Significant Contributions (2016-17 to 2020-21)

ICAR – National Institute of Agricultural Economics and Policy Research
(Indian Council of Agricultural Research)
New Delhi 110 012

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Preface

ICAR-NIAP is recognized as a lead institution for agricultural policy research with considerable influence on policy making in the country. The notable areas of impact are R&D policy, diversification and sustainability of production systems, institutional and market reforms and commodity value chains. Recently, the Institute has advanced the concept of doubling farmers income, regional crop planning for climate resilient agriculture, market intelligence and ecosystem services. Research publications of the Institute are cited internationally and economists working in NARS derive strength from NIAP. Strategy for doubling farmers income, market intelligence and ecosystem services have been adopted by the Government and ICAR-NIAP is a knowledge partner of the Government Departments. The Institute has facilitated various reviews of NARS and represented in high-level Committees. A number of capacity building programs were conducted for agricultural economists, foreign officials and officers of Indian Economic Service. This document contains significant contributions of the Institute during 2016-17 to 2020-21. I sincerely thank my colleagues particularly Dr. S.K. Srivastava, Dr. Raka Saxena, Dr. Rajni Jain, Dr. Vinayak Nikam and Ms. Sonia Chauhan for their useful contributions in compilation and presentation of the material. The guidance and support of ICAR has been extremely useful.

(Suresh Pal)
Director

March 30, 2021

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1. General profile of the Institution

1.1. Establishment and development profile

The National Institute (formerly Centre) of Agricultural Economics and Policy Research (NIAP) was established in 1991 by the Indian Council of Agricultural Research (ICAR). ICAR-NIAP is located at 28°37′56.7″N latitude and 77°10′17.2″E longitude in Pusa, New Delhi. The Institute is committed to provide a leadership role in strengthening agricultural economics and policy research within the National Agricultural Research System (NARS). It acts as a think tank of ICAR in the area of agricultural economics and policy research, and provides credible research-based inputs to the Council to actively participate in policy debates and decisions. Besides ICAR, the Institute also provides regular technical and policy inputs to NITI Aayog, Ministry of Agriculture and Farmers Welfare, Ministry of Consumer Affairs, Food and Public Distribution, other ministries at the Centre and States and to many other stakeholders for policy decisions related to food and agriculture.

Mission

Strengthen agricultural economics research for providing economically viable, socially-acceptable and environmentally-feasible policy options for science-led agricultural growth

Vision

Leveraging innovations for attaining efficient, inclusive and eco-friendly agricultural growth through agricultural economics and policy research

In the year 2006, The Institute got its own fully fledged building near ICAR-IASRI. The year 2014-15 has been a momentous year for the Institute, as the ICAR upgraded its status from 'Centre' to 'Institute'. Over the last three decades, ICAR-NIAP has been contributing significantly to the growth of the discipline of agricultural economics. The Institute has guided the Council in prioritization of its research agenda so as to improve efficiency and equity in agricultural research, and made significant contributions towards understanding contemporary issues and challenges of agriculture. Specifically, the Institute has made notable contributions in the areas like impact assessment of agricultural R&D, doubling farmers' income, research prioritization, investments and subsidies, technological change, agricultural sustainability, optimum crop plans, diversification, climate change, domestic market reforms, international trade, institutional innovations, market intelligence, livestock economics, commodity outlook, prices and demand forecasts. ICAR-NIAP acknowledges importance of partnership in forging strong alliances to tackle common research problems and in shaping the trajectory of agricultural growth through policy-oriented research and communications.

ICAR-NIAP has state-of-art infrastructure and facilities to undertake its mandated activities. A centralized enterprise resource planning (ERP) system solution developed for entire ICAR is fully functional at ICAR-NIAP. Agricultural Knowledge Management Unit (AKMU) manages research information and products, and provides other research related information through well-equipped infrastructure such as latest computers, servers, firewall (Fort iGATE 80c), centralized antivirus and analytical softwares. ICAR-NIAP has a specialized collection of print, electronic and digital resources. This library is housing a total of 7457 publications

including books, journals, bulletins, CD ROMs, database publications, reports, SAARC publications and other reference materials, etc. The library has subscription of 15 international journals and 18 national journals. Institute's library has reserved a separate section for books of official language (Hindi).

1.2. Organizational and functional profile

As per the guidelines of ICAR, Director of ICAR-NIAP is advised by Research Advisory Committee (RAC), Institute Management Committee (IMC) and several other institute-level committees and cells to manage research and other programmes.

RAC comprising of eminent professional outside the ICAR system, ICAR officials and farmers' representatives, guides the Institute in planning research thrusts and strategies. Initiatives in human resource development, approaches towards improving policy dialogues and evaluation are some other areas in which the Institute receives guidance from RAC. Prof. Abhijit Sen, former Member, Planning Commission was the Chairman of RAC constituted by the Council for the three years from June 21, 2017. Present RAC is chaired by Sh. Harsh Bhanwala, Ex-Chairman, NABARD.

The functioning of the institute is supervised by the IMC. Besides RAC and IMC, a number of internal committees and cells, including those mandated by ICAR, are operating for an efficient and decentralized management of the Institute. The Joint Staff Council (JSC) promotes healthy interaction and congenial work environment at the Institute. Director conducts regular meetings with staff, mostly every month, to discuss scientific and management issues to elicit suggestions for cordial functioning of the Institute. The organogram of the Institute is given in figure 1.

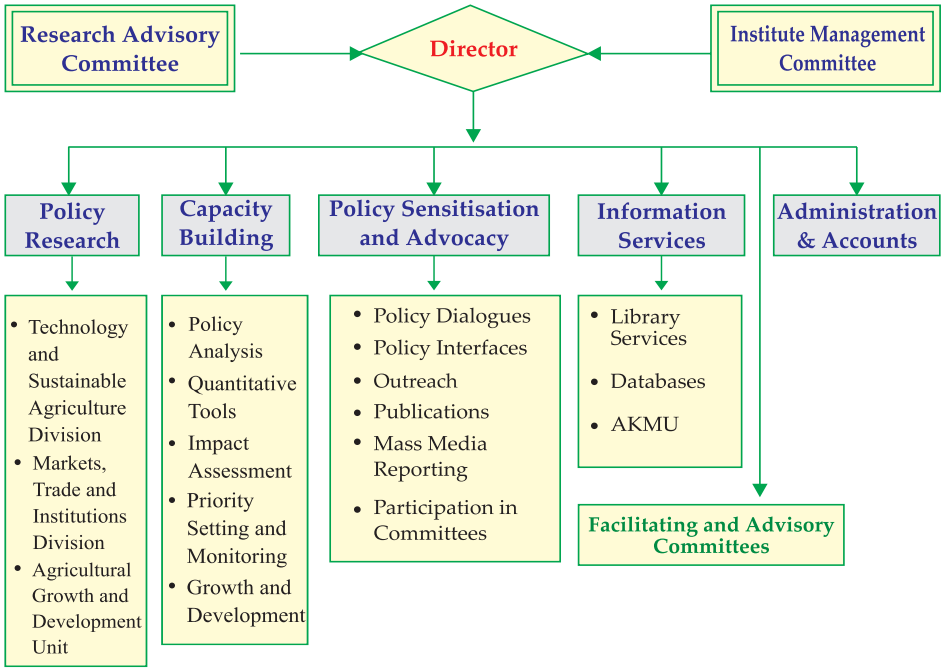


Figure 1. Organogram of ICAR-NIAP

1.3. Financial/Budget profile

Research projects and other programmes of ICAR-NIAP are primarily funded by the ICAR. Besides ICAR, external funding is raised through consultancies and capacity building programme from the other national and international agencies like Ministries under Government of India, NITI Aayog, NABARD, FAO, CGIAR centres (IFPRI, ICRISAT, ILRI, etc), WHO, etc.. The financial budget detail of the Institute during the last five years is presented in Table 1.

Table 1. Budget of ICAR-NIAP during 2016-17 to 2020-21

(Rs Lakh)

Particular	2016-17	2017-18	2018-19	2019-20	2020-21
Budget (Sanctioned)	958	1021	1283	1331	1175
Budget (Utilized)	926	978	1263	1319	904*
Financial efficiency (%)	96.7	95.8	98.4	99.1	-

* Upto January 31, 2021

2. Objectives and relative priorities

To accomplish its vision and mission, ICAR-NIAP undertakes and promotes agricultural policy research, training and policy interfacing programs focusing on:

1. Policy studies on contemporary agricultural development issues through in-house, collaborative and consultancy research
   - R&D policy and technology management
   - Natural resource and environmental economics
   - Agricultural development, markets and trade
2. Strengthening agricultural economics and policy research
   - Capacity development by facilitation, networking and dissemination of information
   - Training programs and collaborative research
   - Enhancing ICAR participation in policy decisions through policy dialogues and institutional linkages

Mandate

- Agricultural economics and policy research on markets, trade and institutions
- Growth and development models for sustainable agriculture
- Technology policy, Evaluation and impact assessment

2.1. Research activities

The research activities of ICAR-NIAP are broadly covered under the following three major themes: (1) Agricultural Growth and Development; (2) Technology and Sustainable Agriculture, and (3) Markets, Trade and Institutions.

Broadly, ICAR-NIAP research portfolio under the theme *Agricultural Growth and Development* comprises structural transformation of agriculture and disparities in development, doubling

farmers' income, agricultural diversification and drivers of growth, investments in agriculture, property rights, gender, agriculture-nutrition-health linkages and emerging topical issues of national importance. *Technology and Sustainable Agriculture* theme includes policy studies on climate change, natural resources management and environment, risk in agriculture, valuation of environmental services, agro-climatic zonal planning, resource use efficiency, impact of agricultural technology, and performance evaluation of agricultural extension system. Under *Markets and Trade theme*, thrust is on policy studies on market intelligence, market reforms, infrastructure development, mapping value chains, marketing efficiency, commodity outlook, price forecasts, price transmission, food quality and food safety, innovations in input markets, credits and farm services, agricultural trade pattern and international agreements. The Institute is actively engaged in collaborative and multi-disciplinary research in a network mode by involving agricultural economists, social scientists, and biological scientists. A pictorial depiction of research activities at ICAR-NIAP is presented in figure 2.

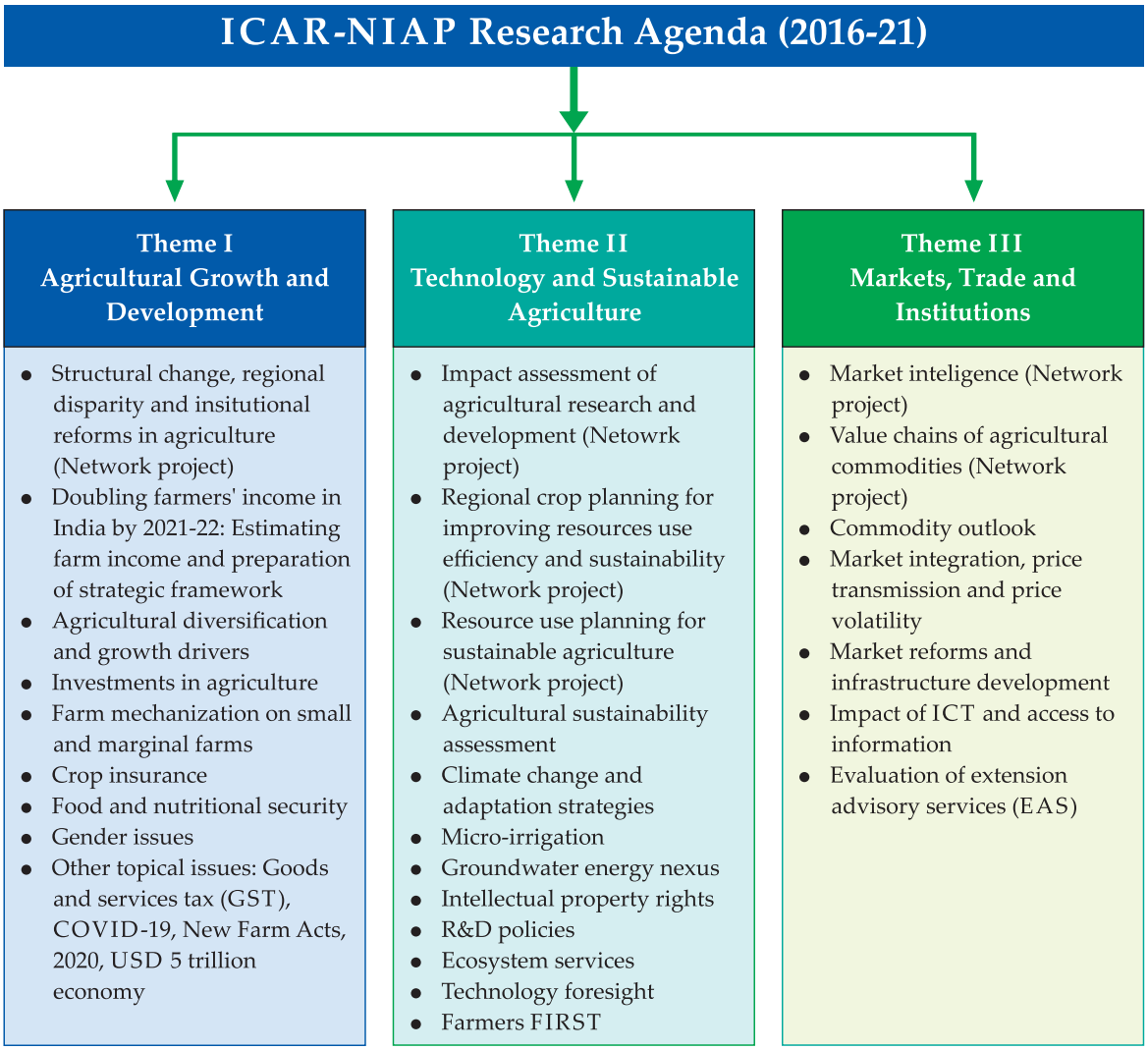


Figure 2. Overview of research activities at ICAR-NIAP during 2016-17 to 2020-21

2.2. Policy interface activities and communications

ICAR-NIAP contributes to policy formulation through participation of its faculty in policy dialogues, debates and several committees of Central and State Governments. The Institute has a history of publishing regularly Policy Papers, Discussion Papers, Policy Brief etc on contemporary policy issues which serves as a medium for constructive critique, and sensitization of peoples' representatives and policy makers. Further, based on in-house research, the Institute regularly provides policy inputs to ICAR, agricultural and other Ministries of Central Government, NITI Aayog, and State Governments. Seminars and workshops are regularly organized on topical issues at the Institute for policy advocacies and dissemination of research based inputs.

2.3. Capacity building

ICAR-NIAP plays a key role in strengthening capacity and human resources development in the field of agricultural economics and policy research. The network projects are used to develop formal linkages among the institutions within and outside NARS and to exchange modern concepts and advanced analytical skills among the researchers on contemporary issues in agricultural economics and policy research. The Institute regularly organizes capacity building workshops and trainings to keep pace with the new developments in the discipline. Association with the Post Graduate School of the Indian Agriculture Research Institute (IARI) for teaching and guiding M.Sc. and Ph.D. students are other capacity building activities of the institute.

3. Significant outputs and outcomes (2016-17 to 2020-21)

A. Research

A1. Significant research contributions

ICAR-NIAP had done considerable efforts to promote evidence based policy research and sensitize agricultural policy planners and ICAR about emerging challenges, priorities and strategies for agricultural development in India. The research conducted in the Institute can be broadly categorized under three broad themes, Agricultural Growth and Development, Technology and Sustainable agriculture, Agricultural Markets, Trade and Institutions.

