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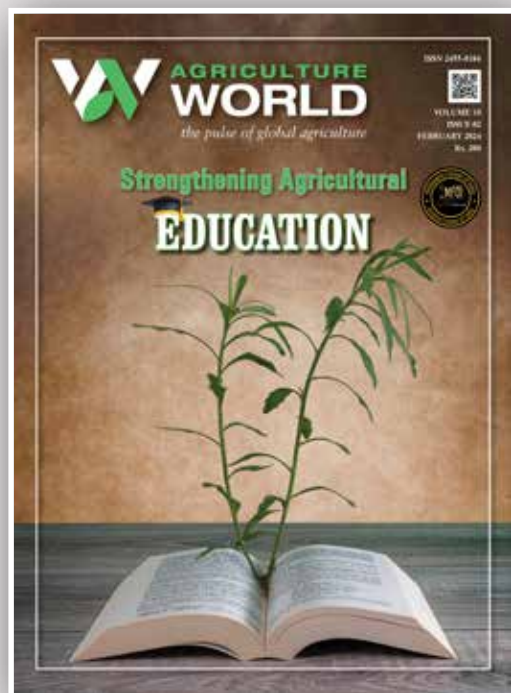
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THE VISION

The Crucial Role of State Agriculture Universities in India



M C Dominic
Founder & Editor-in-Chief

State Agriculture Universities (SAUs) in India play a pivotal role in shaping the agricultural landscape of the nation. Established with the aim of advancing agricultural education, research, and extension services, these institutions serve as the backbone of India's agrarian economy. With a rich legacy spanning decades, SAUs have continually evolved to address the dynamic challenges facing the agriculture sector.

One of the primary functions of SAUs is to impart education and training to a new generation of agricultural professionals. Through comprehensive undergraduate and postgraduate programs, these universities equip students with the knowledge and skills necessary to tackle emerging issues in agriculture, such as climate change, soil degradation, and water scarcity. By fostering innovation and critical thinking, SAUs nurture a cadre of agricultural scientists, researchers, and policymakers who drive progress and sustainability in the sector.

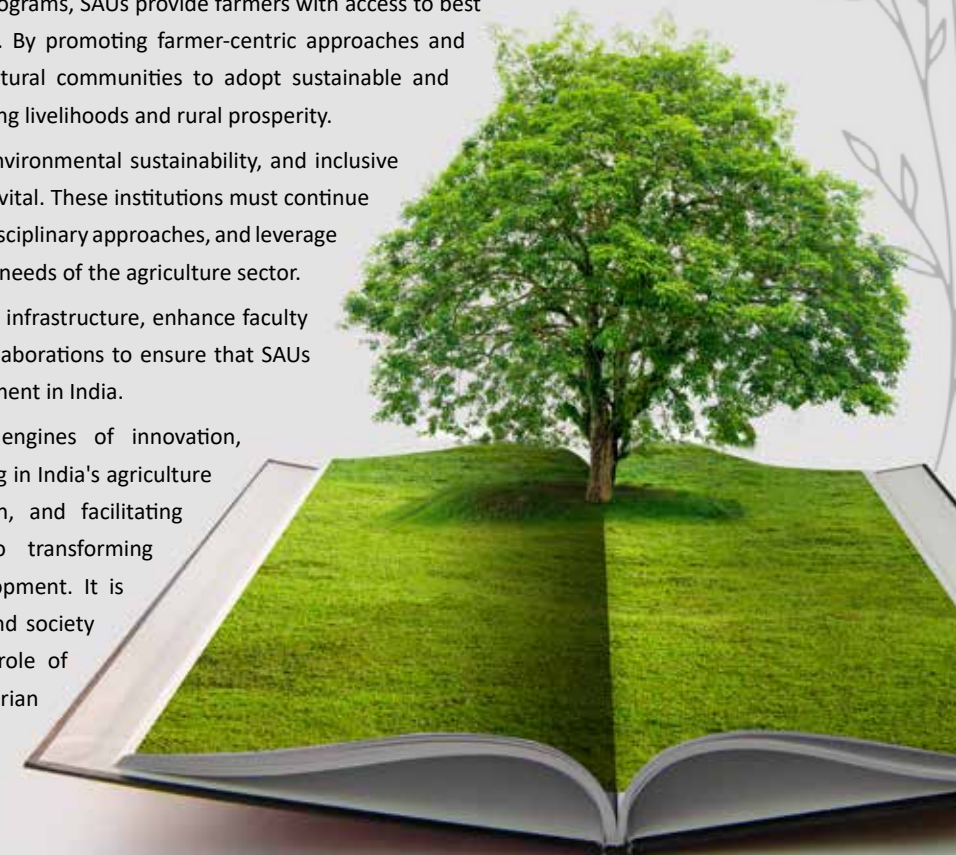
SAUs undertake extensive research to address pressing agricultural concerns and develop innovative solutions. From crop improvement and pest management to sustainable farming practices and value addition, research conducted at SAUs contributes significantly to enhancing productivity, profitability, and resilience in agriculture. Through collaborative partnerships with government agencies, private sector entities, and international organizations, SAUs facilitate technology transfer and knowledge dissemination, ensuring that research outcomes reach farmers effectively.

In addition to education and research, SAUs play a crucial role in extension services, bridging the gap between scientific advancements and on-ground implementation. Through a network of extension centers, demonstration farms, and outreach programs, SAUs provide farmers with access to best practices, technologies, and advisory services. By promoting farmer-centric approaches and participatory learning, SAUs empower agricultural communities to adopt sustainable and profitable farming techniques, thereby improving livelihoods and rural prosperity.

As India strives to achieve food security, environmental sustainability, and inclusive growth, the role of SAUs becomes increasingly vital. These institutions must continue to adapt to evolving challenges, embrace interdisciplinary approaches, and leverage emerging technologies to address the complex needs of the agriculture sector.

Concerted efforts are needed to strengthen infrastructure, enhance faculty expertise, and promote industry-academia collaborations to ensure that SAUs remain at the forefront of agricultural development in India.

State Agriculture Universities serve as engines of innovation, knowledge dissemination, and capacity building in India's agriculture sector. By nurturing talent, driving research, and facilitating outreach, SAUs contribute significantly to transforming agriculture and fostering holistic rural development. It is imperative that policymakers, stakeholders, and society at large recognize and support the pivotal role of SAUs in shaping a sustainable and resilient agrarian future for the nation.



The Vitality of Agricultural Education



In an era marked by technological advancement and urbanization, the importance of agricultural education cannot be overstated. As the backbone of human civilization, agriculture sustains life, provides nourishment, and shapes economies worldwide.

Amidst the allure of urban professions and digital innovation, the significance of understanding agricultural principles and practices is often overlooked. It's time to recognize that investing in agricultural education is not just essential but imperative for the future well-being of societies globally.

Agricultural education serves as the cornerstone of food security and sustainability. The burgeoning global population is estimated to reach 9.7 billion by 2050. With this, the demand for food will escalate significantly.

Agricultural education equips individuals with the knowledge and skills to address this challenge by fostering innovation in farming techniques, promoting sustainable practices, and enhancing productivity. From precision agriculture to hydroponics, advancements in agricultural technology underscore the need for a well-educated workforce capable of harnessing these innovations for the greater good.

Agricultural education transcends the boundaries of the farm. It encompasses a diverse array of disciplines, including biology, chemistry, economics, and environmental science. By integrating these fields, agricultural education cultivates critical thinking, problem-solving abilities, and interdisciplinary collaboration—

qualities vital for addressing complex global challenges such as climate change, resource depletion, and food insecurity.

Agricultural education nurtures a profound appreciation for nature and the environment. By immersing individuals in the intricate web of ecological processes, it instills stewardship values and promotes sustainable land management practices. In an age where environmental degradation looms large, fostering a generation of environmentally conscious agriculturalists is paramount to preserving our planet for future generations.

Equally crucial is the role of agricultural education in fostering rural development and economic prosperity. As the lifeblood of rural communities, agriculture serves as a catalyst for economic growth, employment, and poverty alleviation. By empowering individuals with the skills to optimize agricultural production and add value to agricultural products, agricultural education revitalizes rural economies, mitigates migration to urban centers, and promotes inclusive development.

The importance of agricultural education extends far beyond the confines of the classroom or the farm. It is a catalyst for innovation, sustainability, and societal well-being.

As we navigate an increasingly uncertain future, investing in agricultural education is not just an option but a necessity. It is an investment in the resilience of our food systems, the vitality of our planet, and the prosperity of future generations. Let us seize this opportunity to cultivate a brighter, more sustainable future through the power of agricultural education.

Shiny Dominic
Managing Director

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Agricultural Education For Prosperity



The agricultural sector is undergoing a transformation to meet the increasing global demand for food, fiber, and bioenergy. Here are key aspects of agriculture education that contribute to a sustainable future.

1. Digital Farming and Precision Agriculture

Sensor Technology: Monitor soil health, crop growth, and environmental conditions.

Data Analysis: Analyze large datasets generated by modern farm equipment and sensors.

Precision Farming: Diverse techniques such as variable rate application of inputs and GPS-guided machinery.

2. AgTech and Innovation:

Robotics and Automation: For tasks like planting, harvesting, and weeding to increase efficiency and reduce labor.

Drone Technology: For crop monitoring, pest control, mapping etc.

Biotechnology: Understanding GMOs and other biotechnological advancements for crop improvement.

3. Sustainable Agriculture

Organic Farming Practices

Educating on organic farming methods that promote environmental sustainability and reduce the use of synthetic inputs.

Agro-ecology: Integrating ecological principles into agriculture to enhance biodiversity, soil health, and resilience.

Climate-Smart Agriculture: Training farmers to adapt to and mitigate the impacts of climate change.

4. Business and Entrepreneurship

Farm Management: Farm planning, financial management, and risk assessment.

Market Access: Access markets, negotiate fair prices, and engage in value-added activities.

Entrepreneurial Skills: Encourage innovation and diversification in agricultural practices.

5. Collaboration and Networking

Community Engagement: Collaboration and knowledge-sharing within local communities.

Global Connections: For exchange of ideas, technologies, and best practices.

Educational Technology:

E-Learning Platforms: Utilizing online platforms and mobile apps for remote learning and continuous education in rural areas.

Virtual Reality (VR) and Augmented Reality (AR): Integrating immersive technologies to simulate real-world agricultural scenarios for enhanced learning experiences.

Policy and Advocacy

Policy Awareness: Educating farmers about agricultural policies and advocating for policies that support sustainable and smart agriculture.

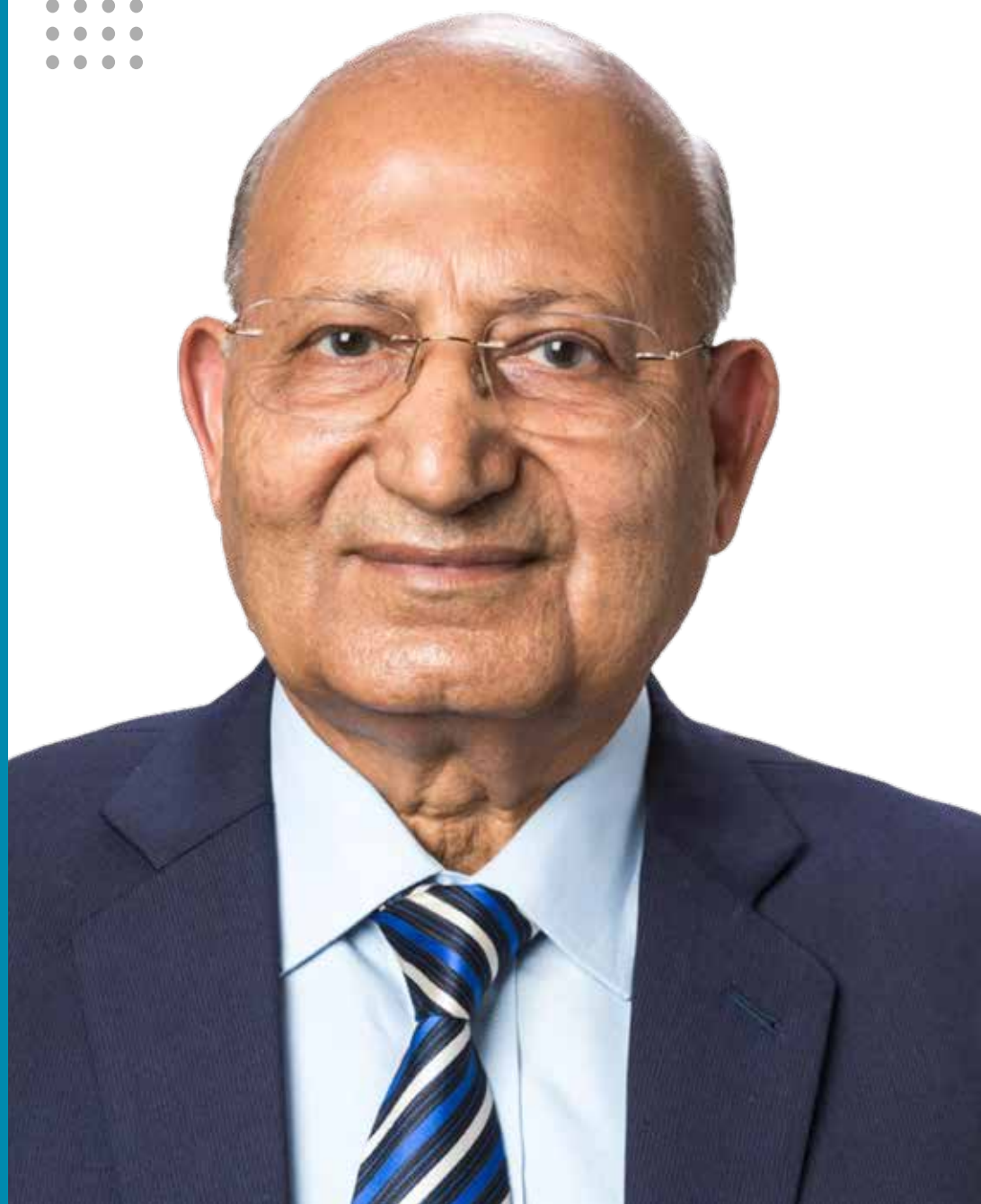
Rural Development: Issues related to rural development, infrastructure, community well-being.

