 36 percent in 2009-10 in the country. Thus, there is casualization of workers in the country and greater focus on development of skill and entrepreneurship among rural youth will help in promotion of self or regular employment and thereby providing a decent-level of income to rural households. The benefits provided under “Skill India” along with access to financial institutions under different government schemes should be used.

**Table 1: Work force employment pattern (%)**

State	Self -employed in non- agriculture sector		Agricultural labour		Self -employed in agriculture		Others	
	2004-05	2009-10	2004-05	2009-10	2004-05	2009-10	2004-05	2009-10
Andhra Pradesh	27	29	24	19	24	21	25	32
Gujarat	22	23	21	14	30	30	28	33
Haryana	20	18	10	8	42	33	28	41
Jharkhand	23	27	7	3	41	28	28	35
Karnataka	26	28	23	17	30	26	21	34
Kerala	18	20	15	10	24	16	43	54
Madhya Pradesh	19	20	18	16	42	38	21	26
Maharashtra	22	24	23	15	28	27	27	33
Punjab	18	17	16	12	34	31	31	41
Tamil Nadu	19	18	26	20	19	17	27	45
All India	22	24	15	11	35	28	28	36

Source: **Based on NSSO data**

## POLICY IMPERATIVES

The foregoing discussion underscores the need for acceleration of transformation of Indian agriculture, involving structural changes in the production, inputs use, markets and employment. This process shall be facilitated by institutional innovations in delivery of inputs and services, marketing of produce, and value chain development. These innovations coupled with technological innovations for better resource use efficiency, climate-smart farm practices and quality assurance shall transform agricultural production systems into more efficient, sustainable and income generating systems. These innovations shall however be encouraged by availability of necessary infrastructure, incentives to the innovators and access to improved technology and capital. Therefore, public investment, price support, trade and credit policy shall have major impact on the innovation capacity and increasing agricultural productivity. It is likely that present policy of low input and low output prices will continue because of food security reasons, and there will be increasing focus on increasing availability of institutional credit, which should provide some resources for investment in agriculture, but public investment should also be enhanced. Agricultural exports though important for higher farm income, support for infrastructure and capacity to comply with SPS requirement should be in place, particularly for products like fruits, milk and milk products, meat and meat products, fish and fish products. Foreign direct investment (FDI) in agro-processing and organized retail is important policy instrument and recently the government has liberalized this sector, allowing 100 percent FDI. This policy shift should accelerate development of agro-processing sector, promote innovations and value creation along the supply chains. Finally, one can't rule out the need for strengthening of institutions at village and community level to improve delivery of services, increase economy of scale, better targeting of development programs, and promote entrepreneurship. The government should invest in these institutions, along with capacity building of farmers, rural youth and women, which are necessary to bring structural changes in rural employment and income patterns. The economy of scale in the production and marketing can also be enhanced by legalizing tenancy and, therefore, reforms in this area should be stepped up and larger responsibility for this and other market reforms rests with the state governments.

### *Farmers welfare*

Low farm income, decreasing land-man ratio and high risk will make farmers vulnerable to various shocks. This coupled with eroding village social safety nets like joint holdings, shrinking common property resources, and individualistic approach shall make farmers more vulnerable. Therefore, there will be need for government programs to improve farmers welfare. The need for focusing on farmers welfare has also been emphasized by the National Commission on Farmers (2004). Initiative of the Union Government to double farm income by 2022 and covering most of the farmers under Pradhan Mantri

Fasal Bima Yojana are welcome steps to ensure higher and stable income. In addition, strengthening of farm services, health and other family welfare programs shall provide much needed support to enhance capacity of rural workers and farmers for income generation. In this context, farm women and agricultural labour will need special interventions. Also, opportunities to augment farm household income like non-farm employment, security of land, and responsiveness of local institutions will be needed. Individualistic approach in use of natural resources is likely to increase rural conflicts, especially in hilly and rainfed areas, and the local institutions should have capacity for resolution of these conflicts. One can also consider the role corporate sector can play in using the resources earmarked for corporate social responsibility for farmers' welfare. Finally, farmers often face problem with regard to quality of services and inputs and therefore making the consumer protection mechanism effective shall help farmers in overcoming several production constraints and reducing income losses.