A1.1. Agricultural Growth And Development

The research studies under this theme during the last five years covered topical issues such as structural transformation, regional disparities, farmers' income, investment in agriculture, diversification, farm mechanization, food and nutritional security and role of gender in agriculture. The key extracts and the brief account of the research contributions in these areas are presented below.

Agricultural growth: The analysis revealed a cyclical pattern in growth trajectory of agricultural output around average annual long-term growth rate of about 3 per cent (Figure 3). In the recent years, the agricultural growth has turned more inclusive with an impressive performance in

Agricultural Growth and Development

Key Findings

- Structural changes in output and employment in rural India have been unraveled and policy prescriptions have been provided to accelerate such transitions and make agriculture responsive.
- Growth trajectory of agriculture follows a cyclical trend around 3% long-run growth. Agriculture has become more inclusive, stable and resilient in recent years. Promotion of processed food export is found a better policy choice for accelerating growth.
- Farm mechanization is rising. But, existing pace of farm mechanization and productivity growth has remained inadequate to absorb wage-push cost inflation and needs acceleration.
- Agriculture has potential to accelerate economic growth in poor regions through its spill-over effects. Agro-ecological zones and aspiration districts have been characterized in terms of agricultural development indicators. Prioritizing and targeting less developed regions produce large and equitable marginal effects on overall economic development.
- Knowledge support has been provided to DFI committee for formulating strategies of doubling farmers' income and monitoring its implementation for achieving the target by 2022.
- Potential of agricultural diversification to accelerate growth, enhance farmers' income, reduce poverty, improve nutrition, and decrease inter-regional disparities has been established. The research suggests fostering investment towards improving post-production infrastructure to unleash the potential of diversification.
- Priority areas for accelerating investment in agriculture have been identified and a framework of public-private-farmer cooperation to foster investment for sustainable agricultural development has been developed.
- Evaluation of food demand and supply showed adequacy of staple food to sustain food security in the near future. Ensuring nutritional security is more challenging than economic security and warrants a holistic approach by converging multi-dimensional efforts.
- Effect of subsidies spent on in-kind PDS transfer on calorie-intake is 3.5-3.9 times the effect of direct cash transfer of food subsidy. This warrants strengthening of PDF functioning or conditional cash transfer.
- Impact of COVID-19 on agriculture sector was found to be least. Reduction in income due to disruption of economic activities is expected to reduce food consumption expenditure by 6.36 per cent to 26.68 per cent and non-food expenditure by 7.69 per cent and 32.79 per cent in 2020-21. The incidence of poverty may see an upward trend in the short-run.
- To achieve target of USD 5 trillion economy by 2024-25, agriculture has to growth at almost double rate than it has grown during last five years. The implications at this level on agriculture and natural resources have been drawn.
- Rationality of enacting New Farm Acts, 2020 and critical areas of its successful implementation have been examined based on empirical evidences

livestock and fisheries sub-sectors. Growth in livestock was more than 9 per cent in Madhya Pradesh, Tamil Nadu, Rajasthan and Andhra Pradesh, and in fisheries it was more than 10 per cent in Andhra Pradesh and Odisha during 2011-12 to 2017-18. Further, Indian agriculture has become more resilient and stable. A simulation study on export promotion policy options suggested that promotion of processed food exports could be a better choice for achieving higher agricultural growth.

Structural transformation: The research unraveled the ongoing transitions in the rural economy in terms of output and employment and provided evidence based policy inputs for strengthening rural and agricultural economy. Due to relatively higher growth in rural

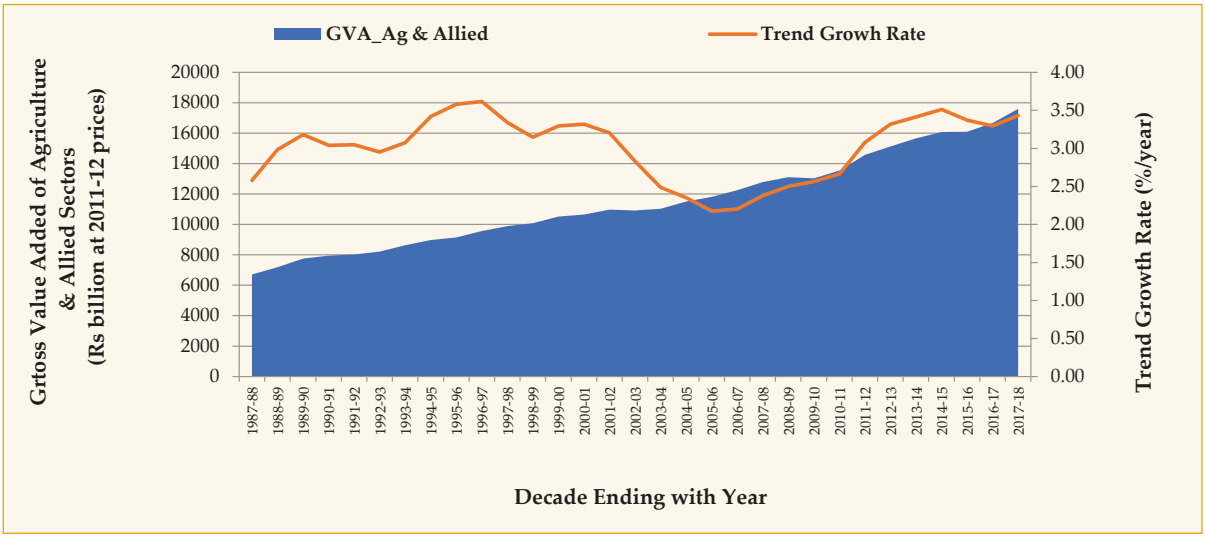


Figure 3. Growth trajectory of Gross Value Added of Agriculture & Allied sectors (at 2011-12 prices)

non-farm sectors, the share of agriculture in output declined from 72.4 per cent in 1970-71 to 39.2 per cent in 2011-12. Although non-farm sectors have overtaken agriculture sector as a major contributor to rural output, the later still engages 64 per cent of rural workforce. The evidences further revealed withdrawal of workforce from agriculture both in absolute and relative terms due to rising employment diversification, albeit at a slower rate. A study has characterized such transitions, identified underlying drivers and drew its implications on the farm and rural economy. Policy prescriptions have been provided to accelerate structural transformation and make agriculture responsive to such changes.

Regional disparity: A study on regional dynamics of growth in agriculture demonstrated absolute convergence in per capita income across the districts, driven by positive spill- over effects of agriculture on overall economic growth. The study showed potential of agriculture to accelerate economic growth of poor regions through its spill-over effects. Another study mapped the disparity in distribution of income among the farmers in the country. At national level, about 70 per cent of the farmers earn per capita income less than Rs. 15,000, whereas only 10 per cent of the farmers have per capita income more than Rs. 30,000. Further, 80 per cent of the farmers of eastern region falls in the category of low-income, while in the western region, the share ranges from 51 per cent in Gujarat to 78 per cent in Chhattisgarh. A study characterized and mapped agro-ecological sub regions (AESR) based on ten indicators representing production, infrastructure, information, marketing and income of the farmers (Figure 4). Less-developed AESRs have been identified for greater prudency in planning. The analysis found large and equitable response of the efforts targeted towards less-developed regions. Another study characterized 117 *Aspirational* districts identified by NITI Aayog based on agricultural developmental indicators and evaluated the probability of shifting away from traditional cultivation to allied activities and other non-farm occupations.

Doubling farmers' income: Despite rising production and commercialization of agriculture, the level of farmers' income is at low level. The development agenda in agriculture has shifted

from production to income of the farmers. A seminal study conducted at ICAR-NIAP filled an important void in the literature by estimating the level of farmers' income at aggregate level. As a knowledge partner, the Institute provided evidence-based inputs to the Doubling Farmers' Income (DFI) committee and directly contributed to developing strategies of DFI. Various research studies pertaining to income estimation, income inequality, price volatility along with market and trade reforms have been undertaken which have provided evidence based inputs for improving income. Technical facilitation has been extended in designing the framework for the proposed "Ease of Doing Agriculture Index". ICAR-NIAP provides continuous knowledge support to the DFI committee in monitoring the implementation of the strategies.

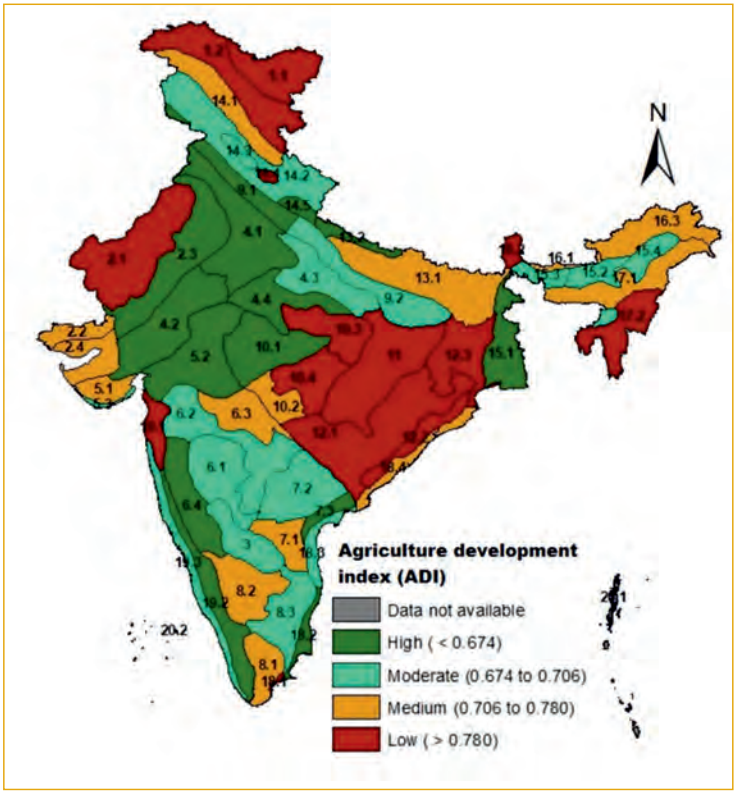


Figure 4. Mapping of AESRs based on Agricultural Development Index (ADI)

Diversification: Although diversification is rising, still production basket is dominated by crops sub-sector (56% of agricultural output) and foodgrains (63% of gross cropped area) within the crops sub-sector (Figure 5). The research conducted at ICAR-NIAP has proven that agricultural diversification has the potential to accelerate growth, enhance farmers' income, reduce poverty, improve nutrition, and decrease inter-regional disparities. Within agricultural sector, crop diversification out of staples towards high-value crops (HVCs) is appropriate when land is scarce and labour is abundant endowments that are typical of the smallholder farmers. The study revealed that small farmers prefers HVCs since economies of scale are usually less important in these relative to staple crops. The likelihood of a farmer being poor is 3-7 per cent less if he grows HVCs. By farm size, the biggest impact of HVCs on poverty is assessed for marginal farmers (-7.49%) followed by smallholder farmers (-6.30%). Growers of HVCs on average allocate close to one-fourth of their area to these crops. Results show that farmers would need to increase their area under cultivation of HVCs from 33 per cent to about 50 per cent to be able to escape poverty. The research suggests fostering investment towards improving post-production infrastructure to unleash the potential of diversification.

Investment in agriculture: Investment in productive assets is a prerequisite for accelerating growth in any sector. An analysis of the investment found stagnation in the investment in agriculture during the 2010-11 to 2017-18, despite rising public investment at about 6 per cent

per annum. This was due to negative growth (-0.77%) in investment by the farmers which contribute 76 per cent of total agricultural investment. The estimates show that small and marginal farmers, who operate 47 per cent of agricultural land, constitute only 9 per cent of the total investment by households. Low earnings from agriculture do not generate sufficient savings which can be invested in productive assets and farmer remains in a vicious cycle of low income-low investment-low income. Further, the level of corporate investment in agriculture is only 2% of total investment in agriculture. The study has identified priority areas and developed framework of public-private-farmer cooperation to foster investment for sustainable agricultural development.

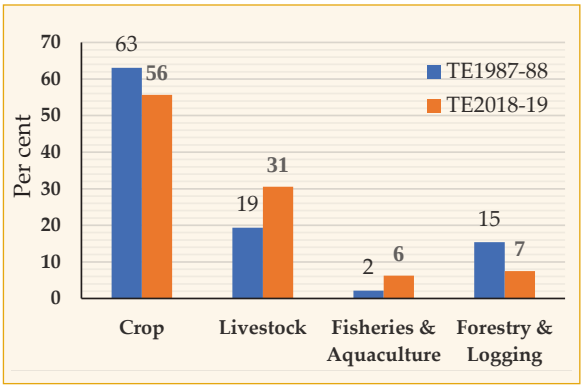


Figure 5. Composition of agricultural output

Farm mechanization: The level of farm mechanization, though rising, is still in its early stage. Further, there exists wide spatial variation in farm mechanization. Haryana had highest tractor density of 76 tractors per thousand hectares of net sown area followed by Punjab (58), whereas Kerala had lowest tractor density (2.3) in 2017-18. Among various factors, increase flow of institutional credits, increase in agricultural GDP and increase in real wages were found to be positively associated with the pace of farm mechanization in the country. The analysis found that withdrawal of labour from agriculture has not affected agricultural output and labour productivity is increasing across the crops and regions. This is an outcome of rising farm mechanization, capital intensity and productivity in agriculture. However, employment diversification has pushed up labour wages and inflated production cost. The research revealed that existing pace of farm mechanization and productivity improvement is inadequate to absorb wage-push cost inflation in crop cultivation. The study provided policy inputs to accelerate rate of farm mechanization and productivity to make cultivation remunerative.

Food and nutritional security: Evaluation of food demand and supply showed adequacy of staple food to sustain food security in the near future. A study unraveled the changing food consumption pattern and suggested to diversifying production basket consistent with changing demand. Studies on nutritional issues showed that improving nutritional security is more complicated than the economic security. Barring few states, calories intake by most of the rural and urban population is lower than the norms. However, long-run declining trend in calories intake are witnessing a trend reversal in the recent years along with a decline in inequality in calories intake across income-categories. The plausible reasons behind such development have been provided. A study indicated that effect of subsidies spent on in-kind PDS transfer on calorie-intake is 3.5-3.9 times the effect of direct cash transfer of food subsidy. This warrants strengthening of PDF functioning or conditional cash transfer. The research has provided evidences on both under as well as over nutrition among Indian households and emphasized creation of awareness about adequate nutrition among other measures. A study looking into the inter-temporal and spatial changes in nutritional security in India recommended using multiple measures in evaluating undernourishment and malnourishment in India.

Gender issues: Studies on gender issues examined the changing female employment in agriculture and role of women in food and livelihood security. A study analyzed the withdrawal of female workers from agriculture over the years and provided plausible reasons of rising de-feminization of agricultural workforce. A study assessing the role of livestock in improving women's bargaining power in intra-household resource allocation showed that additional female worker would increase income from livestock activities by 7 per cent. A study on gender perception in rural farm households showed that male dominance in decision making is observed across the states like Bihar, Jharkhand and Odisha at varying level. Another study which employed games to measure trustworthiness of male and female in household showed that in Bihar and Jharkhand male are more trustworthy than female, while it was vice versa in Odisha.