By incorporating these elements into agriculture education, individuals can be better prepared to navigate the challenges and opportunities presented by modern agriculture, contributing to a smart, sustainable, and resilient future.

Mamta Jain
Group Editor & CEO

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Reorienting Our National Agricultural Education System



NEP 2020 outlines the roadmap for a very comprehensive education system



Education is the foundation of economic and social development. This fact was well-recognized by our ancestors who built such magnificent educational institutions as Nalanda and Takshashila universities and gave to the world the Gurukul system of education. After independence, successive governments developed educational policies and established universities and other educational institutions throughout the country to meet the growing need for well-qualified and trained human resource.

The present government has been making multi-directional efforts towards improving the quality, equity, and integrity of the primary as well as higher education systems so that emerging expectations of learning outcomes are fully met. The National Education Policy (NEP) 2020 outlines a road map for very comprehensive education system that is aligned with the aspirational goals of 21st century education in India.

The current agricultural education system of the country is largely based on the Land Grant System which integrates three pillars of agricultural growth: (i) education, (ii) research and (iii) extension. In India, the first agricultural university based on this system was established in 1960 at Pant Nagar. By now, the number has grown to 76 State Agricultural Universities (SAUs) - including Veterinary, Horticulture, Fisheries and Organic Universities, 4 ICAR Institutes as Deemed Universities, and 3 Central Agricultural Universities producing around 87,411 graduates and post-graduates annually. These institutions have played very significant role for achieving the Green, White and Blue revolutions - making India a food

secure nation. According to Dr Norman Borlaug, known as father of Green Revolution, the cradle of success in India had been the policy support, institutions and competent human resource, which obviously lacked in Africa where he tried to achieve similar results but could not succeed.

Challenges and Constraints

Despite these achievements, over the last six decades, the agricultural education system has faced various challenges such as: i) proliferation of universities established with inadequate planning, infrastructure and meagre resources, ii) bifurcation of multidisciplinary universities into sectoral based universities like: Veterinary, Fishery, Horticulture, etc., iii) political interference and lack of autonomy, iv) inadequate funding, v) high staff vacancies, vi) disintegration of teaching, research, and extension functions, vii) lack of alignment with the new education policy which demands flexibility, diversity, multidisciplinary environment, greater accountability and relevance to emerging societal needs, viii) lack of merit based transparent review system, and ix) non-existence of student-based teacher evaluation system.

Policy Reorientation - A Must

Considering the above challenges, there is an obvious need to revitalize our agricultural education system to train youth (including women) to embrace diversified, ecologically sustainable and economically viable agriculture and allied enterprises. For this, there is need to ensure acceptable inter-institutional compatibility in governance, faculty development, curriculum building and high educational standards.

Towards this, it is high time that a “National Commission on Agricultural Education” is set-up by the Government, on pattern similar to that of National Commission on Agriculture set up in 1970 and later the National Farmers Commission in 2004 to suggest reforms and strategy for implementation, while ensuring needed harmony with the New Education Policy (NEP) - 2020.

Also, to improve quality of agricultural education, there is an urgent need to establish an “Agricultural Education Council”, either through a Bill or an Act, on par with Veterinary Council of India (VCI) under the Department of Agricultural Research and Education (DARE). This will provide a single window system of higher education at the national level. Towards this, the delegation of responsibility by the Ministry of Education has to be accorded to ICAR/DARE on priority. Similar delegation has so far been exercised by ICAR on behalf of UGC, which was duly approved by the cabinet.

Considering the national and state relevance and interdependence for agricultural technologies and products generated by the institutions as national public good, agricultural education be appended to the Concurrent List of the Constitution, like general education, leaving aside the responsibility for



agricultural development with the states. This will ensure much desired integration and generation of technologies that often transcend state boundaries. In future, approval of ICAR/DARE for opening new agricultural college/university must be made mandatory and the funding support by ICAR be extended only to those universities who comply with the Model Act.

Institutional Reforms for Excellence

Over the years, need has been felt to reorient the agricultural education system so that it continues to produce competent and skilled human resource capable of accelerating our agricultural growth. Specific guidelines need to be developed for the establishment of new agricultural education institutions. In keeping with the spirit of NEP-2020, the future institutions should offer only integrated education in all agriculture and allied disciplines as well as in basic sciences, medicine, engineering and humanities. Also, a paradigm shift is required from formal to informal education through vocational short-term diploma/certificate courses aimed at skill development of school or college pass outs. Efforts are also needed by the States and ICAR to prevent and rather reverse the discipline-oriented fragmentation of agricultural universities. Gross Enrolment Ratio (GER) be also based on the data for human resource needs both at the state and national level. Also, the teacher: taught ratio in SAUs, which currently is 1:7, has to be increased substantially with emphasis on creative potential development, as envisaged under NEP.

Enhanced Funding Needed

A White Paper on human resource need in agriculture by the Education Division of ICAR will be timely. In order to fulfil the

mandate under NEP- 2020, greater focus be henceforth on leadership entrepreneurship, employment and discovery (LEED). Selection process of faculty positions starting from the top (Vice-Chancellor) needs to be broad and merit based with greater transparency. In State Agricultural Universities, the career progression be in synchrony with other national agricultural institutions.

Institutional inbreeding has also to be minimized through innovative measures such as: i) promotion of post-graduate Sandwich Programs in collaboration with world class universities; ii) undertaking focused fundamental and strategic research in collaboration with national/international institutions of excellence, and, iii) provision of Adjunct Professors of proven eminence linked with creation of national/international Academic Chairs

Most SAUs are currently starving for funds. Hardly 4-10 per cent of budget is available for operational expenses. Hence, substantial increase in public funding of agricultural institutions is urgently needed. Also, the universities need to be encouraged to generate resources from other sources such as: different government science departments, private and international joint ventures, agricultural industry, philanthropic/ endowment funds, by sale of seed and agriculture produce, etc. In order to revitalize and bring in organizational and management reforms, a one-time catch-up grant, as done in late nineties, be again ensured by the ICAR through special grant from the Government or from Higher Education Funding Agency (HEFA).

Revisiting Land Grant System

There is strong need for revisiting the existing Land Grant System, which is almost 60 years old. For this, a high-level expert committee be constituted urgently to have wider consultation with experienced faculty, industry experts, students, progressive farmers, etc. and suggest needed reforms in our agricultural

education system. Given the fast-globalizing world and increasing appreciation of the One-Health One-World reality and the pivotal role of agriculture in realizing it, the Land Grant System needs to be changed to World Grant System to implement Resilient Agricultural Education System (RAES). The agricultural course curricula should also include courses on basic sciences and humanity to produce highly competent and empowered agricultural graduates. The agricultural education system should also enhance entrepreneurship, vocational programs and startups.

As recommended in the NEP-2020, the curricula should lay due emphasis on local and traditional knowledge and emerging technologies while being cognizant of emerging challenges and the critical issues like declining land productivity, farm income, and concerns of climate change, etc. Technology integration should be given due thrust to make the Teaching-Learning and Evaluation process more effective. To take full advantage of emerging digital technologies, the agricultural universities should benefit from the National Educational Technology Forum (NETF), set-up as an autonomous body under the Ministry of Education. To be more relevant and useful, the students need to be linked more effectively with the farmers/stakeholders right from the first year of course work, as envisaged under RAWE when started in late nineties, changed now to student READY (rural entrepreneurship awareness development yojna) program funded exclusively by ICAR.

Strengthening Accreditation System

Agricultural education institutions need to develop a robust performance and impact assessment system without which ranking of the institutions will remain a challenge. In this context, as stated earlier, the accreditation needs to be made compulsory for all. The composition of these committees be broad-based and the process made transparent – keeping in line with that of National Accreditation Council (NAC).

The Think Tanks like TAAS, NAAS, IAUA should continue deliberating the process of reorientation of our agricultural education so critical for accelerated agricultural growth in India.

Building Strong Base *of*

National Agricultural Education

for Sustainable Agriculture

“If the recommendations in the NEP 2020 are adopted in the true spirit of MERU, they will open up new opportunities that will make agricultural universities more farmer-friendly

National Education Policy, 2020 (NEP, 2020) visualizes a paradigm shift in the Indian higher education system in terms of re-conceptualization of the structure and system and new educational practices that are aligned with the aspirational goals of the 21st century learning of students. The NEP aims at making “India a global knowledge superpower” and seeks to address several challenges, such as quality, affordability, equity, access, and accountability in the existing education system.

The NEP provides several reforms at all levels of education, from school to higher education. It seeks to put more emphasis on improving teacher preparation, changing the current examination system, early childhood care, and reorganizing the educational regulatory structure. The NEP also aims to expand the use of technology, increase public investment in education, establish the National Education Commission (NEC), increase attention on adult and vocational education, and more.

Time To Prioritize Research And Innovation

The NEP 2020 states that universities should prioritize research and innovative ideas by establishing technology development centers, cutting-edge research centers, start-up incubators, stronger ties between businesses and academia, and interdisciplinary (basic science, humanities, and social science) research for the development of sustainable agricultural practices.

Out of 17 sustainable development goals by United Nations, 09 goals are directly or indirectly linked to agriculture and other allied subjects. Thus, out-of-box thinking are required to solve the challenges faced by Indian agriculture.

Transform Agriculture, Build New India

Agriculture is the mother of all cultures. The NEP 2020 should facilitate the creation of a comprehensive New National Agricultural Education Policy (NNAEP) to transform agriculture and build New India. The NEP

ABOUT THE AUTHORS

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2020 has seen the need for reviving agricultural education with allied disciplines regulated and supported by the Indian Council of Agriculture Research (ICAR).

NAEP is set to bring academic credit banks and degree programs with multiple entry and exit options to agricultural universities. NEP has emphasized higher enrollment and multi-faculty campuses.

Historically, in India, agricultural universities were established in the state and were mandated to cover agriculture, horticulture, animal husbandry, fisheries, home science, and forestry in a multi-disciplinary approach across the state. They had three vertical mandates to cover teaching, research, and extension to promote new agricultural technologies and to support farmers' welfare. Later, many universities were established for a single commodity viz. Fisheries, Veterinary, Horticulture, etc.

The NEP provides an opportunity to transform single commodity universities into multidisciplinary education and research universities (MERU). This will provide an opportunity to transform the functionally separate universities into a region-specific multidisciplinary university that will be embedded in the local socio-techno-economic settings and address local problems.

It also recommends that all agricultural universities follow this type of approach, covering all disciplines with an emphasis on regional problems with a holistic outlook. This model will create the space for students to intensively study their own core subject (like agriculture) along with some exposure to other disciplines (like veterinary and fisheries), and it will also encourage trans-disciplinary research in a problem-solving manner.

These multidisciplinary universities can also solve the problems of discipline-specific universities. For instance, horticultural and forestry universities face low student intake, a lack of teaching and administrative staff, and a lack of funds and laboratories. The faculty members can also solve trans-disciplinary problems by taking help from not only agricultural scientists but also those from the veterinary and horticulture disciplines.



Prof. Anil Kumar is Director Education, RLBCAU

A holistic perspective will help tackle problems with the food system by including all enterprises of farmers, like dairy, poultry, crops, and fisheries. Further, with multidisciplinary universities, the scope of research and teaching in departments like agricultural economics and agricultural extension will be expanded to solve the trans-disciplinary problems of farmers.

Roadmap To Fulfil Envisaged Goals

In order to further strengthen the NAEP, following are the need of hour for fulfilling the envisaged goals:

Creating model public agricultural universities for holistic and multidisciplinary education to attain the highest global standards in quality education. It will be possible only with generous funding and capacity building. Navigating the conversion of a single-discipline outstanding institution to a multidisciplinary university requires delicate balancing that requires commensurate resources and top-class managerial and leadership skills.

Shifting the assessment system from one that is summative and based on memorization skills to one that is formative, which will enhance critical thinking and be competency-based, requiring conceptual clarity, is a good step. But at the same time, it requires capacity building in terms of faculty competencies and infrastructure. It can be achieved by providing sufficient resources to highly knowledgeable, skilled faculty with the right aptitude before initiating any lateral or new programme.

Include significant numbers of vocational courses to generate youth with specialized expertise instead of multiple expertises. This initiative is laudable but needs brainstorming to develop manpower on vertical expertise.

The students should get lot of choices to choose from the courses being offered to prepare themselves for emerging areas of job and business opportunities

State-wise priority research areas based on their regional challenges must be identified and strengthened through specific education. Further, the research will be closer to the identification and diagnosis of local problems and evolving solutions, while the extension system is more linked to farmers in understanding their information needs and disseminating the appropriate technologies suitable for local conditions.

Much in line with the aspirations of the NEP, the curricula in agro-forestry, animal husbandry, fisheries, home science, and allied sciences have been responsible for developing much-needed agricultural skills and encouraging an entrepreneurial mindset among the students. They are being inspired to take up self-employment, sustainably enhance rural livelihood security, and propel agricultural transformation through science-based policy-options and actions.

If the recommendations in the NEP 2020 are adopted in the true spirit of MERU, they will open up new opportunities that will make agricultural universities more farmer-friendly. Though agricultural education is a state subject, ICAR is responsible for the quality of education across the country and should continue to work for standards-setting role under the new system of higher education regulation proposed by the NEP.