## RECOMMENDATIONS

1. There is a need for doubling public investment in agriculture for infrastructure development and the priority areas are irrigation, R&D and markets. A significant proportion of these resources must come from the states.
2. In order to facilitate institutional innovations, regulations governing agricultural sector should be revisited and corrective measures should be undertaken to liberalize the sector. A notable example is speedy implementation of model APMC Act in different states.
3. It is important that private sector shall be an important ally of central and state governments in agricultural development and, therefore, present policy of private sector participation should continue in all sub-sectors of agriculture. Important areas are product market, agro-processing and delivery of inputs.
4. Implementation of agricultural market reforms is slow by different states governments and this should be taken by them on priority. Legal framework for contract farming and direct procurement of farm produce by processing industry, retail chain, aggregator etc. should be promoted.
5. Capital requirement for increasing household investment in agriculture and business investment in modernization of value chains should be met with greater focus on term-loan by financial institutions, besides continuing emphasis on crop loan.
6. In order to transfer work force from agriculture to non-agriculture sector, institutions for skill development for rural youth and access to venture capital should be given priority under 'skill India' and MUDRA initiatives of the government.
7. Extension of Jan-Dhan-Yojana, Aadhar and Mobile (JAM) and implementation of tenancy reforms are important initiatives of the government. These initiatives along with Pradhan Mantri Fasal Bima Yojana would help farmers manage risk and extend benefits of other schemes directly to cultivator farmers. These programs should be supported with modernization of land records for effective implementation of the scheme.

8. In order to learn from the reforms, there is a need for assessment of these policy reforms and development programs of the governments and their outcomes. The gaps in implementation of these programs by the states and recommendations made by various committees may also be assessed for addressing the bottlenecks.
9. There are some good examples of acceleration of the transformation of agriculture in different states. These examples often relate to balancing the roles of centre, states, private sector and civil society organizations in various development programs, farm services like extension and market reforms. Lessons from these examples should be drawn for their out-scaling in other states.
10. Technology transfer programs should be given priority for use of available knowledge and technology for raising productivity of crops like pulses and oilseeds, sustain natural resource base in the context of climate change, and improve animal health. In order to reduce rising wage bills, farm mechanization with focus on small farmers in partnership with private R&D should be encouraged.
11. There are sector-specific requirements for their transformation like capital and entrepreneurship development for dairy and meat. These sectors should be paid adequate attention and the government should provide necessary infrastructure and policy support. These sectors have specific requirement for quality assurance and SPS compliance, and actors at different stages of value chain must ensure product quality as per global standards.
12. Doubling of farm income by 2022 needs targeting efforts for increasing productivity, diversification of product mix and realization of better prices. Bridging yield gaps and delivery of technology for higher total factor productivity and irrigation management can provide immediate benefits in terms of higher yields and farm income. This should be followed by diversification of production system towards high value crops for which demand is rising faster. This shall be a demand driven growth and diversification facilitated by dissemination and adoption of improved technology.
13. Post-harvest management of produce, processing and value addition are other important areas which need priority in terms of attracting investment. In this context, facilitating regime for allowing corporate investment, technology delivery, and linkages with R&D and financial institutions are necessary. Development of post-harvest sector shall not only create value for realization of higher prices for farmers but will also reduce pressure on farm for employment, and thus, generating higher income and surplus for further investment on farms.
14. Management of market risk shall be an important component of the strategy for improving farmers welfare. Besides PMFBY for yield risk, financial products and market mechanisms to manage price risk shall go a long way in protecting farmers against risk. Similarly, assurance of quality of farm inputs like seed, pesticides and animal health products is another area where existing mechanism like consumer forums should be made effective. Also, associations of companies can join forces to assure discipline and quality in input markets.

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*Note: The designations and affiliation of the participants are as on the date of Strategy Workshop.*