Impact of COVID-19: The unprecedented occurrence of COVID-19 disrupted several economic activities and adversely affected income levels of majority of the households. In this context, impact of COVID-19 was assessed on agriculture, consumption pattern, and poverty of the households. During initial phase of nation-wide lockdown to curb the spread of virus, supply chain of agricultural commodities got affected, but later on restored due to intervention by the government. Overall, impact of COVID-19 on agriculture sector was found to be least and the sector emerged as a single bright spot among all sectors with positive growth 3.4 per cent (first advance estimate) in 2020-21. However, decline in the income of majority of the households due to disruption in economic activities has created a disequilibrium in the economy through a downward shift in demand curves of food and non-food items. The estimates showed that consumption expenditure during 2020-21 may decline by 6.36 per cent to 26.68 per cent (over 2019-20) which will reduce food consumption expenditure by 4.98 per cent to 21.24 per cent and non-food expenditure by 7.69 per cent and 32.79 per cent depending on the pace of recovering in the economy after first quarter of 2020-21. Further, the households will reallocate consumption expenditure from non-essential to essential commodities. The incidence of poverty may see an upward trend in the short-run.

Implications of achieving USD 5 trillion economy on agriculture and resources: Agriculture sector is accorded a high priority in achieving the target of becoming USD 5 trillion economy by 2024-25. The sector is given a target of contributing USD 1 trillion to the economy at the level of USD 5 trillion. This requires agriculture to grow at almost double speed during the next five years as compared to the last five years. The study has outlined priority areas and identified critical challenges to be addressed for achieving this ambitious target. Further, the implications of changing consumption pattern at higher income level on production and natural resources have been assessed so as to produce sufficient food amid shrinking land and water resources.

New farm Acts, 2020: In the context of improving farmers' income and realizing other commitments, the Government enacted two new farm Acts and amended Essential Commodities Act, 1951 in September, 2020. These new acts, however are being widely debated and there are various arguments both in favour and against the likely benefits of these acts on the farm economy and farmers' welfare. The study has evidently examined the rationality of enacting these Acts and identified critical issues for realizing the intended benefits. The

evidence based analysis reveals that successful implementation of these Acts has potential to create conducive business environment for fostering private investment in infrastructure development, reducing market and price risk and strengthening linkages between farmers and processors/exporters. Successful implementation of Acts, however requires strengthening of Farmer producer Organization, co-existence of competition between AMPC *mandis* and outside market trade, and effective market intelligence and price information system outside AMPC *mandis*.

A1.2. Technology and Sustainable Agriculture

Under this theme, the research focused on the issues such as impact of agricultural research, R&D policies, intellectual property rights, impact of climate change and adaptation strategies, agricultural sustainability assessment, resources use planning, groundwater-energy nexus, optimum cropping plans, and ecosystem services etc.

Technology and Sustainable Agriculture
Key Findings

- Average IRR to agricultural research has been estimated at 72 per cent with a median value of 58 per cent. Total factor productivity in field crops has increased at 1.76 per cent growth rate during 1980 to 2012.
- The research intensity measured as the share of expenditure on research in agricultural GDP in India is much below (0.40%) than in China (0.62%), Brazil (1.82%), average for developed countries (>2 per cent) and general recommended of one per cent for developing countries.
- India's growth in cumulative patents filed in agriculture is higher than the global average during the recent years.
- The climatic shocks adversely affect agricultural productivity and the damage increases with increasing severity of climatic shocks. The impacts vary across the crops and agro-climatic zones (ACZs) necessitating region specific interventions and prioritization of adaptation strategies. Diversification and improvement in irrigation infrastructure has been found to have a positive marginal effect on improving resilience of agriculture. Mainstreaming adaptation strategies to developmental planning has been recommended.
- ICAR-NIAP has assessed economic impact of 29 ICAR technologies developed during last two decades, consisting of improved varieties of field and horticultural crops, animal health management technologies, natural resources management technologies, and aquaculture practices and technologies.
- A framework for agricultural sustainability assessment has been developed and used to assess agricultural sustainability across districts of Punjab and Haryana.
- Optimum resources use plans have been developed under various resources constraints and technology/policy interventions in different regions of the country.
- The potential area under micro irrigation has been estimated as 72-77 million hectare in the country. Among states, Uttar Pradesh has the highest potential area (25%) followed by Rajasthan (12%), and Madhya Pradesh (11%).
- De-subsidization of energy would result in 29, 38, 41, 48 and 82 per cent groundwater saving in paddy, cotton, sugarcane, wheat, and maize, respectively. However, de-subsidization may not lead to change in paddy-dominated cropping patter due to strong price policy support to paddy.
- Effort has been extended to collate evidences on ecosystem services, assess role of R&D in enhancing them and mainstreaming ecosystem services in the development processes.

Impact of agricultural research in India: Several studies have been undertaken to assess the impact of agricultural research and technology. Most of the studies have analyzed internal returns (IRR) to research for individual crops and some have analyzed for the sector as a whole. Based on 28 studies, the average IRR to agricultural research has been estimated at 72 per cent with a median value of 58 per cent. Another way to examine the impact is to compute total factor productivity (TFP). A study revealed 1.76 per cent growth in TFP in field crops during 1980 to 2012; and 55 per cent of this was attributable to technological change, 43 per cent to technical improvement and 3 per cent to scale of farming. Further, it is estimated that one per cent increase in agricultural research expenditure per hectare may lead to 0.084 per cent increase in agricultural productivity. Recently, ICAR-NIAP has assessed economic impact of 29 ICAR technologies developed during last two decades, consisting of improved varieties of field and horticultural crops, animal health management technologies, natural resources management technologies, and aquaculture practices and technologies.

Optimum crop and enterprise plans: The cereal-centric agri-food policy has led to distortions in cropping pattern and exploitation of natural resources, especially groundwater, beyond their sustainable limits. NIAP's research suggests for a holistic approach to crop planning, taking into consideration endowment of natural resources, environment cost and benefits associated with different crops (Figure 6). In order to sustain groundwater resources, optimum crop plans have been developed for the states such as Punjab, Rajasthan, Bihar, Assam, Karnataka, and Maharashtra. The crop plans provide desirable direction of change in existing cropping pattern. Another study based on water availability and footprints revealed agro-climatic zones of eastern and central India more sustainable for paddy cultivation as compared to north-western and south-western zones. Crop suitability assessment indicated that most of the existing crops are either moderately or marginally suitable for cultivation. Amidst reducing availability of land and water resources, optimum enterprise plans have also been developed for arid, semi-arid tropics and flood prone regions using mathematical programming models.

Resources use planning: The studies revealed that cropping pattern in various regions are inefficient in terms of resource use and unsustainable from natural resource use point of view. This has resulted into misallocation of resources, efficiency loss, indiscriminate use of land and water resources, and adversely affecting long term production prospects. Amidst shrinking resources, optimum resources use plans have been developed under various resources constraints and technology/policy interventions. Further, the adoption pattern and impact of resources conservation technologies have been examined for sustainable agricultural development. In Punjab, a short window of time between paddy harvesting and wheat sowing has been found as a major cause of crop residue burning. Based on the comparison of short duration paddy varieties namely PR121 and PR126 with the most preferred variety PUSA44 a study has suggested to promote short duration varieties as these results in substantial savings in inputs and resources. Similarly, Happy Seeder has been assessed as a successful paddy straw management technology, which is associated with reduction in input cost and saving in water and energy. Direct seeded rice (DST) has been found to be comparatively less resource-intensive with higher net returns than the transplanted puddled rice. However, adoption rate

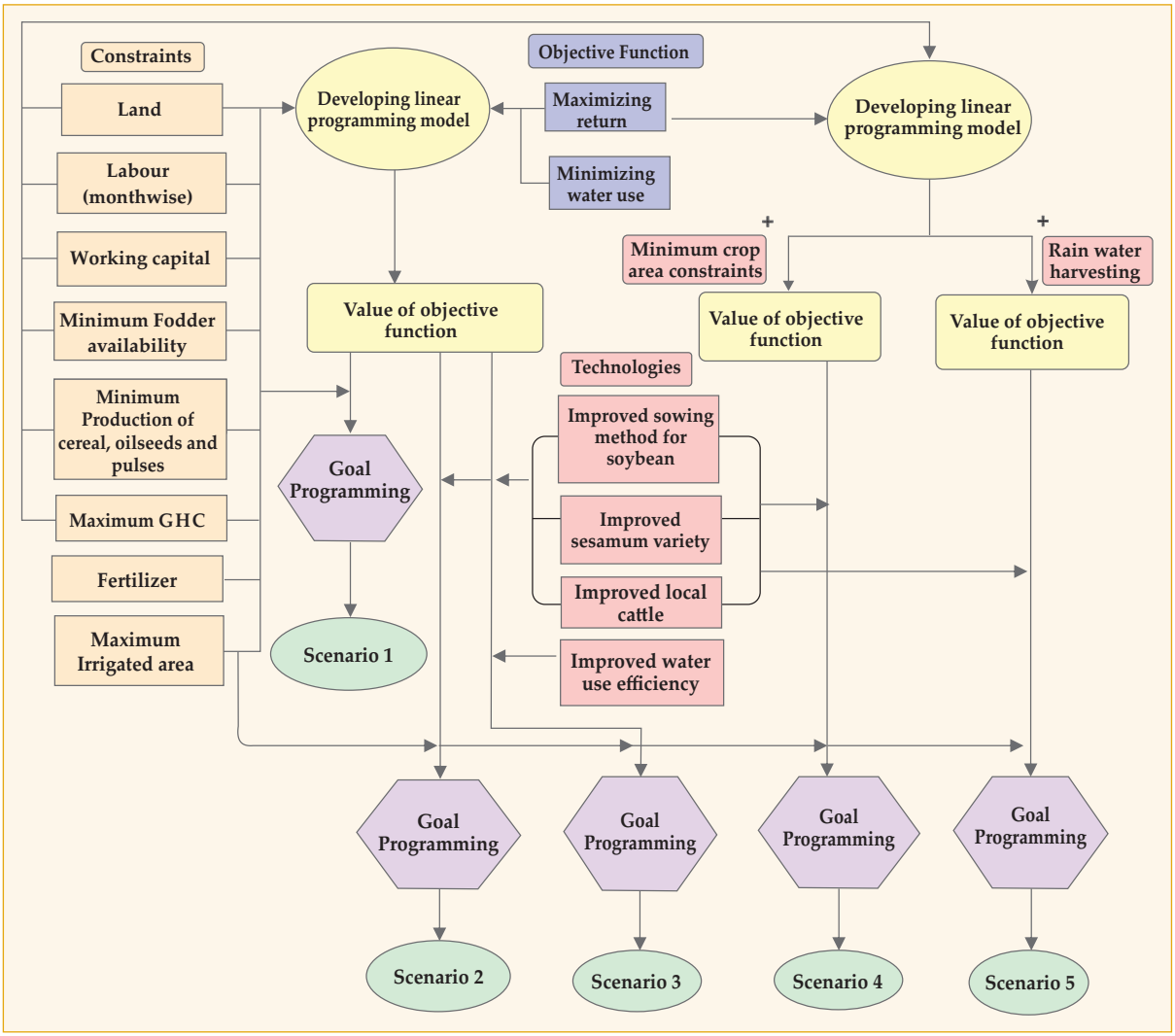


Figure 6. Framework for developing optimum crop plans

of DSR is found to low due to the constraints like non-availability of seed drills, higher weed infestation, and lack of awareness among farmers about its benefits.

Climate change and adaptation strategies: The analysis of long-term climate pattern revealed a significant rise in annual mean, maximum and minimum temperature across agro-climatic zones (ACZs). The climatic shocks, i.e. rainfall deficit and heat stress, adversely affect agricultural productivity and the damage increases with increasing severity of climatic shocks. In the long-run, these effects get accentuated. The impacts of climatic shocks vary across the crops and agro-climatic zones (ACZs), which necessitate region specific interventions and prioritization of adaptation strategies. Diversification and improvement in irrigation infrastructure has been found to have a positive marginal effect on improving resilience of agriculture. Studies conducted at the institute shows clear benefits of the adaption measures such as irrigation, stress tolerant crop varieties and climate resilient agronomic practices. The need for mainstreaming climate-resilient adaption strategies in development policy to overcome the challenges of climate change is also suggested and a framework is developed (Figure

7). In order to mainstream the adaptation strategies in an integrated manner, various developmental programmes of different ministries were studied and converged for enhancing its effectiveness and targeting.

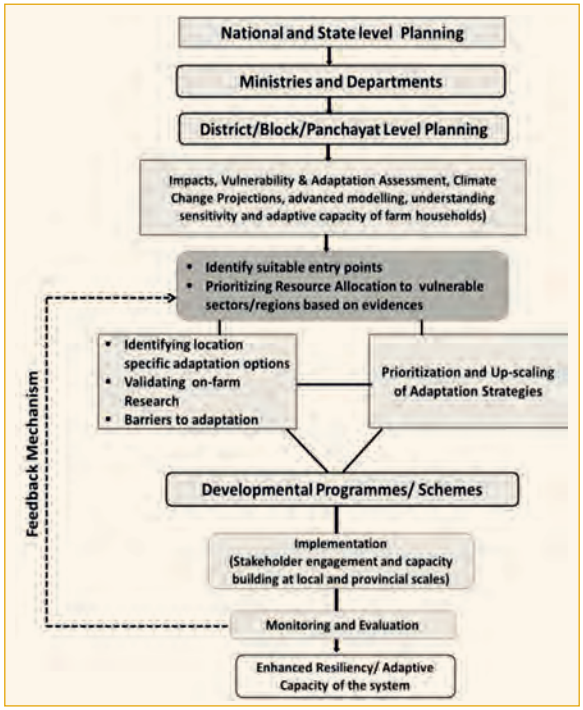


Figure 7. Framework for mainstreaming climate change adaptation

Agricultural sustainability assessment: A framework for agricultural sustainability assessment has been developed and used to assess agricultural sustainability across districts of Punjab and Haryana. The methodology includes calculating 79 sustainability indicators covering six components of the concept (soil, water, agro-biodiversity, environment, economic and social) which were aggregated into Composite Agricultural Sustainability Index (CASI). The study showed that sustainability is moderately sustainable in both the states. Multi-nutrient deficiency, imbalanced use of fertilizers and high use of agrochemicals were some of the low performing soil health indicators in the region. The CASI could be an effective policy tool and an element to support governance in agriculture.

Groundwater-energy nexus: Among various measures, regulation of energy has been found an effective indirect measure to sustainably manage groundwater use in agriculture. A study on groundwater sustainability in Punjab revealed that de-subsidization of energy would result in 29%, 38%, 41%, 48% and 82% groundwater saving in paddy, cotton, sugarcane, wheat, and maize, respectively. However, de-subsidization may not lead to change in paddy-dominated cropping patter due to strong price policy support to paddy. On the other hand, lack of assured and affordable supply of electricity in eastern region has led to predominance of diesel as a major source of energization of pumps. Interestingly, in eastern state, large number of wells are witnessing declining trend in groundwater level, though at a slow rate (Figure 8). This shall be taken as an early warning signal which warrants emphasis on sustainable management of groundwater resources even in the eastern region. The studies have provided empirical basis for rationalizing energy subsidies across different states.

Micro-irrigation: A meta-analysis of micro-irrigation technology has documented potential benefits of adopting the technology. The potential area under micro irrigation has been estimated as 72-77 million hectare in the country. Among states, Uttar Pradesh has the highest potential area (25%) followed by Rajasthan (12%), and Madhya Pradesh (11%). The adoption rate of micro-irrigation technology has been found just 15 per cent of the estimated potential. In the states like Punjab, where groundwater is over-exploited, the level of adoption is very low (0.78%). Serious efforts are needed to promote micro irrigation technology, particularly

in high potential and under-exploited states. It is found that the administrative mechanisms in implementation of micro-irrigation schemes vary across the states. People's participation at different stages of micro irrigation programme plays an important role in its adoption.