Transforming Agricultural Higher Education for a Sustainable Future

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The creation of trained quality human resources in the agriculture and allied sectors through the establishment of State Agricultural Universities (SAUs), since the year 1960s onwards, and the Deemed Universities (DUs) has ushered in the green revolution, followed by white, yellow, blue, and other revolutions. Fuelled by public funding, India boasts an assemblage of 65 SAUs, 4 DUs, 3 Central Agricultural Universities (CAUs) and 4 Central Universities (CUs) featuring Agricultural Faculties, all operating under the aegis of the National Agriculture Research, Education and Extension System (NAREES) overseen by the ICAR. These institutions offer many degree programmes for Undergraduate (UG) to Doctoral levels, encompassing domains like agriculture, horticulture, animal husbandry, fisheries, veterinary sciences, agricultural engineering and more. In addition to imparting education, these establishments engage in critical agricultural research and extend their expertise to farmers and stakeholders. ICAR provides financial support to SAUs, DUs and CUs with Agriculture Faculty throughout the country to strengthen and develop higher agricultural education system. In 2017, ICAR declared all UG courses in agriculture and allied subjects which include Agriculture, Horticulture, Forestry, Sericulture, Community Science, Food Nutrition & Dietetics, Agricultural Engineering, Dairy Technology, Food Technology, Biotechnology, Fisheries and Veterinary & Animal Sciences as professional degree courses.

Guiding the trajectory of India's agricultural education is the Indian Council of Agricultural Research (ICAR). The council holds a pivotal role in shaping and adapting the landscape of agriculture in India as it responds to the challenges and opportunities presented by an evolving world. As a premier research and education organization in the field of agriculture, ICAR plays a multifaceted role in guiding agricultural practices, innovations and policies in the changing agricultural scenario while providing quality education.

The agricultural sector is intricately woven into the fabric of our country, as a significant portion of India's economy relies heavily on it. It not only fuels economic growth and fosters innovation but also bestows upon us a brighter future. The sector contributes to various aspects of the Indian economy including over 24% Gross Domestic Product (GDP), and food security. It is also the largest provider of employment in India directly employing a 54.6% of the population, particularly in rural areas.



ICAR plans to continue being a disruptor to the traditional education system and drive further innovation in agricultural education

ICAR has understood the need of the hour granularly and has revamped the education system as per three pillars

- *Digital Infrastructure*
- *Digital Content*
- *Digital Capacity Building*

To keep the agricultural education system dynamic and resilient, ICAR launched a subproject 'Resilient Agricultural Education System (RAES)' under a mega-project entitled 'National Agricultural Higher Education Project (NAHEP)' in 2021. Under RAES, a robust three-tiered digital framework that has been put in place to strengthen digital infrastructure, enhance digital capacity and create robust, relevant digital content for system-wide consumption. Through this initiative, ICAR is paving the way for a more inclusive and transformative learning experience for students and educators.

Revolutionizing Course Curricula for Future-Ready Professionals

The ICAR has been regularly on periodic basis bringing necessary reforms for quality assurance in agricultural education. Council has been appointing Deans' Committees, which in consultations and deliberations with all stakeholders, have been making recommendations on updating academic norms and standards towards meeting the challenges and opportunities. The '6th Deans Committee' is currently working to restructure agricultural and allied sector course curriculum in alignment with NEP-2020 for UG courses. This overhaul includes the integration of vocational courses, fostering skill development, and setting the stage for a new era in the agricultural domain. Since academic session of 2021-2022 the revamped syllabus with new, cutting-edge courses recommended by the committee on 'Broad Subject Matter in Agriculture (BSMA)' has been implemented for PG and PhD programs in 79 disciplines. New courses include genomics (biotechnology), nanotechnology, precision farming, conservation agriculture, secondary agriculture, hi-tech cultivation, specialty agriculture, geographical information system (GIS), artificial intelligence, big data analytics, food quality, safety standards and certification, food storage engineering, renewable energy, mechatronics etc. The courses on personality development, leadership development, yoga practices, life skills, human values and ethics have also been included in the list of non-credit courses.

Agriculture serves as the foundation of the global economy too, playing a crucial role in ensuring food security and supporting sustainable livelihoods. As the world faces numerous challenges such as climate change, population growth, and limited natural resources, it becomes crucial to equip agricultural professionals with the necessary skills and knowledge to address these issues. In this context, agricultural education serves as a vital foundation, bridging the gap between theory and practice, and preparing students for the evolving demands of the agricultural sector. Since the agriculture students of today are going to become the agriculture workforce for tomorrow, henceforth it is of ultimate importance to impart agricultural education in the most dynamic way.

ICAR at the Forefront of Agricultural Education in India

The Indian Council of Agricultural Research (ICAR), established in 1929, is the apex body responsible for coordinating and

promoting agricultural education, research and extension in India. It plays a pivotal role in formulating policies, setting standards, and developing curricula to enhance agricultural education across the country, for overall sustainable development in the sector. India's National Agricultural Research and Education and Extension System (NAREES) is one of the largest agricultural education systems with 4 Deemed-to-be Universities, 3 Central Agricultural Universities, 4 Central Universities with Agricultural Faculties, 65 State Agricultural Universities (SAUs), 114 ICAR research institutions (including Agricultural Technology Application Research Institute-ATARI) and 731 Krishi Vigyan Kendra (KVK) under the aegis of ICAR. These universities and institutions offer a wide range of courses, including UG, PG, and Doctoral programs in agriculture, horticulture, animal husbandry, fisheries, veterinary, agricultural engineering, and other related fields and also conduct research in agricultural sciences, provide extension services to farmers and other stakeholders. ICAR coordinates with various agricultural universities and institutions to ensure the dissemination of quality education to aspiring agricultural professionals.

The Changing World of Education: Adoption of Digital Initiatives

Education, as a whole, has undergone a significant transformation in recent years. The integration of information and communication technologies, interactive learning platforms,



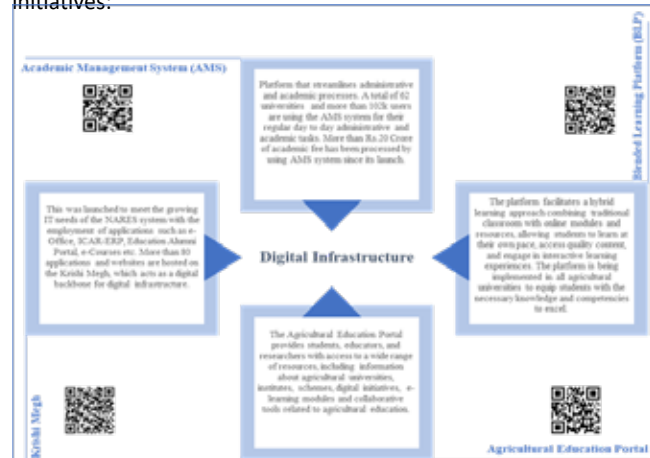
ICAR has embarked on a significant initiative to integrate natural farming into UG and PG course curricula, contributing to sustainable agricultural practices. A dedicated committee was formed to design a syllabus and curricula on Natural Farming in accordance with NEP-2020's provisions. This endeavour seeks to introduce students to traditional techniques that prioritize biodiversity, soil health and a harmonious relationship with nature. Simultaneously, it equips them with enhanced employability and an entrepreneurial spirit.

Attracting Talent in Agricultural Education: ICAR Entrance Examination

The Common University Entrance Test (CUET), conducted by the National Testing Agency (NTA), has been embraced by ICAR for UG courses in Central Universities. This move expands admission opportunities for UG courses in agriculture and allied sciences. Students seeking admission to the prestigious 20% All India Quota seats for 12 UG courses can now embark on their academic journey through CUET (UG) in Agriculture and Allied Sciences. This move encompasses 100% seats in esteemed institutions such as Rani Lakshmi Bai Central Agricultural University, (RLBCAU), Jhansi; Dr. Rajendra Prasad Central Agricultural University (RCAU), Pusa, Samastipur; ICAR-NDRI, Karnal and ICAR-IARI, New Delhi. This has resulted in a seven-fold increase in the number of registrations over the last year. The All-India Entrance Examination for admission (AIEEA) to M.Sc. in 80 disciplines and the All-India Competitive Examination (AICE) for admission to Ph.D. degree programs remain integral components of ICAR's quest to elevate agricultural education. Additionally, the increase to 30% in All India Quota seats for PG and PhD programs opens avenues for advanced agricultural education.

Digital Infrastructure

Digital infrastructure is the key enabler and foundation of RAES to achieve the end goal of providing an exceptional learning experience to various stakeholders by enabling a robust digital ecosystem. Under digital infrastructure, ICAR has launched various initiatives:



ICAR has taken a holistic approach in developing educational initiatives that encompass various aspects. These initiatives include organizing hackathons through the Kritagya Hackathon Portal, establishing a network for alumni engagement known as KVC ALNET, and implementing AI-based disease identification in crops through AI-DISC. Alongside these efforts, ICAR's digital infrastructure initiatives are focused on providing stakeholders with the finest digital facilities available through effective utilization of digital resources. This approach ensures that the goal of delivering top-notch digital services to users of the portal is successfully achieved.

Digital Content

ICAR has taken the lead in introducing numerous pioneering initiatives aimed at elevating agricultural education and establishing an enriching learning atmosphere for students. These ICAR initiatives, falling under the umbrella of digital content, are strategically designed to harness the power of technology, foster collaborative partnerships, and grant access to state-of-the-art resources.

Some of the key initiatives under Digital Content by ICAR includes:

Digital Capacity Building

The digital capacity building in agricultural education is playing a vital role in enhancing the quality of education and preparing the teachers, administrators and students for the agricultural challenges of the future.



ICAR has established a Capacity Building Portal (<https://cbp.icar.gov.in/>) responsible for organizing capacity building sessions and monitoring them. Under the capacity building initiative, Career Development Centres (CDCs) and Faculty Development Centres (FDCs) have been established that facilitate the trainings according to the nature of the training. Trainings under ICAR are conducted on online and offline both. Since 2022, a total of 16 trainings have been conducted with successful participation of 1652 people.

ICAR has taken several initiatives to build capacity through international exposure and training programs also. These initiatives aim to provide agricultural scientists and professionals with the knowledge and skills they need to address the challenges facing the agricultural sector in India. Some of the key initiatives are international fellowships to study and train at leading agricultural universities and research institutions around the world, Joint research projects to conduct joint research projects on a wide range of agricultural topics, training programs for agricultural scientists and professionals from India and abroad and soft skills training to help agricultural professionals develop the skills they need to communicate effectively, work in teams, and manage projects. These initiatives are helping to build a strong pool of skilled agricultural scientists and professionals in India.

ICAR's believe in foresighted and innovative initiatives remains underlined. It believes in creating entrepreneurial spirit among individuals by implementing programmes that cover different thrust areas in agriculture and allied sectors. One such program by ICAR is the "Student Ready" (Rural Entrepreneurship Awareness Development Yojana) initiative, which focuses on preparing students to be industry-ready by providing them with exposure to modern agricultural practices, research facilities, and industry collaborations. As a part of the Student Ready programme, ICAR offers the Rural Agricultural Work Experience (RAWE), where students spend a semester in rural areas, gaining hands-on experience in agriculture and rural development. Additionally, ICAR emphasizes skill development and vocational programs to equip students with practical skills essential for agricultural entrepreneurship. These initiatives contribute to fostering a new generation of skilled and agripreneurs, addressing the emerging needs of the agricultural sector.

ICAR also drives policy reforms in agricultural education through committees such as the Broad Subject Matter Area Committee (BSMA) and the Dean Committee. These committees play a crucial role in formulating and revising the curriculum, ensuring its relevance and alignment with industry requirements. Through regular reviews and consultations, ICAR seeks to keep the curriculum up-to-date and responsive to the changing dynamics of the agricultural sector. Furthermore, ICAR promotes quality enhancement through accreditation processes, such as the

accreditation of agricultural universities by the Indian Council of Agricultural Research-Agricultural Education Division (ICAR-AED). This accreditation ensures adherence to quality standards and benchmarks in agricultural education. ICAR also actively participates in rankings, such as the National Institutional Ranking Framework (NIRF) and international rankings like the QS World University Rankings, to evaluate and improve the quality of agricultural education and research institutions in India. These quality enhancement efforts aim to elevate the standard of agricultural education and promote excellence in the field.

In addition to the digital initiatives, ICAR organized two major conferences in 2022 and 2023 to discuss the future of agricultural education in India. The International Conference on Blended Learning in Education (ICBLE) and Mainstreaming Agricultural Curriculum in School Education (MACE) were held in New Delhi in March 2023 and June 2022 respectively. Both conferences were successful in achieving their goals. ICBLE helped to raise awareness of the potential of blended learning for agricultural education, and MACE provided a platform for experts to discuss the importance of agricultural education and its addition in school education.

During ICBLE, The New Delhi Declaration on Modernization of Agricultural Education System was signed which sets the principle of making agricultural education resilient. Delhi Declaration furthers the agenda on Science, Technology, Engineering, Agriculture, and Mathematics (STEAM) in agricultural higher education. The declaration covers broad perspectives of development of agriculture education aligning it with SDGs and Entrepreneurship, and it assures quality maintenance through the robust system of accreditations.