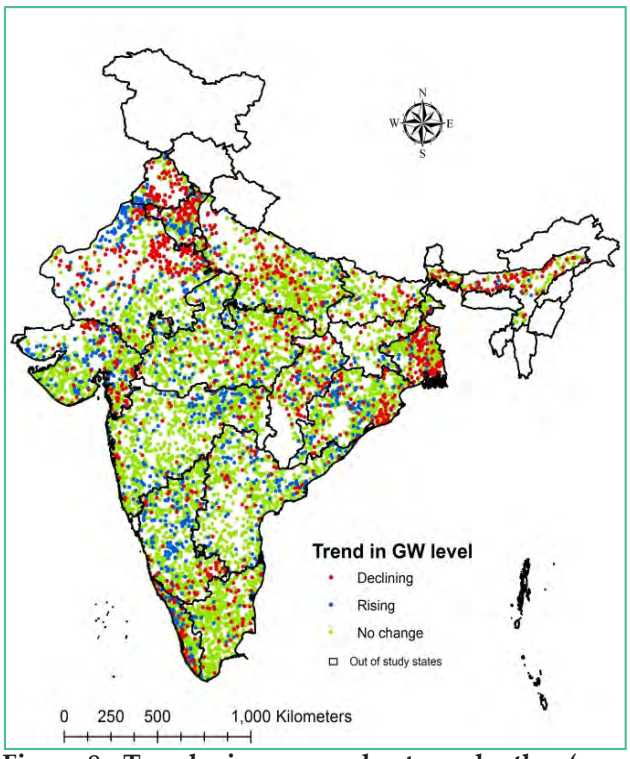


Figure 8. Trend in groundwater depth (pre-monsoon) during 2004 to 2014

Technology foresight: In order to overcome the future challenges in a sustainable manner, there is need to envision the future technological, institutional and policy needs. Technology foresight is described as the process involved in systematically attempting to look into the longer-term future of science, technology, the economy, the environment and society with aim of identifying the areas of strategic research and emerging generic technologies likely to yield the greatest economic and social benefits. The project looked into the trends and patterns of varieties registered under the Protection of Plant Varieties and Farmers Right Act (PPVFRA) 2001, patents in agriculture. The study also carried out a scientometrics analysis of publications in agriculture and allied sectors. These provides insights on the emerging technologies in agriculture. The study showed that plant varieties registered under PPVFA are limited to few crops and regions. No effect of IP protection or institutional set-up was found on the bargaining power for commercialization of varieties by ICAR. The study showed that PPVFRA is perceived as a protection mechanism rather than as a tool for bargaining for technology. The trends in patents in agricultural sector showed that emerging technologies such as synthetic biology and artificial intelligence have achieved its peak in the mid of this decade. Though these technologies have already reached several markets policies to govern them are in nascent stages. India has followed a precautionary approach and policies are often framed in response to technologies. These studies provide us way forward in framing science and technology policy for agriculture in India.

R&D policies: Despite the impressive returns to investment in agricultural R&D, India under-invests in agricultural research. Presently, the research intensity measured as the share of expenditure on research in agricultural GDP in India is much below (0.4%) than in China (0.62%), Brazil (1.82%), average for developed countries (>2 per cent) and general recommended of 1.0 per cent for developing countries. The Institute undertook studies on various aspects of technology policy to assist ICAR to build the case for more investment in agricultural research, and to improve efficiency in allocation of research resources across commodities and regions. This has raised research intensity, brought objectivity and transparency in allocation

of research resources, aligning research agenda with emerging challenges and opportunities, designing competitive research funds and measuring research impact.

Intellectual property rights: The protection of intellectual property rights is indispensable under the new regime, global development and international agreements. A study found that most of the patents granted during 1990 to 2007 are from Asian countries, particularly China. India's growth in cumulative patents filed in agriculture is higher than the global average during the recent years. The amendment of patent law, 2005 has created a positive impact on patenting of agricultural technologies in India. The analysis of the effect of regulatory policies of the government on anti-competitiveness in the Bt cotton industry showed that interaction of business model and regulatory policies results in anti-competitiveness in the Bt cotton industry. Over the years, there has been an increase in the total number of varieties registered under *Protection of Plant Varieties and Farmers Right Act (PPV&FRA)*. Private companies had registered the varieties in both food (395 varieties) and non-food crops (214 varieties). The varieties were mostly from rice (120 varieties), maize (108 varieties), and tetraploid cotton (122 varieties). Public sector (ICAR, SAUs) had diverse set of crops and more number of varieties was registered in food crops (74%).

Ecosystem services: The linkages among the production systems, natural resources, environment and social system have now become more prominent to reduce environmental foot prints of agricultural development. Understand the ecosystem services provided by agriculture is complex as the interaction between agriculture and its ecosystem is bidirectional. In this context, an effort has been extended to collate evidences on ecosystem services, assess role of R&D in enhancing them and mainstreaming ecosystem services in the development processes.

A1.3. Agricultural Markets, Trade and Institutions

The studies under the theme Agricultural Markets, Trade and Institutions have focused on market intelligence, value chains of agricultural commodities, spatial price transmissions, price volatility, market reforms, and institutional aspects of agricultural production.

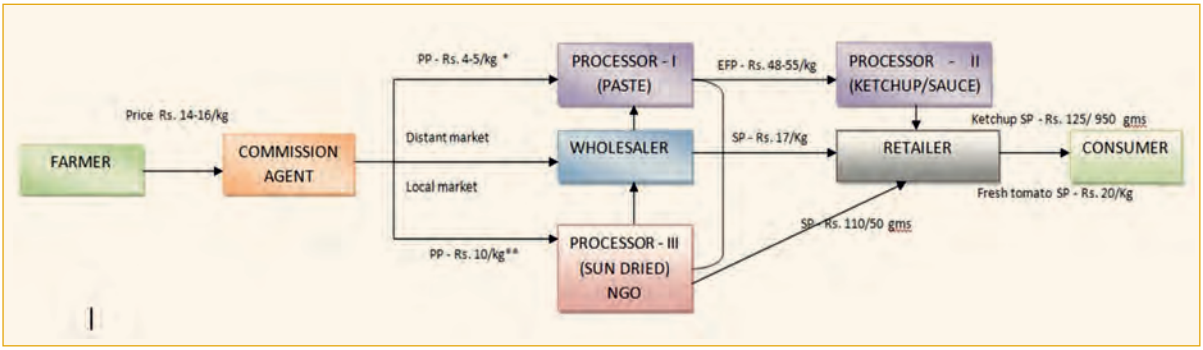
Market intelligence: In a collaborative project, reliable and timely price forecasts have been provided to the farmers throughout the country for more than 40 major agricultural commodities covering cereals, pulses, oilseeds, fruits, vegetables, spices and fibre crops. More than 180 pre-sowing and 263 pre-harvest price forecasts were disseminated to the farmers through various means like personal contacts, SMS, television, radio, university websites, pamphlets and social network before sowing and during harvests to facilitate informed and intelligent decisions by them. For the commodities like horticulture and pulses crops with high volatility in prices, innovations were made in application of statistical model to get higher precision in price forecasts. Based on the price forecast information, several farmers have changed the marketing pattern, by storing commodities and selling them when prices were high.

Agricultural Markets, Trade and Institutions

Key Findings

- More than 180 pre-sowing and 263 pre-harvest price forecasts have been developed and disseminated to the farmers through multiple information channels. Use of price information has helped farmers to change their marketing pattern and realize large benefits (10-15%) across commodities and states.
- Value chains of agricultural commodities such as buffalo meat, tomato, organic ginger, apple, dairy products have been mapped.
- Efficiency, inclusiveness and financing mechanisms of formal and informal value chain in Punjab has been analyzed. The chain-based financing is limited to a small proportion of households especially among those supplying milk to local traders and private domestic processors.
- Majority of the farmers depends on informal market channels for disposing output and thus receive 7-13 per cent lower prices in paddy and wheat. There exists positive association between prices and farmers' access to transportation and information.
- Market behavior of onion arrivals and prices in major markets has been analyzed and reasons behind high price volatility in onion have been identified.
- ICAR-NIAP has developed outlook model for cereals to generate medium and long term projections on project key economic variables such as production, demand, stocks, trade, prices and policy, and to develop scenario analysis of policy impacts.
- Extension Advisory Services (EAS) in India is pluralistic in nature. Farm households having access to EAS operate with comparatively higher technical efficiency than those without access to EAS.

Value chains of agricultural commodities: Efforts have been extended to map value chains of selected agricultural commodities such as buffalo meat in Uttar Pradesh, marine fisheries, tomato in Karnataka, organic ginger in NE Himalayan states, apple in Jammu and Kashmir. A flow diagram of tomato value chain map in Karnataka and value addition at each connecting points in the chain are presented in Figure 9. The special focus is on product transformation for value addition and food safety issues. This would provide insight to planners and policy makers to reduce the weaknesses and capitalize on strengths of value chains of agricultural commodities.



Note: PP: Procurement price, EFP: Ex-factory price, SP: Sale price

*: Processors procure tomatoes only when the prices drop to Rs 4-5/kg

**: Based on order they purchase tomato from the commission agent

Figure 9. Tomato value chain in Karnataka

Efficiency, inclusiveness and financing of dairy value chain: India's dairy sector has witnessed an impressive demand-led growth over the past four decades. The sector is dominated by small-scale producers who often lack access to markets and finances. A study has compared the formal and informal value chain for their efficiency, inclusiveness and financing mechanisms at their upstream in Punjab. Farmers with smaller livestock as well as land holdings are more associated with informal value chains (vendors and local consumers). On the other hand, the formal sector buyers cover the 62 per cent of the farmers representing 69 per cent of the sales supplying milk to cooperatives, multinationals and private domestic processors. The study finds the chain-based financing is limited to a small proportion of households especially among those supplying milk to local traders and private domestic processors. Multinationals and cooperatives hardly provide credit support to farmers. Financing by commercial banks is also limited, and biased towards resource-rich farmers. Smallholders, who have limited collateral for obtaining institutional loans depend more on informal sources for their credit requirements. The findings of this study have direct implications for agribusiness firms as well as financial institutions.

Farmers' choice of market channels and producer prices: The informal buyers-local traders and middlemen, earn rent because of existing information asymmetry in the agricultural marketing system as they know about prices and market conditions which farmers either do not know or know imperfectly. Besides, poor transport and communication restrict farmers from accessing remunerative markets and thereby create opportunities for informal buyers to earn economic rent. A study has shown that 80 per cent of paddy and wheat growing farmers do not receive government-determined minimum support price (MSP), hence, more dependent on informal channels, comprising local traders and input dealers. Therefore, they receive significantly lower prices - 9 to 13 per cent for paddy and 7 to 12 per cent for wheat. A research has established positive association between prices and farmers' access to transportation and information. The policy should focus on improving efficiency of agricultural markets and their outreach by investing in transportation infrastructure that reduces cost of trade for both farmers and traders. Improvements in markets need to be accompanied by development of market information systems to reduce asymmetry in information between farmers and traders.

Production–trade–price linkages and onion price shocks: Onion price spikes are turning frequent and severe over time, creating a situation of crisis. A study examined market behavior of onion arrivals and prices in major markets (Azadpur market in Delhi; Lasalgaon, Pune and Solapur markets in Maharashtra; Bengaluru and Hubli markets in Karnataka; and Indore market in Madhya Pradesh) and identified major reasons behind price volatility. The evidences revealed very strong and significant association between the production in any given year and market arrivals in the following year. Minimum export prices (MEP) was found to effectively control the onion prices in domestic market. MEP is just one factor in controlling the inflationary situation caused by onion; it is largely governed by the management of domestic supply and distribution factors. Hence, there should be a system in place to continuously monitor the prices and market arrivals, to generate advance information to the Government to regulate the fluctuation in supply and prices. This should be followed by appropriate and

early action, based on market intelligence to regulate trade, like liberalizing import, restriction on export and check on hoardings.

The agricultural outlook model: ICAR-NIAP has developed outlook model for cereals to generate medium and long term projections on project key economic variables such as production, demand, stocks, trade, prices and policy, and to develop scenario analysis of policy impacts. It is an open model as it takes into account the trade flows of the commodities with respect to the rest of the world and endogenous prices are attached to the world market prices. Spatial dimensions have been incorporated by specifying supply side equations separately for different regions in the country.

Extension advisory services: A study on assessment of capacity of different Extension Advisory Service providers in terms of staff to agricultural land holdings ratio in Maharashtra indicated a wide gap among different organizations. The study observed that wherever staff numbers are limited, ICT platforms help in better coverage. When emphasis is on skill development, then direct contact methods are very important and KVKs played an important role in such areas. The study on extension system revealed its pluralistic nature and linkages with varying degree have been observed among different extension and advisory services (EAS) providers indicating convergence and coordination among them. Farm households having access to EAS operate with comparatively higher technical efficiency than those without access to EAS.

Impact of ICT and access to information: Impact of ICT in agricultural education indicated that ICT has improved academic development of students. Internet speed, infrastructure facilities, availability of e-resources, operational knowledge of ICT tools and access to ICT were found to be most important factors for enhancing its adoption among the students, while training, computer availability and Wi-Fi availability in university campus were most significant factors for adoption of ICT among the faculty. In a predominantly irrigated agro-ecosystem, access to information increased productivity significantly. Despite relatively low frequency of contact, government sources were found to have some impact. Mass media had positive and significant effects, while ICT and Farmer Producer Organizations (FPO) had not affected productivity significantly. Information impact was not found in a predominantly rain fed cotton agro-ecosystem.

A2. Impact of achievements in quantifiable terms

NIAP's research has been widely applauded and utilized by the various stakeholders including academicians, researchers, research administrators, and policy makers. Being a unique Institute with a mandate of undertaking research to leverage policy decisions to foster efficient, sustainable and inclusive growth in agriculture and rural economy, it is challenging to quantify impact of policy research. However, the implications emerging from its research have served as a credible source to help fill critical gaps in the policy process. The key influences of NIAP's achievements on policies, academics, human resources development and farmers' welfare are as follows:

- Research based knowledge support provided by the Institute to Doubling Farmers Income (DFI) committee has contributed in developing sound strategies for doubling farmers'

income. ICAR-NIAP is also actively engaged in monitoring the implementation of DFI strategies in the country. The estimates on farmers' income prepared by ICAR-NIAP has been used by the NITI Aayog and agricultural ministry. The outcomes of the strategies are reflected through increased crop productivity, rising area under micro-irrigation, appreciable increase in farm mechanization and farm credits, 2.5 per cent growth in crop diversification (towards high value crops), increased cropping intensity from 149 per cent to 154 per cent, and increase in terms of trade from 103 per cent to 109 per cent between 2015-16 and 2018-19. These indicators reveal a positive upward trend in real farmer's income in the country.