ICAR's Successful Incorporation of New Interventions

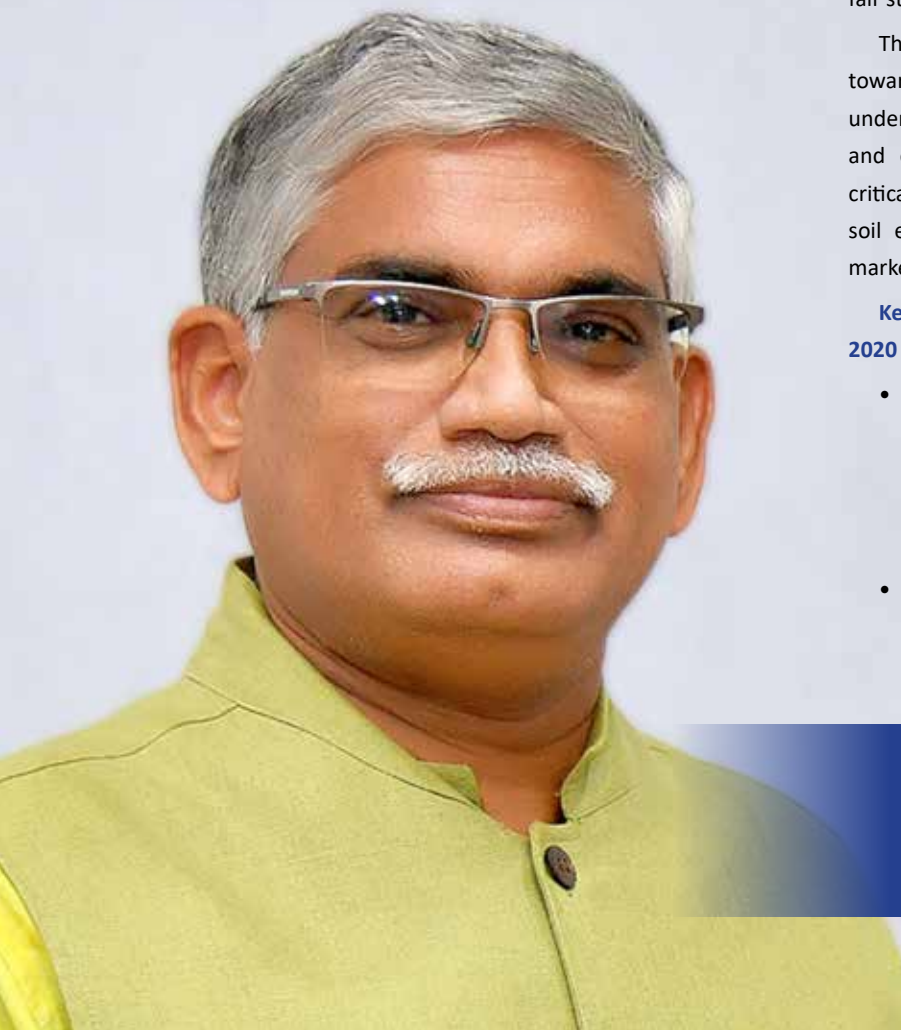
By incorporating these new interventions, ICAR has made significant progress in enhancing agricultural education at the ground level. These initiatives have enabled access to quality education, improved administrative efficiency, promoted collaboration and knowledge exchange, and facilitated data-driven decision-making and innovation in the agricultural sector.

ICAR plans to continue being a disruptor to the traditional education system and drive further innovation in agricultural education. It recognizes that the field of agriculture is constantly evolving, and new challenges and opportunities will emerge in the future. To stay at the forefront, ICAR will continue to bring forth new initiatives, monitor the efficiency of existing interventions, and adapt to the changing needs of the agricultural sector. By fostering a culture of innovation, collaboration, and continuous improvement, ICAR strives to change the face of agricultural education.

Restructuring State Agricultural Universities Under NEP-2020



The National Education Policy 2020 presents a unique opportunity for SAUs to elevate their status as leading institutions in agricultural education and research



The globalization of agriculture is posing a big challenge to Indian agriculture and to align with the changing global scenario, the agricultural education and extension system must be redefined.

The New National Education Policy of India has opened the gateway to introduce several changes in the education system, including higher agricultural education. NEP-2020 has also given emphasis on recognizing, identifying and fostering the unique capabilities of individual students; flexibility to choose learning courses and programs according to their own interest. The National Policy on Agriculture seeks to actualize the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agri-business, create employment in rural areas and secure a fair standard of living.

The agricultural education needs to be redesigned towards developing Professionals with the ability to understand and use local knowledge, traditional knowledge and emerging technologies, while being conscious of critical issues of low productivity, high cost of production, soil erosion, water scarcity, post-harvest management, market problems etc.

Key Strategies For Effective Implementation Of NEP-2020 in SAUs

- The Universities should get familiarized with the key components, objectives and recommendations of NEP 2020 and understand how it emphasizes holistic education, flexibility, multidisciplinary learning and the use of technology.
- Committees or task forces should be established to oversee the implementation process. These committees could focus on curriculum revision,

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pedagogical approaches, technology integration, faculty development and infrastructure enhancement.

- The existing curriculum should be redesigned to incorporate the policy objectives, such as interdisciplinary subjects, experiential learning and skill-based
- learning programs to allow students to choose courses across disciplines. The courses such as Urban agriculture, Precision farming, Artificial intelligence, Internet of things, Climate smart agriculture, Nanotechnology, Hi tech agriculture, Wastewater management, Integrated land use planning, Secondary agriculture, Integrated watershed management, Agri business centres, Digital farming solutions can be incorporated in Student READY programme and curriculum can be developed with coordination of ICAR and ASCI (Agriculture Skill Council of India).
- As there is wide scope for professionals in grading, sorting, assaying, post- harvest processing etc which are vital for e-trading, Certificate Courses can be offered in areas such as Digitalization in agricultural marketing, Supply chain management, Value chain management, Cold chain development and Market intelligence etc.
- Elective courses can be designed over and above the course curriculum from third year onwards as per the interest of the students in areas such as Data Warehouse and Data Mining in Agriculture, Greenhouse Technology, Nanotechnology, Hydroponics, Remote Sensing and GIS Applications, Agricultural Waste management, Natural Resource Economics and Management etc.
- Multilingual education should be implemented as emphasized in the policy by offering courses in regional languages alongside English. Provide language training programs for faculty and students to enhance communication and inclusivity.
- Innovative and learner-centered teaching methodologies should be developed promoting experiential learning, project-based learning and hands-on practical sessions.
- Integrating the technology for effective teaching and learning to enhance accessibility and quality should be embraced.
- E-learning platforms, online courses and virtual labs to promote classroom teaching and promote self-paced learning should be developed.
- Workshops and training sessions should be organized for faculty development to update their skills and knowledge in line with the new pedagogical approaches.

- Variety of assessment methods, including continuous assessments, projects and practical evaluations to gauge students understanding and skills should be implemented. Embrace a comprehensive and holistic approach to assessment, focusing on skill development and practical application of knowledge.
- The infrastructure of universities should be upgraded to support modern teaching methodologies and access to well-equipped labs, research facilities, libraries and online resources should be provided.
- Counseling and mentoring services to support students' holistic development should be established to address their academic, emotional and career-related needs.
- Research collaborations across disciplines should be promoted to encourage faculty and students to engage in innovative projects that address real-world challenges in agriculture, horticulture and related fields.
- Centers of excellence should be established to facilitate collaboration between academia and industry to foster innovation and address industry challenges.
- Partnership with agri/horti industries, agribusinesses and related sectors should be strengthened to provide students with practical exposure through internships, workshops, and guest lectures.
- Students and faculty should be encouraged to engage with local communities through extension programs, workshops, and awareness campaigns related to sustainable agricultural practices.
- The effectiveness of the implemented changes should be regularly reviewed and assessed by gathering feedback from students, faculty, and stakeholders to make necessary improvements.
- Ensuring that the university's policies, procedures, and regulations align with the guidelines of NEP 2020 and the education regulatory bodies in the state.

Unique Opportunity

In conclusion, the National Education Policy 2020 presents a unique opportunity for SAUs to elevate their status as leading institutions in agricultural education and research. We must embrace these changes with enthusiasm and commitment, ensuring that we continue to produce agricultural experts who can address the evolving challenges in the field and actively participate in discussions and initiatives related to NEP 2020's implementation in SAUs. Together, we can shape the future of agricultural education in line with the policy's vision of holistic and innovative learning.

Agricultural Education in India

Challenges and Concerns

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For accelerated agricultural growth, reforms in existing education, research and extension education systems are essential



Agricultural education in India has a rich historical legacy, tracing its origin to the medieval era with prominent institutions like Nalanda and Takshashila Universities incorporating agriculture as part of their curricula. However, recognizing the deficiency in the education system, the Government of India, appointed the University Education Commission in 1948, which emphasized on the pivotal role of agricultural education in ensuring food security for the nation's burgeoning population. The Commission also recommended the establishment of rural universities.

The report of joint Indo-American Teams in 1955 and 1959 and recommendations of Cummings Committee in early 1960s paved the way for the establishment of State Agricultural Universities (SAUs) across India, solidifying the concept of integrated agricultural education. It was based on the Land Grant System of the USA which integrated education with research and extension education.

The transformation of the Indian Agricultural Research Institute (IARI) into a Deemed-to-be University in 1958 marked the conceptualization of rural universities that integrated teaching, research, and extension functions. In 1960, the establishment of Govind Ballabh Pant University of Agriculture & Technology Pant Nagar marked a significant milestone in agricultural education. It adapted a farm, farmer, and consumer centric system. Today, we have a vast network of several SAUs and institutions, playing a significant role in agricultural growth of India.

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The Role Of NARS

Indian National Agricultural Research System (NARS) has played a central role in India's Green Revolution and subsequent agricultural revolutions in different sectors. The SAUs successfully integrated teaching, research, and extension activities, which generated national public goods and helped in rapid dissemination of knowledge from research labs/experimental stations/farms to students, extension workers, and farmers alike.

Indian NARS is currently one of the largest in the world with credible performance and laudable achievements. The SAUs suffer from funding constraints, weak linkages, slow pace in responding to emerging challenges, proliferation & bifurcation of SAUs, lack of robust faculty assessment system and student-based teacher evaluation system, erosion of autonomy, governance deficit etc.

Suggestions

Considering the challenges and concerns of Indian Agricultural Education, the following major suggestions merit consideration:

- As recommended by the Dr RA Mashelkar Committee (2005), the Prime Minister of India may be the President of ICAR Society. This will bring greater integration between economic policies and agricultural research, education and extension programmes and policies, and bring parity with other scientific organizations, such as Space, Atomic Energy, CSIR, etc. In view of the changing context, the agricultural education and research may be appended to the Concurrent List of the Constitution, leaving agriculture per se with the states.
- There is an urgency to review the current situation of the Land Grant Institutions /System. It underscores the need to establish an Agricultural Education Commission on the lines of Farmers' Commission, to review and suggest needed reforms in agricultural education.
- A statutory body like Agricultural Education Council, on the lines of Indian Veterinary Council, may be established with effective functioning of the accreditation system, linked effectively with federal funding.
- The relevance of separate SAUs vis- a- vis General Universities needs assessment and relook in view of increasing interest of Pvt sector and GUs in agricultural education and NEP 2020.
- Bifurcation of SAUs should be curbed and bifurcated universities should be converted into multidisciplinary institutions as also highlighted in NEP 2020.
- There should not be unrestricted proliferation of

universities/colleges in public and private sectors and the provisions of ICAR model act should be adhered to by all SAUs, Private universities and general universities.

- ICAR/DARE should establish institutional mechanisms for interaction with UGC (Now HECI) and MHRD to harmonize directives /guidelines as applicable to the SAUs.
- Linkages between teaching, research and extension within agricultural university education system should be enhanced
- Higher investment in the education system, associated with needed reforms, is extremely important to achieve evergreen revolution and goals of sustainable development.
- As per NEP 2020, the autonomous degree awarding colleges/universities should evolve into research intensive and teaching intensive Universities by 2040. Considering the NEP, model public universities for holistic education called MERU (Multidisciplinary Education and Research Universities) may be nurtured to attain global standards in quality education. Hence, it is high time to upgrade IARI / other DUs of the ICAR/DARE and leading SAUs as global Universities through Act of Parliament
- Agriculture should find a prominent place in course content at primary and secondary school levels, UG education to integrate humanities and arts with science, technology, agriculture, and mathematics (STEAM)
- The system should be accessible to all stakeholders offering theoretical and practical training of different levels and durations, including informal vocation training programmes.
- The course content of state agricultural universities should be relevant to the evolving needs of the country.
- The faculty should be given plenty of opportunities to attend national and international seminars and workshops; and to take sabbatical leave to improve and update their knowledge.

For accelerated agricultural growth, so critical to address Sustainable Development Goals (SDGs), reforms in existing education, research and extension education systems are essential. Further, to successfully address the emerging challenges, and to embrace secondary and speciality agriculture, capable and motivated human resource and reformed education systems will be critical to improve livelihood of farmers and to make agriculture an attractive and economically rewarding profession.

Aligning Agriculture Education with National Education Policy 2020 for Reshaping India

Human Resource Capital is the greatest treasure of a nation. Towards this cause, the NEP-2020 visualizes reshaping Indian agricultural education for developing professionals who have the ability to solve the problem of declining profitability and/or productivity ensuring better livelihood and food security, thus transforming the Green Revolution into an Evergreen Revolution.

The National Agricultural Education Policy (NAEP) must be based on the NEP's five pillars, namely, Access, Equity, Quality, Affordability, and Accountability to achieve the 2030 Agenda. ICAR released a roadmap and implementation strategy for NEP-2020 in Agricultural Education System (ICAR, 2021). Before this, the National Academy of Agricultural Sciences had brought out a National Policy Document (Policy Paper No. 99) on realigning Agricultural Education with NEP-2020 (NAAS, 2021).

Major Highlights Of NEP 2020

Some of the major highlights of NEP 2020 are: increasing the gross enrolment ratio (GER), defining Minimum Standards of Quality of Higher Agricultural Education, improvement in research output and outcome, making dynamic and relevant changes in curriculum and infrastructure to stay relevant and providing placement along with right skills and functional competencies. The multiple exit and entry options or flexibility in the higher education (UG, PG and Ph.D.) programmes are to be adopted also in the higher agriculture education system in the country. The ICAR Deemed Universities are in a process to be transformed into Multidisciplinary Education and Research Universities.

The NEP 2020 focuses on reorienting India's school and higher education systems, as well as instilling research-based studies and innovations in national educational system. The Indian Council for Agricultural Research (ICAR), on the other hand, has been implementing several measures of NEP-2020 on the ground for years and is thus in line with the NEP's goals, but many reforms and new measures are to be taken up for more scale and speed in holistic manner towards Aatmnirbhar Bharat.

The Many Strengths Of AUs

As part of its focus on innovation and research-based learning, the ICAR-Agricultural University (AU) system, with its network of

76 universities, offers degree courses at the undergraduate level in 12 disciplines, with postgraduate programmes in 96 disciplines and PhD programmes in 73 subjects. AUs have created virtual classrooms and e-courses for UG programmes supported by a centralised Academic Management System and now being assisted for online classes by the recently released "KrishiMegh".

In all fields of higher agricultural education, post-graduate courses are being converted into e-courses and blended learning is increasingly promoted. As a recommended choice, the NEP recommends a four-year bachelor's degree programme that includes multidisciplinary education with different multi-entry and exit options to students giving emphasis on making students job providers rather than job seekers.

New curricula are being implemented for Undergraduate program of different disciplines as per guidelines of NEP-2020 with more weightage on skill development courses in first two years giving flexibility and choice to the students in selection of skill development courses from a basket of 'Skill Employment and Entrepreneurship Development (SEED) Modules'.

Also, provisions have been incorporated for Exit and Entry options for students to get "Certificate" by end of first year and "Diploma" at the end of second year along with necessary completion of Student READY /Industry placement/ Industry exposure/ Hands on training in related domain of skill acquired to get first-hand experience to become eligible for the award of Certificate on exit. Similarly, internship is necessary for those exiting after diploma course. These students are expected to acquire competency and confidence to start their own enterprise, as well as will have adequate competency for getting jobs at national and international level. NEP 2020 also provides for vocational education and entrepreneurship development.

Challenges

Implementation of NEP-2020 in present higher agricultural education system of India have number of challenges with regards to institutional and infrastructural capacities in light of global enhancement in technologies and tools in higher education system.

Low and declining budget in agricultural education and research, mushrooming of new institutions without allotting



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adequate resources, splitting and bifurcation of existing agricultural universities, disconnect of education with employability and lack of adequate skills and competence are the important issues to be addressed urgently. Towards meeting the challenges, Centre-State collaboration should be streamlined to ensure harmonization of the regulatory and management systems and educational standard setting.

Ways To Strengthen Higher Education

Whole higher education system in the country requires reorientation of system of evaluation, monitoring, impact assessment, accountability and its harmony with digitalization and good governance. India can take the advantage of adopting appropriate models for strengthening of higher education from the institutes of global excellence at abroad and addition of newer courses encompassing global initiatives for making higher agricultural education system more focussed, competitive and visible. Shortage of faculty in the SAUs is a major constraint to gear up the system in its right spirit and full potential.

In India, as mentioned in NEP-2020, Agricultural Universities comprise approximately 9% of all universities but the enrolment in these universities is less than 1% of all enrolments in higher education which shows that GER is very poor in higher agricultural education system in the country. Both capacity in terms of intake

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Institutions offering agricultural education must benefit the local community directly

of number and quality of students must be improved to increase the performance and competitiveness.

The design of agricultural education is required for making multi-tasking professionals with high problem solving and critical thinking ability by providing more courses and trainings under real working conditions. Institutions offering agricultural education must benefit the local community directly; and for this developing Agricultural Technology Parks to promote technology incubation and business orientation need to be promoted. The NARES should assess manpower needs in terms of demand and supply of skilled human resource and reorient the intake and academic programmes accordingly to make students as Future Ready to deal with the national and international issues.

ICAR is expanding the scale and speed of agricultural education in the country through its IARI-Mega University Hub concept and opening undergraduate programmes in agriculture and allied sciences at its 15 different national institutes and centres expanding academic programs throughout India with hub partners' cooperation.

In future, a strategy is required by IARI to reach a number of 3000 students as per guidelines of University Grant Commission and excel itself as a university of global excellence. ICT, digitalization, biotechnology, nanotechnology, agro-processing, Artificial Intelligence (AI), precision agriculture, carbon positive farming and systems simulation should be integrated as a core part of learning soft power to improve system efficiency over time and space.

Quality Assurance in Higher Agricultural Education for Accelerated Growth

Agriculture sector in India is the key for food security and employment generation, being one of the largest agro-based economies. To foster accelerated growth, it is essential to cultivate a robust and skilled workforce that aligns with the demands of various industries and related sectors. This can be achieved through a well-structured system, efficient delivery mechanisms, and seamless coordination in agricultural education.

Quality agricultural education is not just a means to an end; it is the catalyst for transforming the agriculture sector into a powerhouse of innovation, sustainability, and economic growth. The benefits of investing in quality agricultural education are far-reaching, including improved productivity and efficiency in farming practices, a capacity to adapt to emerging technologies and global challenges.

The quality assurance ensures that students receive a high-quality education from educational institutions which meets specific standards and are committed to the success and satisfaction of their students. It also validates that students have gained the knowledge and skills necessary for their chosen fields. The academic institutions need to validate their programs in order to maintain quality standards. The criteria for accreditation by National Agricultural Education Accreditation Board (ICAR) involves Governance, Academic support, Research support, Extension support, Faculty and Staff development, Student development, Infrastructure and Financial resource management and Accomplishments.

UGC has also stipulated that every University and faculty must get certification by the NAAC in order to multiply its productivity and efficiency, figure out the shortcomings and academic strengths, enhance teaching-learning processes and continuously improve the plan of action. The criteria include: Curriculum aspects; teaching, learning and evaluation; research innovation and extension; infrastructure and learning resources; student support and progression; governance; leadership and management; infrastructure values and best practices. Establishment of a strong quality assurance cell is a pre-requisite for continuous monitoring various parameters impacting teaching learning process.

Why Accreditation Matters

Accreditation is the formal recognition and validation of an educational institution or program's quality and adherence to established standards. It plays a pivotal role in various sectors which includes:

Employability, Credibility and trust, Student Mobility, Global Partnership and Joint Research Programs, Academic Integrity,

Continuous Improvement, Accountability for Licensure, Funding and Grants, Accommodate Changes in the Academic World, Provide Formal Recognition by Peers, Encourage Strategic Planning, Identify Areas for Improvement, Provides Information to Support Resource Decision, Influential in Recruiting Outstanding Faculties and Students, Accommodate Changes in the Academic World, Provide Formal Recognition by Peers, Encourage Strategic Planning, Identify Areas for Improvement, Provides Information to Support Resource Decision, Influential in Recruiting Outstanding Faculties and Students

Key Issues

The Agricultural Universities lack infrastructure, modern equipment and trained human resource to provide adequate skills and entrepreneurship. The key issues are:

- Mushrooming of institutions with inadequate faculty matching strength of students.
- Bifurcation of States Agricultural Universities into different disciplines.
- Lack of autonomy and governance mechanism- increased interference.
- Digital transformation and lack of trained manpower.
- Increased focus on applied learning and graduate employability - regional disparity and inadequate linkages with the industries.
- Enhancing gross enrolment ratio with poor infrastructural facilities.
- Continuous monitoring through Internal Quality Assurance Cells.
- Tracking student performance-weak advisory system and alumni network.
- Faculty performance evaluation- lack of robust assessment system.
- Syllabus, lessons and study resources – curriculum gaps as per stakeholder need and manpower requirement.
- Accreditor's role in implementation and providing guidance on quality improvements – a path way.
- Concerns of Regulators and Policy makers – Regulatory issues like over centralization, bureaucratic structures, lack of accountability and professionalism.
- Slow pace in addressing innovations considering globalization, climate change, liberalization, IP regime and emerging technologies.
- Integration between teaching, research and extension education.
- Lesser Emphasis on Research and allocation of insufficient funds.



Central Agricultural Universities should be established in different agro-ecological regions of the country as institutions of national importance

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- Dedication of faculty and Institutional Leadership.
 - Implementation of National Education Policy.
- Transforming the Regulatory System of Higher Education**
- **Distinct and Empowered Bodies:** It includes Regulation, Accreditation, Funding, and Academic Standard Setting.
 - **The Higher Education Commission of India (HECI):** These four entities will operate under the umbrella institution known as the HECI. HECI will serve as the overarching authority overseeing the entire higher education sector.
1. **National Higher Education Regulatory Council (NHERC):** This body will serve as the primary regulatory authority for the higher education sector, excluding medical and legal education.
 2. **National Accreditation Council (NAC):** NAC will act as the meta-accrediting body.
 3. **Higher Education Grants Council (HEGC):** Responsible for funding and financial aspects of HE.
 4. **General Education Council (GEC):** GEC will be entrusted with defining expected learning outcomes for HE programs, creating a National Higher Education Qualification Framework (NHEQF).
- **Transparency and Technology Integration:** All four verticals, including NHERC, NAC, HEGC, and GEC, as well as HECI itself, will operate with a strong emphasis on transparency and efficient use of technology to minimize human intervention.
 - **Professional Standard Setting Bodies (PSSBs):** Professional councils like the ICAR, VCI, NCTE, CoA, NCVET, and others will function as Professional Standard Setting Bodies.

Institutional Restructuring

The National education Policy 2020 envisages academic institutional restructuring which includes the key points as under:

By 2040, HEIs will evolve into multidisciplinary institutions with catering to 3,000 or more students, Aspire to raise the Gross Enrolment Ratio in higher education, including vocational

education, from 26.3% (2018) to 50% by 2035, A university will be defined as a multidisciplinary institution that offers both undergraduate and graduate programs, Importance of flexibility within this framework, allowing institutions to find their unique place on a continuum, whether they emphasize research (Research-intensive Universities), teaching (Teaching-intensive Universities), or both, Autonomous Degree-Granting Colleges will be large, multidisciplinary institutions primarily focused on undergraduate teaching, but with the freedom to expand their academic activities, HEIs will have the option to offer Open Distance Learning and online programs, provided they meet accreditation standards.

Recent initiatives

Some new initiatives for Higher Education in the country have been taken in order to further widen the scope of the research and learning process.

Education Quality Upgradation and Inclusive Programme (EQUIP), Revitalizing Infrastructure and Systems in Education (RISE), UGC's Learning Outcome based Curriculum Framework (LOCF), Global Initiative for Academics Network (GIAN), All India Survey on Higher Education (AISHE), National Institutional Ranking Framework (NIRF), Scheme for Promotion of Academic Research Collaboration (SPARC), National Research Framework (NRF), Institution of Eminence, Graded Autonomy to Universities.

Strengthening of Higher Agricultural Education and providing enhanced financial support is the need of the hour in order to improve the livelihood of the farming community, make agriculture an attractive profession and continued economic growth of the country. It is also desirable to establish Central Agricultural Universities in different agro-ecological regions of the country as an institution of national importance and also create institutions of eminence in agriculture. The agricultural education council also needs to be established for effective linkages and co-ordination. It shall also be appropriate to bring agricultural education to the concurrent list of the constitution.





A Strategic View Point of INDIAN AGRICULTURE

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Over 30 years of Experience in Farm Mechanisation.

Agriculture is the most essential and noble occupation and farmers deserve our attention and gratitude with each meal that we eat. Agriculture plays a crucial role in the Indian economy and impacts the livelihoods of about two-thirds of the population, directly or indirectly. The importance of agriculture is underestimated when it is viewed from GDP perspective-a mere 15%. In reality, the balance 85% is meaningless and unachievable without food and nutrition sufficiency, that our farmers provide, to build a healthy and productive India.

Transformation of India's food system from a highly deficient one in the mid-1960s to one that is surplus now is commendable. India is now the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. The country still faces several challenges in agricultural development, including small and fragmented landholdings, low productivity, inadequate irrigation facilities, and the effects of climate change. India needs to continue its efforts to increase production of food, feed and fibre to support the ever-increasing population. This needs collective efforts from all stake holders namely our scientists, policy makers, industries and farmers.

Agriculture is a very complex activity as it is dependent on interplay of innumerable natural, environmental, scientific, technological, social and human factors. Depleting natural resources and climate change have increased the challenges. Clearly, the focus has to shift to sustainable agriculture growth. We have probably ignored this till now and need a strategic realignment immediately. Let's understand the situation and the challenges through a few examples:

1. As per study on Sustainability Concerns on Sugarcane Production in Maharashtra, India: A Decomposition and Instability Analysis, Abnave Vikas B-ISBN 978-81-7791-297-5 © 2019. It, out of the total sugar mills in Maharashtra state, 40 per cent mills are in drought-prone districts that are more suited to growing oilseeds and pulses. A lot of sugarcane cultivation is made possible due to a better support price and other support mechanism for the sugarcane growers where the soil and climatic conditions do not support a sugarcane crop. The state's licensing policy is also in favour of establishing new sugar mills or expanding the existing capacity of mills. These state policies have led to a rapid expansion of sugar mills and encouraged sugarcane production in Maharashtra along with water exploitation in the state (World Bank and GOI, 1998). This situation also causes farmer distress and industrial losses- specially during droughts.
2. According to the NABARD and ICRIER, India's top rice and wheat producers Punjab and Haryana-which contribute almost 15% of India's entire rice production, are also among the world's top water-risk zones for agricultural production. Extensive investments in irrigation and electricity infrastructure and government subsidies on water and power consumption have resulted in stickiness for paddy cultivation and rapid depletion of water table. With the current unsustainable use of groundwater, Punjab and Haryana could again become a desert in 25 years, a draft report of the Central Ground Water Board (North-Western region), has warned. As per a Punjab Agricultural University study regarding groundwater fluctuations over

the span of 28 years (1988-2016), there has been an average fall of 51 cm annually. Separate reports by the National Aeronautics and Space Administration (NASA), National Institute of Hydrology, Roorkee, and Indian Institute of technology (IIT) Kharagpur, at different points of time have highlighted the concern over non-renewable loss in ground water volume. This situation was envisaged long back and huge funds were allocated in 2013 for Crop Diversification in Original Green Revolution States (Crop Diversification Program in Haryana, Punjab & Western Uttar Pradesh -GOI) to divert the area of water guzzling crop i.e. paddy to alternate crops. Not much has happened over a decade. Shifting the major chunk of rice production to India's central and eastern states like Odisha, West Bengal, Chhattisgarh and Jharkhand, while encouraging kharif maize, pulses and cotton cultivation, in kharif season, in the rice-growing regions of Punjab and Haryana, could help prevent an impending water crisis by 2030. To add to these woes, Punjab farmers are diversifying to spring maize which is adding to further depletion of ground table. Experts estimate that spring maize was cropped in about one lakh hectares in 2023, which is almost double of last year. State agriculture department and Punjab Agricultural University (PAU) experts strongly favour legislation to ban the water-guzzler 'spring maize' in Punjab. As per Niti Ayog Working Paper-2023, even with its small share in global exports, India is now the biggest exporter of virtual water, that is, the water embedded in exported agri-food products.