- Based on the research based recommendation of ICAR-NIAP, Department of Fertilizer, Ministry of Chemicals and fertilizer, Government of India has decided to play a non-discriminatory facilitator role for public and private entities related to fertilizer without any financial support. This will promote trade and investment in acquisition of fertilizer and its raw material from overseas.
- Research based policy insights through a draft working paper has provided a base for Vision 2035 for agriculture sector which is being prepared by NITI Aayog. Inputs provided by ICAR-NIAP has contributed to Department of Consumers Affairs in monitoring and stabilizing prices of agricultural commodities.
- As a knowledge partners, the Institute is contributing to DAC&FW in undertaking a major program to institutionalize the capacity for development of market information and price forecasting system in the country.
- Evaluation of impact of ICAR technologies in terms of verified socio-economic indicators has provided a feedback to the NARS on the pace and current status of agricultural R&D. This has provided the Council a basis for mobilizing resources for R&D, bringing objectivity and transparency in allocation of research resources, and aligning research agenda with emerging challenges and opportunities.
- ICAR-NIAP provided research based feedback to the scientific community that present rate of farm mechanization and yield improvement is inadequate to reduce cost push inflation and absorb rising production cost, respectively. This is expected to accelerate pace of R&D for technological upgradation and institutional innovations for improving technological adoption.
- ICAR-NIAP has conceptualized and promoted the concept of ecosystem services in current policy discourse.
- Dissemination of timely and reliable forecasts on prices of agricultural commodities to the farmers through collaborative institutes in network mode helped the farmers to change their marketing pattern and realize large benefits (10-15%) across commodities and states. Farmers in Uttar Pradesh who followed the forecasts of potato crop had realized 30-40 per cent higher price (estimated to be Rs. 100-150 per quintal). In Gujarat similarly cotton farmers who followed the price advisory were able to gain Rs. 36,000 on an average.

A3. Publications

During the last five years (2016-17 to 2020-21), the Institute has produced high quality publications addressing emerging issues in agriculture and overall economic development in the country. The research achievements have been disseminated through **372 publications** including 8 policy papers, 5 policy briefs, 211 peer reviewed national and international journals, 8 books and technical manual, more than 100 book chapters and popular articles, and **26** newspaper articles. **The per scientist average number of publications per year was 3.54 and about 57 per cent of the publications (average number of 2.01) were published in peer reviewed journals.** Out of total publications, 62 research papers have been published in high impact factor journals with NAAS rating more than six (Table 2). **Average NAAS rating of the journals where research papers were published during the last five years is 5.93.**

Table 2. Summary of publications of ICAR-NIAP published during 2016-17 to 2020-21

S.l. no.	Type of publications	Numbers
1	Policy Papers	**8**
2	Policy Brief	**5**
3	No of peer reviewed research articles in journals	**211**
	Papers with NAAS rating more than 6	62
	Papers with NAAS rating 3-6	112
	Papers in other peer reviewed journals	37
4	Books, conference proceedings and technical manuals	**8**
5	Book chapters, popular articles and proceedings	**114**
6	Newspaper articles	**26**
7	Total publications (Sum of (1:6)	**372**
8	Per scientist per year research papers in peer reviewed journals	**2.01**
8	**Per scientist per year total publication**	**3.54**

Figure 10. Glimse of ICAR-NIAP publications

Table 3. List of papers with NAAS rating more than 6

Sl. No	Publications	NAAS rating (2020)
1	Singh, N.P., Anand, B., Singh, S. and Khan, M.A. (2019) Mainstreaming climate adaptation in Indian rural developmental agenda: A micro macro convergence. ***Climate Risk Management***, 24: 30-41.	10.90
2	Kumara, K.T.M., Kandpal, A. and Pal, S. (2020). A meta-analysis of economic and environmental benefits of conservation agriculture in South Asia. ***Journal of Environmental Management***, 269:110773. DOI: 10.1016/j.jenvman.2020.110773.	10.87
3	Singh, N.P., Anand, B., Singh, S., Srivastava, S.K., Rao, C.H., Rao, K.V. and Bal, S.K. (2021). Synergies and trade-offs for climate resilient agriculture in India: An agro-climatic zone assessment. **Climatic Change**, 161:11. https://doi.org/10.1007/s10584-021-02969-6.	10.17
4	Birthal, P.S. and Jaweriah, N. (2019) Crop diversification and resilience of agriculture to climatic shocks: Evidence from India. ***Agricultural Systems***, 173: 345-354.	10.13
5	Negi, D.S., Birthal, P.S., Roy, D. and Khan, M.T. (2018) Farmers' choice of market channels and producer prices in India: Role of transportation and communication networks. ***Food Policy***, 81:106-121.	9.79
6	Misra, T., Arora, A., Marwaha, S., Chinnusamy, V., Rao, A.R., Jain, R., Sahoo, R. N., Ray, M., Kumar, S., Raju, D., Jha, R. R., Nigam A and Goel, S. (2020). SpikeSegNet-a deep learning approach utilizing encoder-decoder network with hourglass for spike segmentation and counting in wheat plant from visual imaging. ***Plant Methods***, 16, article no 40. Open access available at https://www.frontiersin.org/articles/10.3389/fpls.2016.01419/full.	9.61
7	Varghese, N. and Singh N.P. (2016) Linkages Between Land Use Changes, Desertification and Human Development in The Thar Desert Region of India ***Land Use Policy*** 51(2016) : 18–25	9.57
8	Birthal, P.S., Jaweriah, H. and Negi, D.S. (2019). Diversification in Indian agriculture towards high value crops: Multilevel determinants and policy implications. ***Land Use Policy***. https://doi.org/10.1016/j.landusepol.2019.104427.	9.57
9	Ghosh, S., Kolady, D.E., Das, U., Gorain, S., Srivastava, S.K. and Mondal, B. (2019). Spatiotemporal variations in effects of participatory irrigation management (PIM) reform in India: A panel data analysis, ***Agricultural Water Management***, 222: 48-61.	9.54
10	Birthal, P.S., Chand,R., Joshi, P.K., Saxena, R., Rajkhowa, P., Khan,T., Khan, A., and Chaudhary, K.R. (2017) Formal versus informal: Efficiency, inclusiveness and enhancing of dairy value chains in Indian Punjab. ***Journal of Rural Studies***, 54, 288-303.	9.30
11	Sam, A.S., Subash, S.P., Kächele, H., Kumar, R., and Müller, K. (2020). Climate change, drought and rural communities: Understanding people's perceptions and adaptations in rural eastern India. ***International Journal of Disaster Risk Reduction***, 44: 101436.	8.89
12	Kumar, S., Singh, D.R., Singh, A., Singh, N.P. and Jha, G. K. (2020). Does Adoption of Soil and Water Conservation Practice Enhance Productivity and Reduce Risk Exposure? Empirical Evidence from Semi-Arid Tropics (SAT), ***India Sustainability*** *2020*, 12(17), 6965; https://doi.org/10.3390/su12176965	8.57

Sl. No	Publications	NAAS rating (2020)
13	Singh, N.P., Anand, B. and Khan, M.A. (2018) Micro-level perception to climate change and adaptation issues: A prelude to mainstreaming climate adaptation into developmental landscape in India. ***Natural Hazards***, 1-18. https://doi.org/10.1007/s11069-018-3250-y.	8.32
14	Jain, R., Kishore, P. and Singh, D.K. (2019). Irrigation in India: Status, challenges and options. ***Journal of Soil and Water Conservation***, 18(4): 354-363.	8.18
15	Jumrani, J. and Birthal, P.S. (2017) Does consumption of tobacco and alcohol affect household food security? Evidence from rural India. ***Food Security***, 9(2), 255-279. DOI: 10.1007/s12571-017-0660-8.	8.15
16	Singh, S., Singh, L.B., Singh, D.R., Chand, S., Ahmed, S.K.Z., Singh, V.N. and Roy, S.D. (2018) Indigenous underutilized vegetables for food and nutritional security in an island ecosystem. ***Journal of Food Security***, 10(5): 1173–1189.	8.15
17	Kolady, D., Srivastava, S. K., Just, D. and Singh, J. (2020). Food away from home and the reversal of the calorie intake decline in India. ***Food Security***, https://doi.org/10.1007/s12571-020-01107-x.	8.15
18	Vatta, K., Sidhu, R. S., Lall, U., Birthal, P. S., Taneja, G., Kaur, B., Devineniand, N. and Alister, C. M. (2018) Assessing the economic impact of a low-cost water-saving irrigation technology in Indian Punjab: the tensiometer. ***Water International***.	7.89
19	Sam, A.S., Abbas, A., Subash, S.P., Kächele, H., Kumar, R. and Müller, K. (2019) Linking food security with household's adaptive capacity and drought risk: Implications for sustainable rural development. ***Social Indicators Research***, 142(1): 363-385.	7.87
20	Siddiqui, M. Z., Donato, R. and Jumrani, J. (2017) Looking Past the Indian Calorie Debate: What is Happening to Nutrition Transition in India. ***The Journal of Development Studies***, DOI: 10.1080/00220388.2017.1408798.	7.59
21	Mittal, S., Subash, S.P. and Ajay, A. (2018) Agricultural information and knowledge network in rural India: A case of Bihar. ***Journal of Agricultural Education and Extension***, 24(5):393-418.	7.52
22	Chand, P, Jain, R, Chand, S, Kishore, P, Malangmeih, L and Rao S. (2020). Estimating water balance and identifying crops for sustainable water resources in Bundelkhand region of India. Transactions of American **Society of** ***Agricultural Engineers***, 63(1): 117-124.	7.15
23	Balaji, S.J., Jhajhria A., Kumar S., Immanuelraj, T.K. and Kar, A. (2017) Agriculture–nutrition linkages: A preliminary investigation for rural India, ***Outlook on Agriculture***, 46(4), 302-308.	7.07
24	Sreeram, V., Gupta, J., and Subash, S.P. (2020). Diversity, complexity, and structure of social networks: Study of a smallholder dairy project. ***Outlook on Agriculture***, 49(3): 245-255.	7.07
25	Aditya, K. S., Subash, S. P., Praveen, K.V., Nithyashree, M.L., Bhuvana N and Sharma, A. (2017) Awareness about Minimum Support Price and Its Impact on Diversification Decision of Farmers in India. ***Asia and the Pacific Policy Studies***, 4(3), 514-526.	6.96
26	Singh, N.P., Anand, B. and Khan, M.A. (2019) Assessment of household perceptions to climate adaptation for resilient rural development planning in India. ***Indian Journal of Traditional Knowledge***, 18(2): 376-382	6.92

Sl. No	Publications	NAAS rating (2020)
27	Singh, N.P., Srivastava, S.K., Sharma, S., Anand, B. and Singh, S. (2020). Dynamics of socioeconomic factors affecting climate vulnerability and technology adoption: Evidence from Jodhpur district of Rajasthan. ***Indian Journal of Traditional Knowledge***, 1(1): 192-196.	6.92
28	Rana, R. K., Arya, S., Kadian, M. S., Singh, B.P., Quiroz, R. and Monneveux, P. (2016) Socio-economic feasibility of potato cultivation in Andhra Pradesh, India ***Potato Research***, 59(2): 167-179.	6.86
29	Jagadambe, S., Shiji, C.P., Subash, S.P., and Balaji, S.J. (2018) Effect of Non-farm Employment on Farm Commercialization in Agricultural Households in Rural India. ***Indian Journal of Economics and Development***, 14 (1a), 298-303.	6.82
30	Srivastava, S.K. and Kolady, D. (2016), Agricultural biotechnology and crop productivity: macro-level evidences on contribution of Bt cotton in India. ***Current Science***, 110(3):311-319	6.76
31	Sendhil, R., Ramasundaram, P., and Balaji, S. J. (2017) Transforming Indian agriculture: is doubling farmers' income by 2022 in the realm of reality? ***Current Science***, 113(5),848-850.	6.76
32	Srivastava S.K, Chand R, Singh J, Kaur, A., Jain R., Kingsley, I and Raju, SS (2017) Revisiting groundwater depletion and its implications on farm economics in Punjab, India, ***Current science***, 113(03), 422-429.	6.76
33	Srivastava, S.K., Singh, N.P., Singh, J., Rao, K.V. and Balaji, S.J. (2019). Agriculture development based mapping of agro-ecological sub-regions and its implications for doubling farmers' income in India. ***Current Science***, 117(2): 282-287.	6.76
34	Prasad, I., Rao, G.,G., Chinchmalatpure A. R., Kumar, S., Nikam, V. R., Singh, C. and Sharma, D.K. (2016) Morphophysiological traits imparting salinity tolerance in Maize (Zea Mays L.) Hybrids under saline water irrigation in vertisols. ***Communications in Soil Science and Plant Analysis***	6.69
35	Patel, R.M., Sharma, A.N. and Sharma, P. (2019). Prediction of Helicoverpa armigera (Hubner) larval population using weather based forewarning model in soybean. ***Journal of Agrometeorology***, 21(4): 494-498.	6.64
36	Singh, N.P., Singh, S., Anand, B. and Bal, S.K. (2019). Climate vulnerability assessment in semi-arid and arid region of Rajasthan, India: An enquiry into the disadvantaged districts. ***Journal of Agrometeorology***, 21(2): 197-202.	6.64
37	Singh, N.P., Singh, S., Anand, B. and Ranjith, PC. (2019). Assessing the impact of climate change on crop yields in Gangetic Plains Region, India. ***Journal of Agrometeorology***, 21(4): 452-461.	6.64
38	Jaybhay, S.A., Taware, S.P., Varghese, P., Nikam V.N. (2017) Soybean cultivation by farmers of Maharashtra: Identification and analysis of the problems. ***Legume Research***. DOI: 10.18805/lr.v0i0.7842.	6.34
39	Radhakrishnan, K., Prakash, S., Narayanakumar, R., Krishnan, M., Madan, M. S. and Kumar, N.R. (2018) Economic analysis of marine fishing crafts in Thoothikudi province, Tamil Nadu, ***Indian Journal of Geo-Marine Science*** 47(03), 653-659.	6.30
40	Niasr, U., Yongtong, M. and Kumar, N. R. (2020). A Competitive analysis of Indian fish export to USA: Growth, performance, comparative advantage and Instability, India, ***Journal of Geo Marine Sciences***, 49(05): 790-797	6.30

Sl. No	Publications	NAAS rating (2020)
41	Saxena, R., Khan, M.A., Choudhary, B.B. and Kanwal. V., (2019). The trajectory of livestock performance in India: A review. ***Indian Journal of Dairy Science***, 72(6): 569-679.	6.26
42	Kumar, R., Singh, P., Nikam, V.R., Satyapriya and Tomar B. S. (2017) Good practices and lessons learnt from innovative horticultural farmers for enhancing profitability and sustainability. ***Indian Journal of Agricultural Sciences***, 87(1): 97-101.	6.25
43	Jain, R., Malangmeih, L., Raju, S.S., Srivastava, S.K., Kingsly, I. and Kaur, A.P. (2018) Optimization techniques for crop planning: A review. ***Indian Journal of Agricultural Sciences***, 88(12): 1826-1835.	6.25
44	Kumar, S., Kumar, S., Chahal, V.P. and Singh, D.R. (2018) Trends and determinants of crop diversification in Uttar Pradesh. ***Indian Journal of Agricultural Sciences***, 88(11): 1704–1708.	6.25
45	Kumara, K.T.M., Kumar, S., Singh, D.R. and Kingsley, I. (2018) Participation in community based tank irrigation system in a rainfed region of India. ***Indian Journal of Agricultural Sciences***, 88(4):596-600.	6.25
46	Nikam, V., Kumar, S. and Kingsly, I. M. (2019). Impact assessment of mobile app using the economic surplus model. ***Indian Journal of Agricultural Sciences***.89(6): 1039-43.	6.25
47	Nikam, V., Singh, P., Kumar, S. and Arathy, A. (2019). Farmers producers organisations: A new paradigm in extension for upliftment of small and marginal farmers. ***Indian Journal of Agricultural Sciences***. 89(9): 15-24.	6.25
48	Balaji, S.J., Kumar, S., Nikam, V.R., Kingsly, I.T., Jumrani, J., Joshi, V. and Kumar, A. (2020). Impact of direct seeded rice technology adoption on farm income in Punjab. ***Indian Journal of Agricultural Sciences*** 90(3): 625-628.	6.25
49	Chand, K., Kumar, S., Suresh, A., Dastagiri, M. B. (2020), Marketing efficiency of vegetables in developing economies: Evidences for critical intervention from Rajasthan, India, ***Indian Journal of Agricultural Sciences***, 90 (8): 1419–27.	6.25
50	Kumara, K.T.M., Kumar, S. and Aditya K. S., Singh, D. R., Immanuelraj, K., Kallega, H. and Singh, P. L. (2020). Economic Impact of Tank Rehabilitation in Rainfed Region of India. ***Indian Journal of Agricultural Sciences***, 90(3):138-141.	6.25
51	Nath, K, Jain, R., Marwaha, S., Roy, H.M., Arora, A. (2020). Identification of optimal crop plan using nature inspired metaheuristic algorithms. ***Indian journal of Agricultural Sciences***, 90(8): (in print)	6.25
52	Rai, M. P., Chand, K. C., Kalvaniya, H. S., Agarwal, T., Sharma, P.C. and Jat, M.L. (2020) How profitable climate smart agricultural practices are? Voice of farmers from rice-wheat ecologies. ***Indian Journal of Agricultural Sciences*** 90 (7): 1271-1276.	6.25
53	Subash, S.P., Balaji, S.J., and Pal, S. (2020). Agricultural input markets in India – Recent policy reforms and way forward: A review. ***Indian Journal of Agricultural Sciences***, 90 (6):1047–1053.	6.25
54	Dixit, A.K. and Birthal, P.S. (2016) Greenhouse gases emission from livestock production system of India: An actual consumption appro*ach.* ***Indian Journal of Animal Sciences***, 86 (11): 1331–1336.	6.23