- Another case in point is the area under millets in Rajasthan where the agroclimatic conditions are suitable for millets. It is notable to note that while the productivity of millets has almost doubled, the area under millets has reduced by almost 63% in last 5 decades. The net production of millets has grown marginally. There was a spike in the area sown with the Indian Government's initiative to celebrate 2023 as International Year of Millets. However, there is continued focus and efforts for growth of millet production and consumption.

Clearly, all agencies need to get together to address this situation. Niti Ayog in its working paper (2023) -From Green Revolution to Amrit Kaal Lessons and Way Forward for Indian Agriculture discusses many such issues. **If one approaches our issues and opportunities from a strategic lens, it will be evident that India has most diverse agro-climatic regions and we erred in not growing crops as per those in many instances.** If we start cropping based on these agroclimatic conditions, a lot of our issues will get solved without any technological or costly intervention-



New opportunities have arisen in the sphere of science, technology, and agri business which can transform agriculture production

and this will be sustainable too. A major policy change will be needed to adopt this strategy. This is a big challenge due to political and social implications. However, there is no choice left if we have to take care of our coming generations. **Let's not find solutions to our mistakes, let's undo what we can.**

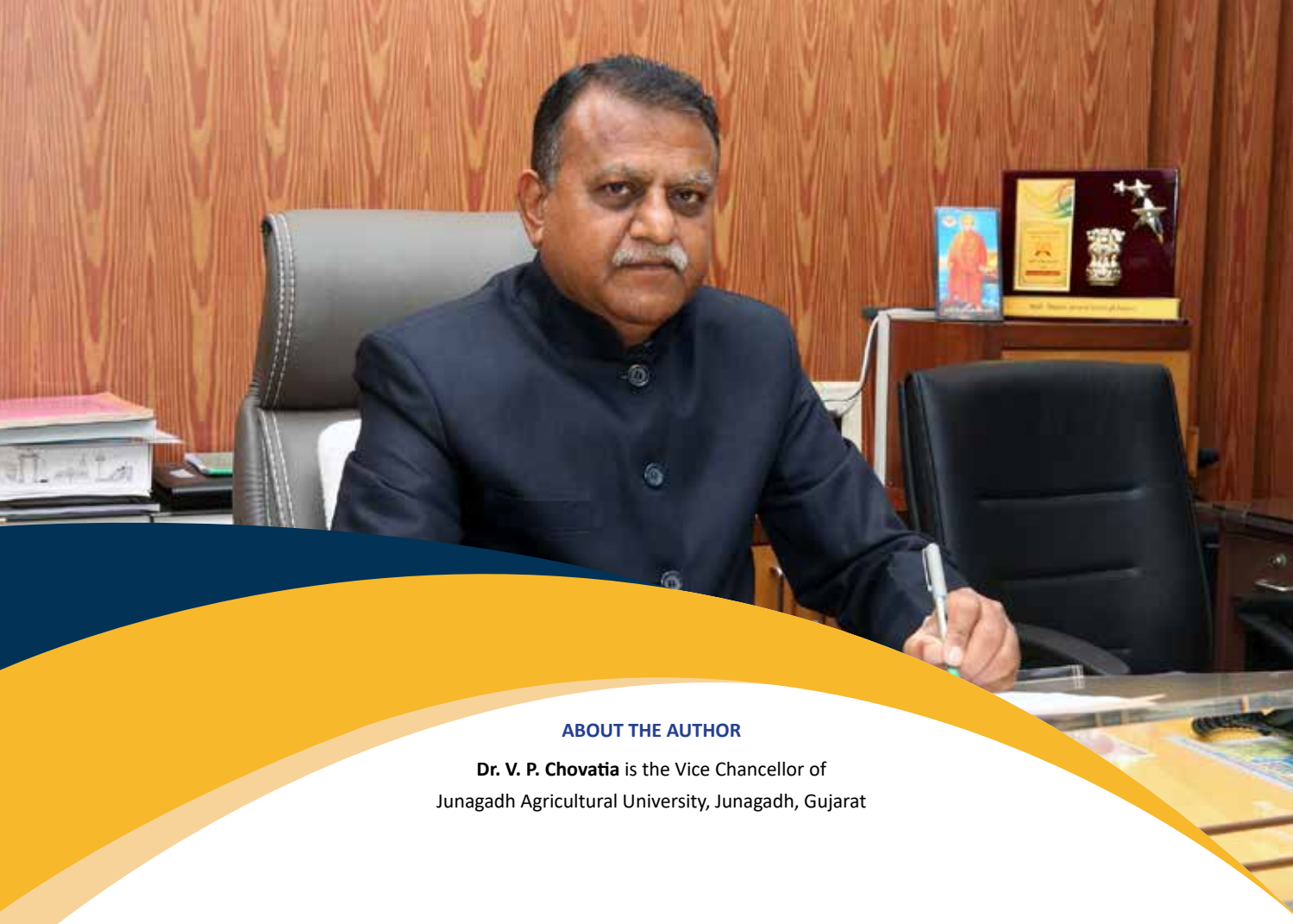
Once we have optimised the cropping pattern, the next step is to improve productivity by recommending and promoting better seeds, fertilisers, machines and agronomic practices. India, with one of the strongest National Agricultural Research Systems in the world, is well placed to take care of such demands. Here again, we need a policy shift from subsidy towards investment in Agri R&D- (Gulati et al. 2018). In FY 2020-21, as per the Union budget, India's expenditure on Agri-R&D (ICAR budget) was a meagre INR 7762 crore (about USD 1.1 billion) (Government of India 2021a). Thus, there lies a huge scope for achieving higher growth momentum, as the marginal returns from expenditures on agricultural research are almost 5 to 10 times higher than through subsidies (Fan et al. 2007). If agricultural growth is to provide food security at a national level, then the expenditure on Agri-R&D needs at least to be doubled immediately (Paroda 2019).

While we have been working on traditional ways of agriculture, new opportunities have arisen in the sphere of science and technology, information communication technology (ICT) and agri business which have the potential to transform agriculture production. We are a global IT and technology hub and Indian agriculture can gain a lot by harnessing this prowess. Some of the areas that may be addressed through this are:

- Technology can help in providing farmers with real-time information on weather patterns, market prices, and crop health. This can help farmers make informed decisions about crop management and improve their overall productivity.
- Drones and satellite imagery can be used for mapping and surveying farms to help farmers identify problem areas and take corrective action. Similarly, smart irrigation systems can optimize water usage and minimize wastage.
- Technology can help farmers access better market information and connect directly with buyers, eliminating intermediaries and reducing transaction costs.

Realigning our priorities will need involvement and support from each and every stake holder. Agriculture is a State Subject but alleviating hunger is everybody's moral responsibility. A single state may not be able to ensure food security on their own-however, all states together can ensure food security as well as nutrition security for our citizens. A strong political will is essential for such a major change. Our farmers are hard-working, receptive and resilient. Aligning them will be a big piece of this change management. Policy measures to de-risk the farmers from initial losses and uncertainties will be essential for helping adoption. In addition to this, a lot of efforts are needed in extension activities, demo farms, education and hand holding of farmers. While digital penetration has helped in extension, the role of physical efforts can not be undermined. Agricultural Universities and Krishi Vigyan Kendras (KVK) will have to take-up this responsibility. Various public and private industries need to be enrolled and their CSR budgets need to be ploughed back into such efforts. If we are able to manage all this, there are high chances of success and ushering India into the Next Green Revolution. The question is- Do we really have any other option?

The author has taken liberal references from various publications and acknowledges their contribution



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Future Prospects for Strengthening National Agricultural Education System



The agricultural education system in India must actively explore avenues for industry-academic collaboration, attracting additional industries to contribute to academic research

India's global position is undergoing a significant shift thanks to burgeoning economic growth and trade prospects. Undoubtedly, the backbone of India's socio-economic framework is agriculture providing livelihoods for over 55% of the population. To foster the growth and advancement of agriculture, there is a pressing need to inspire talented youth to contribute in this sector. Looking back at the historical roots of India's agricultural education system, we find its origins in ancient times. Literary evidence suggests that Taxila University's curriculum, encompassing various sciences like medicine and astronomy, also included the study of agriculture.

Agricultural universities are entrusted with the triple mandate of providing Agricultural Education, Research, and Extension. Currently, India boasts a total of 74 agricultural universities, comprising 63 state agricultural universities, 4 ICAR-deemed universities, 3 central agricultural universities, and 4 central universities with dedicated agriculture faculties.

These universities along with several private Universities offers education in the disciplines of Agriculture, Horticulture, Agricultural Engineering, Forestry, Fisheries Science, Food Technology, Veterinary and Animal Husbandry, Dairy Science, Agri. Business Management, etc.

The student enrolment across various UG, PG, and Ph.D. programs in these institutions is estimated to be around 1.65 lakh. Here are some perspectives strengthening the National Agricultural Education System for the development of entrepreneurs, managers, agro-industrial workers and nurturing farming with a firm commitment to sustainable growth in agriculture.

Introducing Agriculture As A Subject At School level

The current school curriculum lacks any exposure to agriculture for the student population, leading to a significant gap in their understanding of this vital sector. Consequently, when it comes to choosing careers, agriculture is often overlooked. To address this issue, it is imperative to introduce agriculture education at the primary level, ensuring that all students aged 6-14 acquire a foundational understanding of agriculture.

Furthermore, attention should be directed towards rural students in the 15-17 age group who typically conclude their secondary school education. Targeting this demographic for basic agricultural education is essential, aiming to equip them with practical knowledge that can be immediately applied, making them valuable contributors to their communities.

The initiation of polytechnic programs in agriculture and allied fields is recommended to foster the development of skilled manpower, addressing the societal need for specialized expertise in agriculture. Encouraging meritorious students to pursue agriculture education holds the key to amplifying the contributions of Agriculture Universities towards the development of Indian agriculture.

Fostering Skill, Entrepreneurship, and Start-up Ecosystem Development

To cultivate an innovation mindset, students should be equipped with problem-solving skills focused on addressing real-world challenges in agriculture and fulfilling the unmet needs of the nation. The growth of nationwide students Start-up ecosystem hinges on collaboration among mentors, academia, and industry stakeholders. Establishing such an environment would empower students to convert their ideas into prototypes, fostering the creation of successful start-ups.

The Agritech sector, exhibiting rapid growth, holds immense potential to revolutionize Indian agriculture and augment farmers' incomes. The Students' Ready program initiated by ICAR emerges as a pivotal feature in enhancing skills and entrepreneurship among students.

Leveraging programs like "Skill India" and "Make in India" within the Agricultural Education system can maximize the benefits for students, inspiring and preparing them for entrepreneurial endeavors. By integrating these initiatives, we can fortify the foundation for a dynamic ecosystem that nurtures skills, entrepreneurship, and innovative start-ups in the agricultural domain.

Maintaining Minimum Standards for Agricultural Education Institutes

The avenues like appropriate infrastructure, well-equipped laboratories, agriculture land availability, qualified teachers and sufficient student to teacher ratio are integral to providing a comprehensive and effective agricultural education. Accreditation implementation in its fullest means are not observed as it is not mandatory for any University/Institute to start or run a graduate or PG program related to Agricultural and allied disciplines like VCI in case of Veterinary education and MCI for medical education.

It is also noticed that in many cases, courses related to agriculture and allied sciences are functioning without having the minimum required facilities with huge intakes ranging from 200 to 1000. As agriculture is more focused on practical aspects, low quality passed out graduates from such colleges will have a huge negative impact on Indian Agriculture. Therefore, mushrooming of such colleges/ courses without proper standard and academic infrastructures should be controlled by formulating statutory authority.

Capacity Building of Teachers

Capacity building of teachers in agricultural universities is of paramount importance for making the students market ready on new subjects and emerging areas. Given the dynamic nature of the field, staying abreast of the latest developments ensures that educators provide students with the most relevant and current knowledge.

Moreover, exposure to international teaching- learning environments is crucial to elevate the standard of agricultural education in India on a global scale to make Indian agricultural education more globally recognized and competitive.

The capacity building for teachers in agricultural universities not only enhances their subject matter expertise but also equips them with innovative pedagogical approaches, creating a more dynamic and effective learning environment for students.

Promoting Internationalization

All India Survey data from Government of India for the year 2022 on Higher Education states a predominant growth in the number of foreign students opting to India. However, Agriculture and allied subject do not appear in the list of top subjects with most number international students.

Hence the Indian Agricultural Education System should



take actions to attract international students through better infrastructure, modern laboratories, well equipped classrooms, top grade resources, interactive learning and 360-degree support at each stage. The AUs should be flexible in eligibility of admission in specific discipline to broaden the chance to attracts international students. Specifically, State Agricultural Universities (SAUs) can serve as a hub for Asian and African students. Apart from these, operationalizing programmers like students' exchange, faculty exchange, guest faculty, dual degree, sandwich programme with reputed foreign universities can be beneficial in terms of global networking, ranking, as well as global employment opportunities.