Sl. No	Publications	NAAS rating (2020)
55	Kumar, R., Singh P., Nikam, V.R. and Sharma, J.P. (2016) Farmer-led innovations: best practices and lessons learnt in livestock rearing. ***Indian Journal of Animal Sciences***, 86 (7): 816–820.	6.23
56	Chand, P., Sirohi, S., Saxena, R. and Mishra, A. (2018) How profitable is dairying in tribal Chhattisgarh? ***Indian Journal of Animal Sciences***, 88(6): 749–754.	6.23
57	Birthal, P. S., Pandey, G., Jumrani, J., Jaweriah, N. (2019). Supply response in Indian dairying. ***Indian Journal of Animal Sciences***, 89(4): 459-465.	6.23
58	Mukherjee, A., Singh, P., Rakshit, S., Satya, P., Burman, R.R., Kumari, S., Sinha, K. and Nikam, V. (2019). Effectiveness of poultry based farmers' producer organization and its impact on livelihood enhancement of rural women. ***Indian Journal of Animal Sciences***, 89(10): 1152-1160.	6.23
59	Sirohi, S., Chand, P., Sharma, D. and Saxena, R. (2019). Estimation of bovine equalizing units in India: A regional perspective. ***Indian Journal of Animal Sciences***, 89(9): 1009-1013.	6.23
60	Kanwal, V, Sirohi, S and Chand, P. (2020). Effect of drought on livestock enterprise: Evidence from Rajasthan. ***Indian Journal of Animal Sciences***, 90(01):94-98.	6.23
61	Nikam, V., Kumar, S., Kingsly, I., Balaji, S. J., Jhajhria, A., Chahal, R. and Kumar, D. (2020). Economic potential of AVIKASIL-S technology for estrus synchronization in sheep. *The* ***Indian Journal of Animal Sciences***, 90(3):139-141.	6.23
62	Saxena, R., Singh, N.P. Paul, R.K. and Kumar, R. (2019) Market linkages for the major onion markets in India. ***Indian Journal of Horticulture***, 76(1): 133-140.	6.11

A4. Citations of 30 most important publications, 2016-17 to 2020-21

ICAR-NIAP's research is widely read and used by academicians, researchers, administrators and policy makers. As per the recent study by Confederation of Indian Industries (CII, 2017[1]) on research productivity in Indian Universities and research institutions, citation per paper (C/P) which reveals citations density to denote quality of work/paper done, was highest for ICAR-NIAP (2.35 C/P) in 2017-18 among ICAR institutions. A summary of the citations captured through different sources is presented in table 4. Number of citations of 30 most important publications published during last five years are presented in table 5.

Table 4. Summary of citations of the publications during 2016-17 to 2020-21

Particulars	Total number of citations			Per scientist number of citations		
	Google scholar	Scopus	Web of Science	Google scholar	Scopus	Web of Science
Citations of publications	**649**	**234**	**164**	**31**	**11**	**8**
H index	**13**	**8**	**7**	**3**	**0.38**	**0.34**
i index	**19**	**7**	**3**	**4**	**0.34**	**0.14**

1 CII (2017). Glimpses of Research Productivity of Indian Universities and Research Institutions, CII-ICIeport 2017, Confederation of Indian Industry, New Delhi.

Table 5. List of 30 most cited papers published during 2016-17 to 2020-21

Sl. No	Publications	Citations
1.	Chand, R., Srivastava, S. K., & Singh, J. (2017). Changing structure of rural economy of India implications for employment and growth. ***Working Paper***, NITI Aayog.	39
2.	Birthal, P.S., Chand, R., Joshi, P.K., Saxena, R., Rajkhowa, P., Khan,T., Khan, A., and Chaudhary, K.R. (2017) Formal versus informal: Efficiency, inclusiveness and enhancing of dairy value chains in Indian Punjab. ***Journal of Rural Studies***, 54, 288-303.	33
3.	Varghese, N. and Singh N.P. (2016) Linkages Between Land Use Changes, Desertification and Human Development in The Thar Desert Region of India. ***Land Use Policy*** 51(2016) : 18–25	31
4.	Negi, D.S., Birthal, P.S., Roy, D. and Khan, M.T. (2018) Farmers' choice of market channels and producer prices in India: Role of transportation and communication networks. *Food Policy*, 81:106-121.	24
5.	Aditya, K. S., Subash, S. P., Praveen, K. V., Nithyashree, M. L., Bhuvana, N., & Sharma, A. (2017). Awareness about minimum support price and its impact on diversification decision of farmers in India. ***Asia & the Pacific Policy Studies,*** 4(3), 514-526.	22
6.	Birthal, P. S., Negi, D. S., and Devesh, R. (2017). Enhancing farmers' income: who to target and how? ***Policy Paper-30***, National Institute of Agricultural Economics and Policy Research.	20
7.	Vatta, K., Sidhu, R. S., Lall, U., Birthal, P. S., Taneja, G., Kaur, B., Devineniand, N. and Alister, C. M. (2018) Assessing the economic impact of a low-cost water-saving irrigation technology in Indian Punjab: the tensiometer. ***Water International.***	16
8.	Chand, R., Srivastava, S. K., & Singh, J. (2017). Changes in rural economy of India, 1971 to 2012. **Economic & Political Weekly,** 52(52), 65.	16
9.	Srivastava, S.K. and Kolady, D. (2016), Agricultural biotechnology and crop productivity: macro-level evidences on contribution of Bt cotton in India. ***Current Science,*** 110(3):311-319	16
10.	Birthal, P.S. and Jaweriah, N. (2019) Crop diversification and resilience of agriculture to climatic shocks: Evidence from India. ***Agricultural Systems,*** 173: 345-354.	15
11.	Sam, A.S., Abbas, A., Subash, S.P., Kächele, H., Kumar, R. and Müller, K. (2019) Linking food security with household's adaptive capacity and drought risk: Implications for sustainable rural development. ***Social Indicators Research,*** 142(1): 363-385.	14
12.	Jumrani, J. and Birthal, P.S. (2017) Does consumption of tobacco and alcohol affect household food security? Evidence from rural India. ***Food Security,*** 9(2), 255-279. DOI: 10.1007/s12571-017-0660-8.	14
13.	Srivastava, S. K., Chand, R., & Singh, J. (2017). Changing crop production cost in India: Input prices, substitution and technological effects. ***Agricultural Economics Research Review,*** 30(347-2017-2758).	14
14.	Singh, N.P., Anand, B. and Khan, M.A. (2018) Micro-level perception to climate change and adaptation issues: A prelude to mainstreaming climate adaptation into developmental landscape in India. ***Natural Hazards,*** 1-18. https://doi.org/10.1007/s11069-018-3250-y.	13

Sl. No	Publications	Citations
15.	Srivastava, S. K., & Chand, R. (2017). Tracking Transition in Calorie-Intake among Indian. ***Agricultural Economics Research Review,*** 30(347-2017-2034), 23-35.	13
16.	Subash, S. P., Chand, P., Pavithra, S., Balaji, S. J., & Pal, S. (2018). Pesticide use in Indian agriculture: Trends, market structure and policy issues. *Policy Brief-43*, National Institute of Agricultural Economics and Policy Research.	12
17.	Srivastava S.K, Chand R, Singh J, Kaur, A., Jain R., Kingsley, I and Raju, SS (2017) Revisiting groundwater depletion and its implications on farm economics in Punjab, India, ***Current science,*** 113(03), 422-429.	12
18.	Pavithra, S., Gracy, C. P., Saxena, R., & Patil, G. G. (2018). Innovations in agricultural marketing: a case study of e-tendering system in Karnataka, India. ***Agricultural Economics Research Review,*** 31(347-2018-3189), 53-64.	12
19.	Kishore, A., Birthal, P. S., Joshi, P. K., Shah, T., & Saini, A. (2016). Patterns and drivers of dairy development in India: Insights from analysis of household and district-level data. ***Agricultural Economics Research Review,*** 29(347-2016-17219), 1-14.	10
20.	Siddiqui, M. Z., Donato, R., & Jumrani, J. (2019). Looking past the Indian calorie debate: What is happening to nutrition transition in India. ***The Journal of Development Studies,*** 55(11), 2440-2459.	9
21.	Pavithra, S., Mittal, S., Bhat, S. A., Birthal, P. S., Shah, S. A., & Hariharan, V. K. (2017). Spatial and temporal diversity in adoption of modern wheat varieties in India. ***Agricultural Economics Research Review,*** 30(1), 57-72.	9
22.	Saxena, R., Singh, N. P., Choudhary, B. B., Balaji, S. J., Paul, R. K., Ahuja, U., & Deepika, J. (2017). Can livestock sector be the game changer in enhancing the farmers' income? Reinvesting thrust with special focus on dairy sector. ***Agricultural Economics Research Review,*** 30(347-2017-2744).	9
23.	Chand, S., Kumar, A., Bhattarai, M., & Saroj, S. (2016). Status and determinants of livestock insurance in India: A micro level evidence from Haryana and Rajasthan. ***Indian Journal of Agricultural Economics,*** 71(3), 335-346.	9
24.	Vishnu, S., Gupta, J., & Subash, S. P. (2019). Social network structures among the livestock farmers vis a vis calcium supplement technology. *Information processing in agriculture*, 6(1), 170-182.	8
25.	Singh, N. P., Anand, B., Singh, S., & Khan, A. (2019). Mainstreaming climate adaptation in Indian rural developmental agenda: A micro-macro convergence. ***Climate Risk Management,*** 24, 30-41.	8
26.	Rana, R. K., & Anwer, M. D. (2018). Potato production scenario and analysis of its total factor productivity in India. ***Indian Journal of Agricultural Sciences,*** 88(9), 1354-61.	8
27.	Saxena, R., Singh, N. P., Balaji, S. J., Ahuja, U. R., & Deepika, J. (2017). Strategy for doubling income of farmers in India. Policy Paper-***National Centre for Agricultural Economics and Policy Research,*** (31).	8

Sl. No	Publications	Citations
28.	Jain, R., Kingsly, I., Chand, R., Kaur, A. P., Raju, S. S., Srivastava, S. K., & Singh, J. (2017). Farmers and social perspective on optimal crop planning for ground water sustainability: a case of Punjab state in India. ***Journal of the Indian Society of Agricultural Statistics,*** 71(1), 75-88.	8
29.	Saxena, R., & Ramesh, C. (2017). Understanding the recurring onion price shocks: revelations from production-trade-price linkages. ***Policy Paper-33,*** National Centre for Agricultural Economics and Policy Research.	8
30.	Subash,S.P., Kumar, R.R. & Aditya, K.S. (2018). Satellite data and machine learning tools for predicting poverty in rural India. ***Agricultural Economics Research Review,*** 31 (2), 231-240.	7

A5. Significant advancements made in science and technology

ICAR-NIAP has made significant contributions to the advancement of principles of economics and their applications for providing policy options for agricultural development. The significant contributions are summarized below:

- A number of attempts have been made in India to estimate the farm income; however, these attempts were largely based on the point information. Also, in some cases, the approach could not cover the sector as a whole due to paucity of data and aggregation issues. The doubling of farmers' income requires initial or benchmark set of estimates regarding the income which are to be doubled in a given time-frame. Estimation of level of farmers' income using aggregated figures from National Accounts Statistics (NAS) is valuable contribution to the literature on economic assessment of farmers' welfare. The approach considered various options deriving the net farm Income from agriculture by deducting the paid-out labour cost, imputed value of family labour and rental value of land. Inclusion of non-farm income is important as this will be directly responsible for upscaling farmers' welfare. This estimation has contributed in developing strategies for doubling farmers' income and monitoring its progress.
- The methods of partial budgeting, partial equilibrium model and optimization methods were advanced and applied for setting commodity, regional and program priorities for agricultural research. These methods were also extended to impact assessment of agricultural research. This area of priority setting and impact assessment became one of leading fields of specialization in agricultural economics research.
- The research conducted at ICAR-NIAP along with collaborating partners has produced advanced techniques and methodologies of impact assessment of agricultural development and technology.
- The Institute has made significant advancement to the concept of market intelligence and development of models of price forecasting for agricultural commodities. The work has received attention of the Government and responsibility has been given to ICAR-NIAP for building capacity and institutionalization of price forecasting on a regular basis in the country.

- ICAR-NIAP has also advanced the application of multimarket commodity modelling for demand and supply projections in a simultaneous equation model. The results can be used by the Government for stabilizing commodity prices for welfare of consumers and farmers.
- Framework of assessment of agricultural sustainability and composite agricultural sustainability index (CASI) developed at ICAR-NIAP is an important contribution to the literature on monitoring sustainable agricultural development.
- The methodology of volumetric assessment of groundwater extraction for irrigation crops using the available secondary data has provided researchers and water management practitioners a tool to monitor and plan efficient use of scarce groundwater resources among alternate uses.
- Assessment of IPR and its implications for competitiveness in input markets has improved understanding about regulatory frameworks for improving agricultural R&D. ICAR-NIAP's research has provided inputs to the Government for responsive and eco-friendly regulations for seed industry, and trade and safe use of agro-chemicals.
- Development of Framework and composite index for assessing vulnerability and resilience of agriculture at district and agro-climatic level has provided valuable insights on inter-regional variations necessitating regional level prioritization in scientific explorations and technological developments. Further, advanced econometric models have established role and contribution of measures such as diversification and irrigation infrastructure in devising climate adaptations strategies. The suggested approach of mainstreaming climate adaptation measures in developmental planning is an unique contribution to the climate change literature.
- SAS code for retrieving unit-level cost of cultivation data and estimating indicators such as micro-nutrients use, gender–wise disaggregated labour use, diesel use, credit use, mixed farming, input use in dairy, output disposal pattern, etc has provided researchers, academicians and students immense possibilities of exploring new dimensions of agricultural development using cost of cultivation data which was earlier not accessible. This can also significantly save time and financial resources in primarily data collection.