Use of Information Technology in Teaching-Learning

The advancement of digital technology has played an important role in all sectors of life including teaching-learning process. It has been observed that Agricultural Universities of India proved to be more responsive towards online learning and continued to teach and evaluate the students during Covid-19. Online teaching learning resources increased depth of understanding and retention of course content, more time to think and reflect before communicating, increased student-to-teacher interaction and discussion; a more student-centred learning environment. The virtual reality (VR), augmented reality (AR) and mixed reality (MR) products are the next-gen revolutionary technologies that can be harnessed for up-scaling, re-inventing, and re-shaping our way of teaching and its standard.

New Education Policy (NEP) and Agriculture Education

Agricultural Education has an urgent challenge of implementing the new education policy. Holistic and Multidisciplinary Education

is one the prime features of NEP. However, in recent past, many specialized Universities like Veterinary University, Horticultural University, Fisheries University, etc. have been established, which not in line with the vision of NEP.

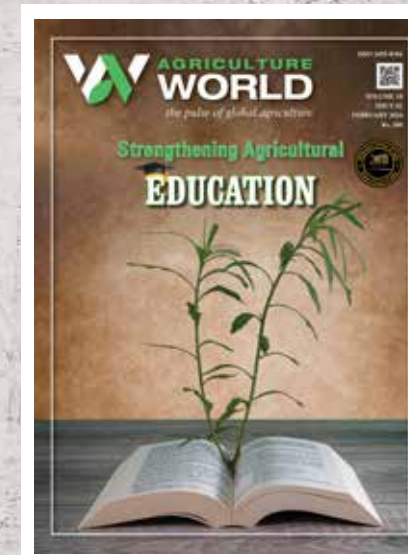
The model of specialized university is not advisable for integrated and sustainable development of the farmers and nation. Other interventions of NEP, such as the choice-based credit system (CBCS), assessment reforms, promotion of multilingualism, and the introduction of the Academic Bank of Credit (ABC), should be deeply adopted in the future within the Agricultural Education System of India for making the students more competitive and employable.

Aligning Education and Research

The synthesis of research with education is integral to advanced education systems, enhancing the learning environment, improving educational quality, and preparing students and educators for future challenges and opportunities. Since their inception, Agricultural Education Institutes have conducted targeted research to address specific needs, significantly contributing to agriculture and the welfare of farmers.

Despite these efforts, research funding from industry remains relatively low compared to support from government agencies. The agricultural education system in India must actively explore avenues for industry-academic collaboration, attracting additional industries to contribute to academic research and development funds along with diverting fund from Corporate Social Responsibility initiatives.

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Strengthening The National Agricultural Education System



Aligning the NEP 2020 with Agricultural Education, Research and Extension would help in handling challenges in the agriculture effectively



Indian Agricultural Education in real sense began by 9000 BC. when agriculture started. Earlier agriculture was well documented in Upanishads and Vedas. When agriculture was invented, the first agricultural teachers were the priests. Agriculture was in curricula of Takshashila (6th century BC) and Nalanda universities (5th Century AD).

However, there was no formal system of agricultural education until 1877, when the first agricultural college was established at Saidapet which was later shifted to Coimbatore. A Camel and Ox breeding farm was started at Karnal in 1829. A bacteriological research laboratory for Veterinary Sciences at Pune in 1889, the Imperial Agricultural Research Institute (IARI) in 1905 at Pusa (Bihar) were important establishments towards agricultural education.

IARI Started building trained human resources, but overall organized effort for agricultural education, research and extension (AGREE) received limited attention during the pre-independence period. A fundamental Department of Agriculture in India was established in the year 1871 as Department of Revenue, Agriculture and Commerce with the help of Lord Mayo (4th Viceroy) and A.O Hume (in Civil Service Bengal). The inherent desire of the colonial rulers was to develop agriculture to the economic necessities of the British capitalism. For example, to supply cotton to the textile industries of Manchester. Severe famines in India, during 1899-1900 made Curzon Viceroy to give attention on agriculture.

Post Independent history of Agricultural Education in India

The first Prime Minister of Independent India, Pandit Nehru said "Everything else can wait but not agriculture" signifies the importance of agriculture and its education because at that time food security was the major concern, hence agriculture development became an overriding priority. The impact of the strengthening education system also strengthened the agriculture education.

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Independent India's first Education Minister, Maulana Abul Kalam Azad envisaged a strong control of the Central Government over education to evolve a uniform education system throughout the country. Establishment of University Education Commission (1948-49), the Secondary Education Commission (1952-53), the University Grant Commission, the Kothari Commission (1964-66), NCERT (1961) to develop proposals for modernization of education system, to advice governments in formulating and implementing education policies were the important decisions.

The first new policy on education was announced in 1968 (NPE,1968) and second one was in 1986 (NPE,1986). To increase literacy and knowledge, policy recommendations were fully implemented but the suggested budget allocation for education (6% of GDP) in both NPEs was not realized. In fact, it is still around 4.4%.

At the time of Independence, the country had 17 agricultural, 4 Veterinary and 1 Agricultural engineering colleges. Dr. S Radhakrishnan heading university education commission then remarked that the country's position in food production was pathetic. Major food grain production went up in high speed, increasing from 50 mt in 1951 to about 350 mt in 2023-24 accounting 600 percent more, meeting our country's food security. The credit of this success goes to Indian National Agricultural Research and Education Systems (NARES), one of the largest scientific communities in the world with respect to human resource, infrastructure, research, education, and extension network. ICAR is the apex body of the NARES, which is under the administrative control of DARE, MoA and FW, GOI.

About 102 research institutes, 4 deemed universities, 11 zonal coordinating centers, 70 agricultural universities and 721 KVKs spread across states and union territories are part of NARES. With the vision of ensure food and income security for all through technological innovation and sustainable agriculture production and mission of harness power of science and education with a human touch for higher and sustainable agricultural production, NARES is working in the country. Four revolutions in India, Green, white, Blue, and Sweet are the result of efforts of the NARES.

Challenges in Agriculture

Dwindling population in Agricultural production system, instability in food grain production due to erratic weather and decreasing soil health are the major challenges in sustainable and nutritious food grain production. Decreased funding for agricultural education, research and extension are also a matter of concern in future agriculture. Decreasing marginal return in food grain production will be a matter of concern for food and nutritional security.

Strengthening National Agriculture Education, Research and Extension To Meet Challenges

Government of India has launched New Education Policy (NEP,2020) in 2020. Aligning the NEP 2020 with Agricultural Education, Research and Extension would help in handling challenges in the agriculture effectively. NEP 2020 is based on five pillars viz. access, equality, quality, affordability and accountability in education. NEP 2020 envisions higher education institutions to focus on research and innovation by setting up

- Startup incubation centers
- Technology Development centers
- Centers in frontier areas and research
- Greater industry-academia linkages
- Interdisciplinary research

Fortunately, in Agricultural Universities/ Institutions although not in all but at least in few, these programs are set up. But all these need to be increased through higher funding for developing more and more infrastructures and with running costs. NEP2020 aims at multiple exit and entry opportunities for earning certificate/ diploma and degrees from the same course. Adopting this, unemployment after completion of the degree program will not be there as students exit with skills of their interest to take up jobs or startups. In agriculture it will be successful because with few skills, students would find many opportunities of jobs, develop their own business, or can go back to his/her farming.

Credit bank system of NEP2020 will also be useful in agricultural education. Students have opportunities to learn in more than one institution for a single degree program that will give good exposure for effective learning and diverse culture of the country.

There are certain challenges in developing new curricula and arranging courses in such way that student would get sufficient and efficient knowledge and skill suitable for certificate and diploma as he/she does exit in between. Similarly, throughout the country the same curricula and year wise subject teaching must be similar for exploring credits bank facility.

Conclusion

National Agricultural Education system has been strengthened after independence through education policies and special programs like NATPs, NAIPs, NAHEPs and Sujala from ICAR. DBT and DSTs have also supported agriculture research and education.

National Agricultural Education Accreditation Board (NAEAB) of ICAR ensures the quality of higher education in India by monitoring universities/Institutions. National level several monitoring teams ensures quality research in our country.

Fisheries Education For A Sustainable Future



Most fisheries research is directed towards local, national, or global applications. It is prioritized based on SDGs, relevance to fish farmers, communities, and industry

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‘Educate to Escape Extinction’ could well be the catchphrase for present times! It is no wonder that all United Nations Member States adopted the 2030 Agenda for Sustainable Development in 2015. Within the global partnership, India too is committed to working towards the 17 sustainable development goals (SDGs) to ensure ‘peace and prosperity for people and the planet, now and into the future’. It is agreed that poverty and other deprivations must end, inequality be reduced, health and education systems improved, and economic growth spurred even as we control climate change and preserve natural resources. Activities of all the food production systems, including the fisheries sector, are in one way or the other related to all the 17 SDGs, but the four goals majorly related to fisheries research and education institutions are ‘zero hunger’ (SDG 2), ‘quality education’ (SDG 4), ‘responsible consumption and production’ (SDG 12), and ‘life below water’ (SDG 14).

Fisheries Education for Sustainable Blue Economy

Being the only national Deemed University dedicated to fisheries education, ICAR- Central Institute of Fisheries Education, Mumbai took the lead in this direction by selecting the theme ‘Fisheries Education for Sustainable Blue Economy’ for the 3rd International Symposium on Aquaculture and Fisheries Education (ISAFE3), a triennial event of the Asian Fisheries Society (AFS), held at ICAR-CIFE, Mumbai, in May 2018. The delegates deliberated on pertinent topics like ‘Education for sustainable fisheries and aquaculture’, ‘Attracting and retaining youth in the fisheries sector’, ‘Climate change and environmental concerns through fisheries education’, ‘Skill development through training and informal education’, ‘Entrepreneurship development, and ‘Course curricula in Asia-Pacific region for better job opportunities’, all of which focused on directing action towards achieving the SDGs. Under a special students’ session organised during the event, young minds discussed possibilities of valuation of ICAR-CIFE’s human capital, importance of gender studies and social science in fisheries education, extent of entrepreneurship among students, aspirations of youth in fishing communities, potential of online courses and to the extent of social media usage.

This event prepared the ground for the syllabus revision by Broad Subject Matter Area (BSMA) Committee under ICAR-Education Division in 2021, and also generated recommendations that were in tune with India’s New Education Policy declared later in 2020. Some of the pertinent recommendations that resonate with SDG of ‘quality education’ and NEP2020, and are being implemented by ICAR-CIFE are mentioned below.

- Treat education as the fourth pillar of sustainability and find innovative ways to bridge the urban-rural knowledge & skill divide through inspired basic and problem oriented applied research, and better connect between R&D and the rural livelihoods.

- Ensure uniformity with enough flexibility of course curricula and minimum standards in fisheries higher education across India via regulatory bodies (NCHAE/FCI) and by strengthening governance and leadership in AUs reforms
- Foster and strengthen collaboration among countries in SAARC and Asia-Pacific region for joint academic programs, greater faculty-student exchanges, collaborative research programs to constantly enhance the quality of education
- Improve basic infrastructure in Fisheries Colleges and reorient the education from content-centred to learning-centred approach for preparing next generation of SMART fisheries professionals
- Bridge the employable skill gaps (40-50%) among fisheries professionals by reorienting course curriculum that is still tilted against skill enhancement (both technical and soft skills) producing mainly job seekers (only 3% have become entrepreneurs) with greater involvement of industry and potential employers.
- Technology enhanced learning offer new opportunities to reach the unreached and strengthen the conventional learning systems by harnessing the use of ICT tools for ODL through MOOCs, webinars, video conferencing, mobile Apps, social media, smart classrooms, IoT, AI, etc.
- Climate change is one of the most pressing global concerns and has already begun to impact fisheries and aquaculture. Create awareness as well as introduce courses on climate change and related aspects in curriculum to address the lack of conceptual clarity on the subject among fisheries academia, take up multi-disciplinary research program and regularly involve all stakeholders.
- Train the millions of school drop-outs through vocational education following ASCI defined QPs and provide gainful employment in fisheries and aquaculture sector. Introduce programs on scuba diving, mangrove based agro-aquaculture, aqua based eco-tourism, disaster management, island fisheries management, coastal zone regulation and management, blue carbon economy, etc.

Quality Fisheries Education

Quality fisheries education being the major focus of this national deemed university, ICAR-CIFE, once again took the lead by organising a meeting of the Deans of Colleges of Fisheries and Fisheries Universities of the country in April 2023 to discuss implementation of NEP 2020.

The Policy, that holds sustainability at its core, envisions a higher education that is multidisciplinary and holistic in order to create thinking, knowledge driven, ethical, responsible, cultured

and innovative Indians who can find and create new livelihood opportunities and work towards a sustainable future. Very rightly, it identifies the practices of early stream selection and discipline rigidity in the Indian education system as major bottlenecks that stand in stark contrast with the high flexibility of curricula in the developed countries, a flexibility that has evidently ignited minds and fuelled inventions.

This flexibility is not just restricted to choices of disciplines and courses, but is extended to who can enroll for the academic programmes and also to the duration of enrollment. It is expected that this flexibility would eventually translate into broader job eligibility criteria. NEP 2020 expects universities to be large spaces with 3000 or more students. There are presently thirty-four universities and colleges offering higher fisheries education in India, with about 5500 students enrolled at any given point of time. ICAR-CIFE, where only Masters and PhD programmes are offered, will need to work out modalities for expansion. Introducing undergraduate education would be most profitable as young minds benefit best in the company of senior students and scholars. In addition, the Policy encourages universities to offer vocational courses as well, because the multi-disciplinary environment of the campus is expected to benefit the students of these courses in a more holistic manner.