A6. External funds mobilized

The research and other programmes are primarily funded by the Council. However, the Institute also mobilizes external funding through sponsored projects and consultancies on mandated area of research, and capacity development trainings. **During 2016-17 to 2020-21, ICAR-NIAP has mobilized Rs 7.4 crore from external sources including ICAR sponsored projects under planned budget. This constitute 12.7 per cent of total institute budget.** Year wise external financial resources mobilized by the Institute is presented in table 6.

Table 6. External funds mobilized during 2016-17 to 2020-21 at ICAR-NIAP

(Rs Lakhs)

Particulars	2016-17	2017-18	2018-19	2019-20	2020-21*
External fund	82	164	176	204	114
Institute fund (budget)	958	1,021	1,283	1,331	1,175
Share of external fund in institute fund (%)	8.6	16.1	13.7	15.3	9.7

* upto 31.01.2021

B. Policy interface, capacity building and extension activities

ICAR-NIAP is actively involved in policy interactions and advocacies, and capacity development and extensions activities. This section provides a glimpse of these activities during 2016-17 to 2020-21.

B1. Policy interface and advocacy

The Institute had engaged in several policy advocacies for ICAR, Agricultural and other Ministries of central government, NITI Aayog, state government and other international organizations based on in-house research. Apart from being members of different committees and taskforces formed by the government agencies, the scientific staff have also contributed as members of Research Advisory Council and Board of Studies of ICAR, SAUs and other research institutions. They are also being presidents and secretary of academic societies. Few significant policy interactions and advocacies provide by ICAR-NIAP during last five years are outlined below.

- The Government of India constituted a high level committee (DFI Committee) constituting senior economists and government officials for formulation of DFI strategies. DFI Committee was constituted on 13-Apr-2016 and submitted the Final Report to the Government in Sept-2018. The Empowered Body was constituted to implement the DFI Recommendations on 23.01.2019. ICAR-NIAP is the Knowledge Partner to DAC&FW and Director ICAR-NIAP is the member of DFI Committee as well as Empowered Body and playing strategic role in implementation of DFI strategies.
- As a representative of DARE/ICAR, ICAR-NIAP regularly participates and provides inputs to Inter-Ministerial Committee (IMC) constituted by Department of Consumers Affairs, Ministry of Consumers Affairs, Food and Public Distribution to review prices of essential commodities and agricultural scenario in the country.
- ICAR-NIAP facilitated Ministry of Chemicals and Fertilizers to deliberate on framing policy for overseas acquisition of raw material by Indian the Indian fertilizer companies. A study conducted at the institute analyzed the existing import mechanism and devised a policy framework that aims at encouraging international co-operation.
- ICAR-NIAP facilitated Committee (headed by Dr. R.S. Paroda, Chairman, TAAS) constituted by the Principal Scientific Advisor to the Government of India for Agriculture

Policies and Action Plans for a Secure and Sustainable Agriculture. The report submitted by the Committee provides deep insight into the agriculture situation of India and scientific, institutional and policy reforms with time-bound action plans to meet sustainable development goals of ending hunger, poverty and malnutrition.

- ICAR-NIAP provided policy input on various aspects on agricultural market reforms. This includes revision of the APLM and Contract Farming Model Acts. The input was also provided on development of agro-processing clusters and new approaches of ensuring MSP to farmers.
- Director, ICAR-NIAP delivered two lectures on recent developments in Indian agriculture in a Special Seminar on agriculture organized under Speakers' Research Initiative (SRI). The seminar was chaired by Hon'ble Speaker of Lok shabha and attended by Hon'ble Members of Parliament.
- ICAR-NIAP has prepared a draft working paper for agriculture and allied sectors for NITI Aayog which would form basis of Vision 2035 document being prepared by the NITI Aayog. The paper evaluates transitions in agriculture and discusses emerging opportunities and challenges for a paradigm shift towards sustaining food and nutritional security and accelerating overall economic development in the country.
- ICAR-NIAP regularly provides evidence based inputs to Pre-Budget Consultation, Ministry of Finance, Government of India.
- ICAR-NIAP has provided inputs (particularly on assessment of socio-economic impact) on development of framework for rating and ranking of R&D labs. This framework is being implemented by the office of Principal Scientific Adviser to the Government of India and the Institute is part of the process.

Figure 11. Glimpse of policy advocacy activities undertaken by ICAR-NIAP

- ICAR-NIAP contributed in improving national level surveys of Government of India. Inputs were provided to improve contents and modalities for the implementation of Situation Analysis of Farm Households, Indebtedness and Livestock Survey of National Sample Survey Office (NSSO). Similarly, technical inputs were provided to NABARD for All India Rural Financial Inclusion Survey.
- ICAR-NIAP provided policy inputs to the State Planning Board, Government of Chhattisgarh, on improving efficiency, equity and sustainability of alternative extension systems in the state.
- ICAR-NIAP organized a policy consultation meet under the chairmanship of Dr Trilochan Mohapatra, DG, ICAR on Goods and Services Tax (GST) and its reflections on agriculture. On the recommendation of the meeting, GST rates for some inputs and machinery were rationalized and few are under active consideration.
- Provided inputs to the Committee on recommend the maximum sale price of Bt. Cotton seed for the year 2018-19.
- ICAR-NIAP facilitated the Committee of Ministry of Agriculture and Farmers Welfare on Outcome Review of Indian Council of Agricultural Research. The Institute compiled information on significant research outputs and their outcomes.
- ICAR-NIAP contributed to the National Academy of Agricultural Sciences (NAAS) in developing framework for ranking of ICAR research institutes. The institute facilitated in finalizing impact indicators and quantifying the performance of ICAR institutes.
- ICAR-NIAP has contributed to Agriculture Centre of South Asian Association of Regional Cooperation (SAARC) through a country paper on fostering investment in agriculture through Public-Private-Farmer Cooperation (PPFC).
- ICAR-NIAP has initiated an annual series of *Agriculture Development Report* (ADR) which provides an annual account of agricultural development, research highlights, inputs for budget, key indicators on performance of agriculture, etc.

B2. Capacity building

The Institute's capacity building programs aim at improving capacity of agricultural economists and social scientists in the NARS. Further, the faculty of the Institute offer voluntary services of teaching and guiding post graduate students of ICAR-IARI and ICAR-IASRI. Substantial efforts have also been extended towards honing analytical skills of ICAR-NIAP faculty in agricultural economics and policy research. Capacity development programmes and activities of the Institute during the last five years are summarized in table 7 and 8.

Table 7. Number of capacity development programmes/activities organized by ICAR-NIAP during 2016-17 to 2020-21

Capacity building programme	Number of programmes
CAFT/Summer/Winter schools	8
Training programmes funded by ICAR-NIAP	21
Sponsored training programmes:	
International	2
National (Indian Economic Services)	6
Seminar/Workshop/Brainstorming Sessions	21
Lectures delivered by ICAR-NIAP faculty in scientific forums	184
Teaching courses taken by ICAR-NIAP faculty (no.)	54
Post-graduate students passed out under chairpersonship of ICAR-NIAP faculty (no.)	7

Table 8. Number of capacity building programmes attended by NIAP staff during 2016-17 to 2020-21

Particulars	Programs attended by NIAP staff (number)			Mandays attended by NIAP staff (number)		
	Scientists	Technical	Administration	Scientists	Technical	Administration
National						
Within Institute	33	0	10	87	0	11
Outside Institute	157	7	6	551	30	28
International	31	0	0	97	0	0
Total no. of programs in 5 years	221	7	16	735	30	39
Average no. of persons	21	5	10	21	5	10
Average no. of programs / person in 5 years	11	1.4	1.6	35	6	3.9
Average no. of programs per person per year	2	0.28	0.32	7	1.2	0.78

B3. Extension activities

Vocational training programmes

During the last five years, the institute has conducted many training programs. Two international training programs conducted for the nationals of Africa and Asian nations. A training program for the extension functionaries was conducted in collaboration with MANAGE, Hyderabad for Asian and African nationals. Through these trainings, capacity of foreign delegates (about 35) in the areas of policy formulation, policy analysis and policy communication etc. was improved.

Figure 12. Glimpse of the trainings organized by ICAR-NIAP

Further, six inception level training programmes for the Indian Economic Service (IES) Officers were organized at ICAR-NIAP to acquaint them with core issues in agriculture sector. During the last five years, eight summar/winter school have been conducted on advances in methodologies and techniques in social science research for the researchers and academicians of NARS. During 2020-21, ICAR-NIAP organized a special 20 days webinar on quantitative methods in social sciences which was attended by 4200 researchers and students virtually. A book entitled "quantitative methods for social sciences" has been published and distributed to all heads of social sciences divisions of State Agricultural Universities for the purpose of improving skills of faculty and students in using quantitative and advanced methodologies. Soft-copy of the book is available in the Institute's website. ICAR-NIAP faculty delivered 184 lectures on advance methodologies and emerging issues in agriculture in various training programmes organized within as well as outside the Institute.

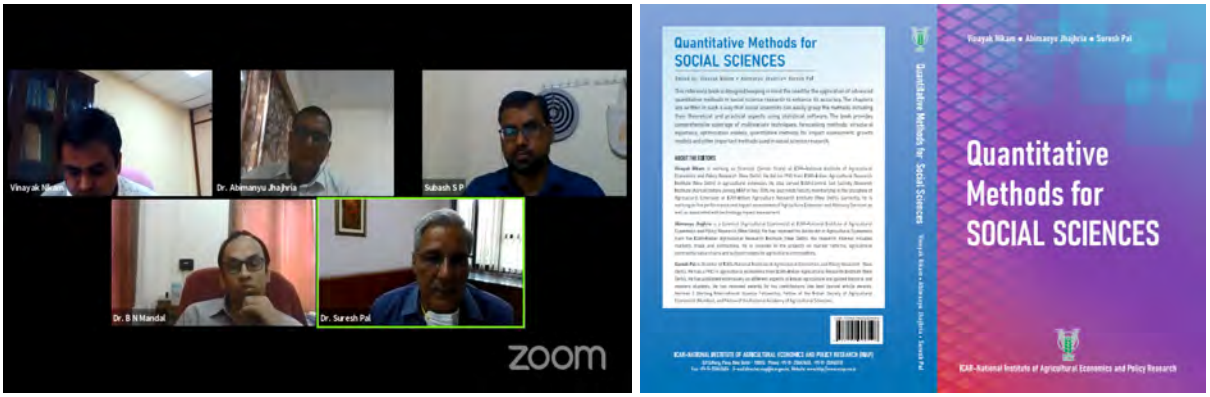


Figure 13. Snapshot of online lecture series and book on quantitative methods for social sciences

Radio and TV talks

Institute staffs have been actively participating in radio and TV show organized by various channels to discuss and give opinions about the existing government activities related to agriculture and its way forward. Institute scientific staffs are regularly called for the pre-budget discussion. Recently, Scientist are at forefront in promoting awareness among the farmers about the three farm act brought by the government. Through national TV and

Figure 14. Mass media activities of NIAP scientists on national TV channels.

Radio channels, NIAP scientist could reach out to millions of the farmers. During 2016-17 to 2020-21, the ICAR-NIAP faculty have attended about 40 TV/Radio shows on topical issues such as Pre-budget discussions, PM-ASHA scheme, sugar policy, climate change, land use planning, importance of micro irrigation, MSP, food security and public distribution system, new farm Acts, etc.

Press coverage

The research based insights have been effectively communicated to the general public through publications in national newspapers like The Hindu, Financial Express, Business Standard, The Economic Times, The Times of India. **During 2016-17 to 2020-21, about 25 newspapers articles** have been published on topical issues such as PM-KISAN, nutrition, strengthening agricultural value, loan waiver, artificial intelligence, MSP, structural change in agriculture, union budget, etc.

Impact of extension programmes

Through its research on the impact of extension activities, the Institute has provided valuable insights for improving extension programmes in the country. A study has evaluated various organizational aspects and linkages among different Extension and Advisory Service (EAS) providers. The study characterized pluralistic nature of EAS provides and revealed presence of convergence and coordination of varying degree among various EAS providers. In eastern states (Bihar, eastern Uttar Pradesh, West Bengal and Odisha), technical efficiency in crop cultivation in case of farm households having EAS access from public, private and media sources was higher (0.71) as compared to the households with no EAS (0.59). This indicate that pluralistic EAS provisions can have a synergistic effect on farm technical efficiency. Another study in Maharashtra state suggests that adoption of technology by the farmers is greatly influenced by the social network characteristics. Thus, adoption rate of technology can be improved by targeting the contact persons having better social network characteristics such as education level, land holding, association in village organization, etc. ICAR-NIAP in collaboration with 52 partners, is engaged in impact assessment of more 400 technological interventions across the country under Farmer FIRST programme of ICAR. The programme aims at participatory technological development, assemblage, assessment, refinement for location specific and need based technologies for the farmers for enhancing their income and securing the livelihood. The Institute has contributed through the development of framework and methodologies of impact assessment of location specific technologies in terms of verifiable indicators.

Effective linkages with stake holders

ICAR-NIAP has developed strong linkages with stakeholders through inter-institutional collaborative research projects, capacity building programmes, policy interface activities and extension programmes. A glimse of linkages is presented in table 9.

Table 9. Linkages of ICAR-NIAP with stakeholders developed during 2016-17 to 2020-21

S.L.	Particulars	Number
1.	No. of collaborative institutes/SAUs in research projects and consultancies	
	• Management and impact assessment of Farmer FIRST project	52
	• Network project on market intelligence	14
	• Network project on policy imperatives for promoting value chain of agricultural commodities in India	8
	• Network project on resource use planning for sustainable agriculture	7
	• Network project on regional crop planning for resources use efficiency and sustainability	6
	• Network project on structural transformation, regional disparity and institutional reforms in agriculture	5
	• Efficiency of micro-irrigation in economising water use in India: Learnings from potential and under explored states	3
	• Agricultural sustainability in India- A parametric study	3
	• Strategic research component of national innovations in climate resilient agriculture	2
	• Doubling farmers' income in India by 2021-22: Preparation of strategic framework	2
	• Institutional mechanisms in irrigation water management system and water markets	2
	• Assessing impact of soil and water conservation schemes	2
	• A study on agro-economics of tobacco in India	2
	• Tweaking current schemes in de-minimus to meet green box criteria as per legal agreement on agriculture	2
	• Transformation and sources of growth in Southeast Asian Agriculture	2
	• Framing policies for overseas acquisition of raw material by Indian fertilizer companies and role of Government in India	2
	• Research studies on post-harvest profiles of 10 selected commodities	2
2	No of foreign visits of ICAR-NIAP faculty	17
3	No of foreign delegates visited ICAR-NIAP	14

Number of villages and farmers covered

Under the programme Mera Gaon Mera Gaurav (MGMG), the Institute has adopted 15 villages from Rohtak, Palwal and Mewat districts of Haryana state with the aim of bridging the technological gap and accelerating overall socio-economic development of farmer households. **During 2016-17 to 2020-21, 350 activities were undertaken in these villages benefitting 7654 farmers.** The awareness was created among the farmers on new varieties, resources saving technologies, soil health cards, organic farming, government schemes like PM-KISAN, PM-

FBY, e-NAM, PM-ASHA, micro-irrigation, etc and literature support was provided. Efforts have been extended to create linkages of farmers with line-department, KVK, SAUs and ICAR institutes through interaction meetings and facilitating technology transfer. During COVID-19, scientists contacted farmers virtually and guided them about care and hygine norms during undertaking agricultural operations. Information about the protection of crops from Locust attack was also given to the selected farmers and they were urged to disseminate the information to other farmers in village.

Figure 15. NIAP scientists interacting with the farmers from MGMG villages of Haryana

Awards and recognitions won by extension scientists

- Young Scientist Award by Indian Society of Extension Education, New Delhi in 2018 to Dr Vinayak Nikam, Scientist (Agricultural Extension).
- Young Scientist Award by Society of Extension Education, Agra in 2018 to Dr Vinayak Nikam, Scientist (Agricultural Extension).

Success stories documented

- ICAR-NIAP has documented impact of 29 ICAR technologies adopted by the farmers in terms of verifiable socio-economic indicators
- The changes in disposable pattern of agricultural commodities and increase in farmers' income on account of reliable price forecasts provided by ICAR-NIAP and collaborating institutes in Uttar Pradesh and Gujarat have been documented.
- Benefits realized and farmers' perceptions on adoption of micro-irrigation technology in six states (Rajasthan, Uttar Pradesh, Maharashtra, Gujarat, Punjab, and Andhra Pradesh) have been documented.

- Benefits of mobile app *abinitio* based weather advisory service developed by ICAR-National Centre for Grapes, Pune and commercialized by Express Weather Pvt Ltd and S K Crop Tech company to the farmers have been documented.

4. Staff position and budget, 2016-17 to 2020-21

Table 10. Staff position at ICAR-NIAP

Year	RMP		Scientific Staff		Technical Staff		Administrative & supporting staff	
	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled
2016-17	1	1	25	22	5	5	14	12
2017-18	1	1	25	22	5	5	12	12
2018-19	1	1	25	22	5	5	14	12
2019-20	1	1	25	26	5	5	14	11
2020-21	1	1	30	28	5	5	14	10

During the last five years, ICAR-NIAP has effectively utilized sanctioned budget with the financial efficiency of more than 95 per cent. Year-wise budget utilization is presented in Table 11.

Table 11. ICAR-NIAP Budget and its utilization during 2016-17 to 2020-21

(Rs Lakhs)

Particular	2016-17	2017-18	2018-19	2019-20	2020-21
Budget (Sanctioned)	958	1,021	1,283	1,331	1,175
Budget (Utilized)	926	978	1,263	1,319	904*
Financial efficiency (%)	96.7	95.8	98.4	99.1	-

* Upto January 31, 2021

5. Awards/recognitions by the ICAR-NIAP scientists and staff at national level

The scientists of ICAR-NIAP are duly recognized in scientific fraternity and policy forums and have been awarded with several national and international awards. **During 2016-17 to 2020-21, ICAR-NIAP scientists have received 20 awards of repute.** ICAR-NIAP bagged 9 awards in ICAR sports meets also during the last five years. Further, technical expertise of the scientists has been recognized by various committees, task forces, and working groups constituted to address national issues. Several faculty members have served professional societies as members of editorial board, chairman and lead speakers in conferences. A glimse of the awards and recognitions is provided in table 12.

Table 12. Awards and recognitions at National level by ICAR-NIAP and staff Scientists during 2016-17 to 2020-21

Sl.	Particulars of Award/Recognition	Recipients
	Awards	
A	**National Awards of high repute**	**2**
1	*ICAR - Rafi Ahmad Kidwai Award- 2020*	*Dr Suresh Pal*
2	*ICAR - Rafi Ahmad Kidwai Award- 2016*	*Dr Pratap Singh Birthal*
B	**Fellowships of national academies and professional societies**	**3**
3	*NAAS Fellow-2021*	*Dr N P Singh*
4	*Fellow, Indian Society of Agricultural Economics-2017-18*	*Dr Suresh Pal*
5	*Fellow, Indian Society of Agricultural Economics-2017-18*	*Dr Pratap Singh Birthal*
C	**Young Scientist Awards from ICAR, National academies and professional societies**	**7**
6	*NAAS Young Scientist Award-2020*	*Dr S.K. Srivastava*
7	*Young Agricultural Economist Award, Agricultural Economics Research Association-2020*	*Dr Balaji, S.J.*
8	*Uma Lele AERA India-AAEA Mentorship Grant-2020*	*Mr. Subash S.P.*
9	*Young Agricultural Economist Award, Agricultural Economics Research Association-2018*	*Dr S K Srivastava*
10	*Young scientist Award, Society of Extension Education-2018-19*	*Dr Vinayak Nikam*
11	*Young scientist Award, Indian Society of Extension Education-2018-19*	*Dr Vinayak Nikam*
12	*Uma Lele AERA India-AAEA Mentorship Grant-2018*	*Dr Balaji, S.J.*
D	**No. of best paper published in journals and presentation in conference**	**8**
E	**No. of awards received in ICAR sports meets**	**9**
	Recognitions	
A	Selection as Member, Commission for Agricultural Costs and Prices (CACP)	Dr N . P. Singh
B	Number of scientists invited to lead/be part of official delegation to National Institutions and International Conventions	12
C	Number of sessions chaired by scientists in conferences	7
D	Number of lead lectures delivered by scientists in conferences	26
E	Number of positions of editorial board in reputed journals	16
F	Number of committees, task forces and working groups of national importance served by ICAR-NIAP Scientists	70
G	Number of scientists hired as consultants by National/ International Organizations	10

6. Overall impact, 2016-17 to 2020-21

Overall impact of the contributions of the Institute in mandated area of research, policy interface, capacity building and extension is summarized below.

- **Methodology/process/concept development:** The research carried out at ICAR-NIAP has made notable contribution to the existing literature on science and technology through development of process, methodologies and concepts. Few such contributions are;
  - Methodology for estimation of farmers' income
  - Strategic framework for doubling famers' income
  - Methodologies of impact assessment of agricultural technologies
  - Development of optimum crop plan for sustainable agriculture
  - Sustainability assessment framework
  - Models to forecast prices of agricultural commodities
  - Commodity outlook models
  - Framework to assess resilience to climate change of agro-climatic regions
  - Mapping value chains of agricultural commodities
  - Methodology of volumetric assessment of groundwater extraction and process of retrieving unit level cost of cultivation data (SAS code)

  The insights generated out of the research have provided valuable feedbacks to the scientific community on the status of technological adoption and its impact. This has also provided a basis to the Council to mobilize and prioritize resources for improving agricultural R&D and address the emerging challenges in agriculture.
- **Direct contribution to policies**: The research based policy inputs have directly influenced several national policies and contributed to the implementing agencies (ministries) in achieving the national level targets such as doubling farmer' income, stabilizing prices, securing reliable sources of fertilizer, sustainable agriculture development, etc. The technical guidance provided by the Institute has also improved national level surveys (eg. Situation Assessment Survey of NSSO, All India Rural Financial Inclusion Survey of NABARD).
- **Strengthened role of ICAR in policy process and governance:** The contribution of ICAR-NIAP has strengthened the role of ICAR in policy process. This was done through providing credible research evidence and participation in several important committees and programs of the Government. The Institute has also provided input for acceleration of technology flow to farmers, technology evaluation, and management reforms. The outcomes of various programs of ICAR were put forth for consideration of various review committees and decision making bodies. The most recent include ICAR Reviews, rating of R&D labs, cadre review of ICAR, trade policy, agro-processing, GST, stabilization of commodity prices etc. ICAR-NIAP has contributed to the development of the scientific institutions by facilitating the review process. Few select cases are outcome review of ICAR, rating and ranking of R&D labs of India, review of performance of Agro-economic Research Centres (AERC), etc.
- **Strengthened R&D ecosystem:** Institute had played a major role in developing the IPR guidelines in ICAR. Institute also provided inputs to Competition Commission of India on Merger and acquisition of inputs companies.

- **Capacity development**: The processes, methodologies and concepts developed at the Institute have been effectively disseminated through various capacity development programmes. This has augmented analytical skills and capacity of researchers, academicians and students.
- **Knowledge dissemination:** The policy and technical inputs disseminated through research papers and institute publications have been widely referred at national and international level. The high uptake level of ICAR-NIAP research is evident from the highest per publication citation of for its publications among ICAR institutes (CII, 2016[2]).
- **Interface with farmers:** ICAR-NIAP has disseminated information and created awareness among the farmers on improved agricultural practices through the programmes like Mega Gaon Mera Gaurav (MGMG) and Farmers FIRST. The evaluation of extension programmes has provided valuable insights for improving agricultural extension system in the country.

Consultancy woks

Several consultancy works have been provided to the Institute in last five years from various national and international organizations on time bound research. Involved investigators have fulfilled the full expectations of providing agencies. The details of consultancy studies completed during last five years are presented in table 13.

Table 13. Consultancy provided to national and international organization

S. L.	Consultancy project	Year	Consultancy provided to	Budget estimate (Rs lakhs)
1	Tweaking current schemes in de-minimus to meet green box criteria as per legal agreement on agriculture	2019-20	Indian Institute of Foreign Trade	3.60
2	Preparation of commodities profile	2019-20	Department of Food Distribution	1.50
3	Sources of agricultural growth in South Asia	2018-19	IFPRI	6.21
4	A decade of development and transformation in rural Chhattisgarh: Insights from Bastar	2017-18	Government of Chhattisgarh	8.55
5	A study on agro-economics of tobacco in India	2016-17	WHO	23.45
6	Evaluation of the benefits of the commodity futures market in the cotton ecosystem	2016-17	MCX, Mumbai	15.45
7	Climate change, impact and adaptation: Gender perspective in Indian context	2016-17	NABARD	13.80

2 CII (2016). Glimpses of Research Productivity of Indian Universities and Research Institutions, CII-ICI Report 2016, Confederation of Indian Industry, New Delhi

7. Management and institutional development

A. Externally funded projects during 2016-17 to 2020-21

In addition to the in-house projects, 15 externally funded projects have been undertaken during the last five years. The list of the projects is presented in table 14.

Table 14. Externally funded project at ICAR-NIAP during 2016-17 to 2020-21

S. L.	Project title	Budget (Rs. lakhs)	Project duration	Funding source
1	Network project on market intelligence	389.09	April 2013 to March 2017	ICAR
2	Network project on regional crop planning for resource use efficiency and sustainability	236.49	July 2013 to March 2017	ICAR
3	Network project on structural transformation, regional disparity and institutional reforms in agriculture	190.95	August 2017 to March 2021	ICAR
4	Network project on policy imperatives for promoting value chain of agricultural commodities in India	297.88	November 2017 to March 2021	ICAR
5	Doubling Farmers' Income in India by 2021-22: Estimating Farm Income and Preparation of Strategic Framework	278.85	April 2017 to March 2022	DAC&FW
6	Agricultural sustainability in India: A parametric study	86.7	June 2018 to March 2021	ICAR headquarter
7	Strategic research component of national innovations on climate resilient agriculture	49.87	April 2017 to March 2021	NICRA
8	Efficiency of micro-irrigation in India: Learnings from potential and under explored states	24	December 2017 to May 2019	NITI Aayog
9	Investments in ICAR leadership in agricultural higher education	-	February 2019 to March 2021	NAHEP
10	Agricultural innovations and technology management	343.30	November 2017 to March 2021	ICAR
11	Management and impact assessment of farmers FIRST project	144.05	February 2017 to March 2021	ICAR
12	Climate change, impact, adaptation and mitigation: gender perspective in Indian context	13.80	March 2017 to April 2018	NABARD
13	Technology Foresight in Agriculture	43.5	October 2017 to March 2020	ICAR

S. L.	Project title	Budget (Rs. lakhs)	Project duration	Funding source
14	Identifying pathways of socio-economics and socio-personal attributes and study their influence on agricultural performance across different agro-ecosystems in India	24.0	March 2016 to March 2017	ICAR
15	Institutional innovations in irrigation water management systems for enhancing efficiency and inclusiveness of stakeholder in Northern India	26.71	September 2017 to March 2020	ICAR

B. Total funds spent on salaries, infrastructure, equipment, civil and recurring contingencies

Table 15. Expenditure under various heads (both institute and externally funded)

(Rs Lakhs)

Indicators	2016-17	2017-18	2018-19	2019-20	2020-21*
Salaries	396	520	669	696	659
Pensions and retirement benefits	21	39	133	119	56
Infrastructure	53	70	58	65	45
Equipment and capital (capital):	50	82	89	77	5
Civil	0	0	0	0	0
Recurring contingency	487	431	490	567	254
Total (Actual Expenditure)	1,008	1,142	1,439	1,523	1,019
Total (Sanctioned Expenditure)	1,108	1,223	1,532	1,559	1,417
Financial efficiency (%)	91.00	93.31	93.91	97.67	71.88

*upto 31.01.2021

C. Internet and LAN Connectivity

Keeping pace with the current knowledge diffusion trends, the Agriculture Knowledge Management Unit (AKMU) at ICAR-NIAP is delivering policy related research inputs, and providing other information through electronic and web mode. NIAP restructured its website with the help of new responsive technology and recent guidelines. The new website is now hosted at ICAR data Centre (niap.icar.gov.in) while the previous website is still maintained at ERNET (niap.res.in). Besides, AKMU maintains the institute domain name server, website (http://www.ncap.res.in) which provides a clear impression of the Institute with all the latest information and activities, particularly about its staff, infrastructure, research projects, publications, employment, tenders, RTI information and linkages. Institute website serves as an online MIS for researchers and other stakeholders across the globe. The goal of AKMU is to strengthen information management using modern technologies within NARS. All institute publications are managed in digitized

format and access is provided to all stakeholders free. Major infrastructure developed in AKMU during last five years is presented in table 16.

Table 16. Internet and LAN connectivity infrastructure at ICAR-NIAP

1.	Internet connectivity (Band Width)	100 MBPS is upgraded to 1 GBPS from NKN India
2.	LAN connectivity status	150 active LAN Nodes with latest switches instead of 100 nodes
3.	Computerization status	100 % computerisation Note: All staff is equipped with computers, email id, ICAR-ERP and internet connectivity to support Bio-metric, PERMISNET, PIMS, HYPM, MIS-FMS, e-office and other initiatives of ICAR.
4.	Any other major infrastructure developed in AKMU during last five years	1.Upgrade Firewall system for Institute to FG-301 E 2.Setup Dell Power edge VRTX blade server for the Institute
5	Software upgradation	SPSS, GIS, STATA, E-views, Antivirus
6	Online meeting	Zoom software during the COVID threat for online meetings
7	Facebook Presence	ICARNIAP facebook page is created with regular posting of important events and live training programmes as per need
8	Youtube Presence	A new link has been created for ICAR-NIAP to keep inventory of videos having participation of ICAR-NIAP and the scientists

D. Finance Computerization

Finance in the institute is completely managed by computer software as per guidelines from ICAR and Ministry of Finance. For this purpose, Finance management system and ICAR ERPMIS FMS are being used.

E. Digitization of Library

ICAR-NIAP has well equipped digitized library and full records of its inventory is maintained on TLC (opac) software. The issue and return of library resources are operated using TLC software. Presently, library is housing a total of 7,457 publications including books, journals, bulletins, CD ROMs, database publications, reports, SAARC publications and other reference materials, etc. The library has subscription of 15 international journals and 18 national journals. Library is playing active role in timely dissemination of scientific and technical information for research via Document Delivery Service (DDS), Current Awareness Service (CAS), Newspaper Clipping Service, Resource Sharing Activities in other sister institute's libraries like IARI, IASRI, NBPGR, Inter Library Loan (ILL) facility from the CGIAR institutes like IFPRI, IWMI, CIMMYT, IRRI, ILRI, ICARDA, ICRISAT etc.

भाकृअनुप
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