In addition, rather than just India centric education, the NEP 2020 points towards an international appeal to be built into degree programmes and curricula being offered in India. Introduction of specially designed broad-spectrum disciplines to attract global students would lead to a more vibrant campus and create an innovative environment that would benefit the Indian fisheries sector. National and international linkages of universities are emphasized in the NEP, and student and faculty exchange can be made possible with more globally appealing courses.

At the Deans' Meet held at ICAR-CIFE, Mumbai, the ten major points deliberated upon include (i) gaps between the present system and NEP 2020 guidelines; (ii) duration of B.F.Sc. (3 or 4 years); (iii) possibility of providing multiple-exit option to undergraduate students; (iv) completion of M.F.Sc. course work within two semesters; (v) possibility of making students of four-year undergraduate programmes eligible for PhD; (vi) output based student research (vii) online learning courses (viii) industry partnership for 'studentpreneurship'; (ix) innovative teaching methods; (x) credit transfer, and significant recommendations/decisions were agreed upon to improve the quality of education.

Online Learning

In present times the significance of online learning cannot be ignored. It is the need of the hour that common teaching platforms be developed for all Fisheries Colleges/ Universities. Online learning can be improved by including multimedia elements like podcasts,

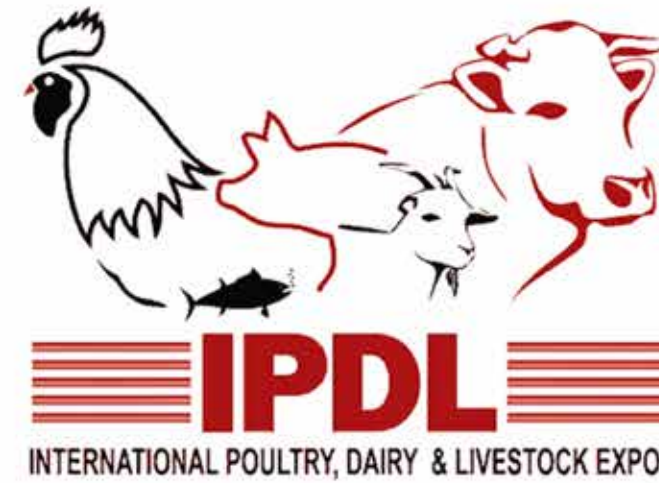
videos and interactive activities. The different learning needs of students may be taken into account while creating online courses. Students may learn at their own pace and receiving individualised instruction using tools like adaptive learning technologies. Regular assessments on online learning platforms would be beneficial for students to monitor their development and identify areas that require improvement.

There should be opportunities for students to interact with each other and the teacher because online learning can occasionally feel lonely. Discussion panels, live video chats and other interactive exercises can be used for this. Providing prompt and meaningful feedback to students can help them stay on track and improve their understanding of the course material. Automatic feedback software or customized feedback by the teacher could be integrated to improve the quality of education.

Agricultural education system is based on the belief that research is an integral part of higher education. In line with SDGs and NEP 2020, most fisheries research is directed towards local, national, or global applications, and it is prioritized based on sustainable development goals, relevance to fish farmers, communities, and industry, but it is imperative that the objectives be clearly defined and designed to maximize hands-on experience, possibility of publications and technology generation. However, to improve the quality of research, it is recommended that on completion of the academic year there should be an evaluation to assess the overall student research outputs and to generate ideas for the next year. Rewarding students and faculty members with best outputs provides encouragement and motivation and this is being done in most institutions.

Fisheries education encompasses other SDGs by promoting use of renewable energy, reducing energy and water requirement, hygiene and biosafety, reducing drudgery in aquaculture and fisheries operations, and waste recycling. Much innovation in directed towards solar powered devices for the fisheries sector, minimising greenhouse gas emissions in aquaculture operations, single cell biomass production for carbon sequestration, and products from fish waste, etc. On-campus energy and water saving, cleanliness, enabling environment for differently abled, gender equality, tree plantation, promoting and conserving biodiversity are all important criteria for university ranking, which has directed higher attention towards the SDGs. These issues are being routinely highlighted through curricular and co-curricular activities.

As we strive towards achieving sustainable development goals, education is our only hope and the seats of higher learning must be strengthened with qualified and dedicated faculties, appropriate infrastructure, and support systems, so that the young minds are ignited with knowledge and sensitized to sustain life on this unique planet.



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Steering Agricultural Higher Education *Toward Academic Excellence*



Many Western and European countries have adopted university autonomy coupled with accountability for enhancing efficiency and effectiveness in universities

Agricultural higher education and research is vital for the development of human capital, innovation, climate change mitigation and Sustainable Development Goals (SDGs). Strategic and effective investments in agricultural education and research can serve every country – from the poorest to the richest – by developing its talent and leadership pool, generating, and applying knowledge to local and global agricultural challenges and participating in the global knowledge economy. Agricultural higher education is both an aspiration for growing numbers of young people around the globe and a fundamental requirement for employment in the industries that drive the global knowledge economy and rural development.

Establishing World-class Agricultural Higher Education Institutions

As the global environment for agricultural higher education expands – encompassing not only the traditional student exchanges and scholarly sojourns but also issues such as digitalisation of agriculture, blended learning, cross-border investments, and market-type competition among institutions for international ranking – stakeholders in national agricultural research and education system must re-evaluate their priorities and expectations for enhancing the research outputs and quality of university education. International pressures, largely the result of global flows of higher education resources – funding, ideas, students, and staff – have forced institutions to re-examine their vision and missions. Moreover, these pressures have forced state and national governments, by far the largest funding sources for agricultural higher education and research, to re-examine their commitments to and expectations from their higher education institutions. One prominent outcome of these debates has been the rise in league tables and world university rankings of various sorts (THES-Times Higher Education Supplement, ARWU-Academic Ranking of World Universities, SJTU- Shanghai's Jiao Tong University, QS-Quacquarelli Symonds, etc.) and, subsequently, the growing desire to transform existing SAUs in to world-class centres of excellence possessing basic features, such as highly qualified faculty, excellence in research, quality teaching, high levels of

Agricultural higher education in India has a rich historical legacy, tracing its origins to the medieval era with prominent institutions like Nalanda, Takshashila and Valabhi Universities incorporating agriculture and veterinary (cattle breeding) as part of their curricula. The evolution of agricultural higher education over time, led to the establishment of State Agricultural Universities including veterinary, horticulture, fisheries (64), Central Agricultural Universities (3), Deemed Universities (4) and Universities with Faculty of Agriculture (4) across the country adapting US Land Grant University concept. These institutions have played a pivotal role in advancing agricultural education, research and innovation leading to Green, White and Blue Revolutions, transforming India from food scarcity situation – “Living from Ship to Mouth” to “Food Self-sufficiency”.

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government and non-government sources of funding, international and highly talented students, academic freedom, well-defined autonomous governance structures, and well-equipped facilities for teaching, research, administration, and (often) student life, and compete for a place at the top of a global hierarchy of higher education.

The superior results of globally ranked agricultural higher education institutions (highly sought graduates, leading-edge research, and technology transfer) can essentially be attributed to three complementary sets of factors at play – (a) a high concentration of talent (faculty and students), (b) abundant resources to offer a rich learning environment and to conduct advanced research, and (c) favourable governance features that encourage strategic vision, innovation, and flexibility and that enable institutions to make decisions and to manage resources without being encumbered by bureaucracy (Fig. 1). International experience shows that three basic strategies can be followed to establish world-class universities: (i) Governments could consider upgrading a small number of existing universities that have the potential of excelling (picking winners).

This path of transformation is less expensive but ability to attract talented students, governance within the same regulatory framework and institutional culture to transform within is difficult; (ii) Governments could encourage several existing institutions to merge and transform into a new university that would achieve the type of synergies corresponding to a world-class institution (hybrid formula). In this model, costs are neutral and it provides opportunity to change leadership and attract new staff but existing staff may resist, governance with a new legal status, difficult to create a new identity out of distinct institutional cultures; and (iii) Governments could create new world-class universities from scratch (clean-slate approach). This model provides ample opportunity to select best staff and students, create appropriate regulatory and incentives framework and to create culture of excellence but it is more expensive.

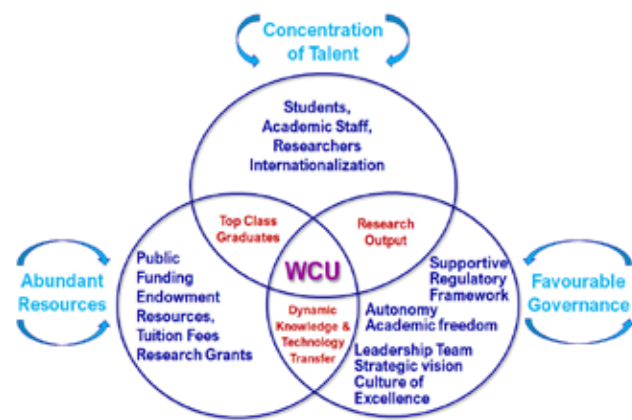


Fig. 1. Characteristics of a World-Class University – Alignment of Key Factors

The establishment of a top-class university requires, above all, strong leadership, a bold vision of the institution’s mission and goals, and a clearly articulated strategic plan to translate the vision into concrete targets and programs. Universities that aspire to better results engage in an objective assessment of their strengths and areas for improvement, set new stretch goals, and design and implement a renewal plan that can lead to improved performance. By contrast, many institutions are complacent in their outlook, lack an ambitious vision of a better future, and continue to operate as they have in the past, ending up with a growing performance gap compared with that of their national or international competitors.

Ensuring Autonomy for Improving Educational Output

Autonomy is an important and heavily debated aspect in university-level agricultural education system particularly in India, where universities are largely publicly funded. Autonomy means that University staff are empowered to utilize their professional talents and experience in realizing the best learning and research outcomes. Following definitions describe the different dimensions of autonomy:

- 1. Academic autonomy** – Capacity to decide on overall student enrolment & selection procedure; Ability to introduce and terminate degree programmes; Designing course curricula; Decide on instructional language and pedagogy; and deciding on areas, scope, aims, and methods of research,
- 2. Financial autonomy** – Acquiring and allocating funding; Deciding on level of tuition fees for national & foreign students; Internal allocation of funds; and accumulating financial surplus,
- 3. Organizational autonomy** – Setting university structures and statutes; Building collaborations & partnerships; Deciding on Institutional chairs; Electing decision-making bodies & External renowned members, and
- 4. Staffing autonomy** – Responsibility for recruitment and Ability to decide on recruitment criteria, salaries, and promotions

The Strength Of SAUs

Increasing evidence suggests that SAUs will be better suited to pursue the goals of adding value to the “talent” or “competencies” of their graduates as well as improving their research output if given more autonomy and sufficient funding by public policymakers. Some key findings are:

- Increased managerial (organizational & financial) and staffing autonomy at university level has significant positive impact on students’ enrolment, attracting international students & researchers, graduates’ competencies and university research output.
- Autonomy combined with adequate public funding per student (in relation to GDP) at university-level agricultural education, and better opportunities for students to obtain financial support appear to make universities

better equipped to enhance graduate competencies & employment rates, publications in the top 10% most-cited scientific journals and quality and quantity of university research output

- Universities with a greater degree of autonomy and freedom from constraints on their academic programmes and with generous public funding significantly explained university performance and were most successful in raising funds from alumni (endowment and gifts per student)
- An influx of additional positive funding in the form of grants or endowments combined with greater managerial autonomy is associated with an increase in research performance and more patents
- Academic autonomy allows the academic staff to design their own courses and tailor them to the needs of their students to facilitate learning and the acquisition of skills relevant to the market increasing enrolment of students and graduate employment rates.
- Improved graduate competencies and university research output contribute to worker productivity and economic innovation. Employer satisfaction with university graduates appears to be closely related to the quality of university research output.
- Organizational autonomy is reported to be associated with a 13% higher likelihood of being ranked as a top 500 university.
- Sufficient published evidence suggests that an increase in autonomy for universities would provide better educational outcomes and have a direct impact on market (worker) productivity.

India’s Plan to Build the Biggest Higher Education System in the World

Fuelled by its drive toward further growth and competitiveness, India has embraced the transformational power of higher education and is planning to put the sector to work in the coming decades. A technological, pharmaceutical, and service-sector powerhouse for South Asia and the world, India plans to diversify its higher education sector, make institutions more autonomous, and double its Gross Enrolment Ratio in the next 15 years through, among other things, the use of digitalization and an emphasis on equity and research and development.

These goals were laid down in a new sector strategy, the National Education Policy (NEP), which was endorsed by the Government of India in August 2020. Further aspects of the NEP include: (i) A strong emphasis on equity and inclusion, (ii) A diversification of the sector through the establishment of multidisciplinary institutions, (iii) Enhancement of learning environments and support for students, (iv) Strengthening of research capacity, (v) Empowerment of institutional leadership and strengthening of institutional autonomy, (vi) Development of career progression pathways for academic staff, (vii) Greater focus on online and distance learning, and (viii) Disclosure of information to strengthen public oversight.



Increasing evidence suggests that autonomy is likely to strengthen universities’ ability to improve graduates’ competencies, international attractiveness, research output, and employability provided that an effective quality control system is in place

Towards this there is a need to set up a “National Commission on Agricultural Education” to formulate needed reforms and a time-bound implementation strategy that is aligned NEP 2020, while the envisaged biggest higher education system in the world takes shape.

Policy Advice – Change Towards Excellence and Autonomy

The highest-ranked universities are the ones that make significant contributions to the advancement of knowledge through research, teach with the most innovative curricula and pedagogical methods under the most conducive circumstances, make research an integral component of undergraduate teaching, and produce graduates who stand out because of their success in intensely competitive arenas during their education and (more important) after graduation. International experience provides a few lessons regarding the key features of such universities—high concentrations of talent, abundance of resources, and flexible governance arrangements—and successful approaches to move in that direction, from upgrading or merging existing institutions to creating new institutions altogether. Highly ranked agricultural institutions require huge financial commitments, a concentration of exceptional human capital, and governance policies that allow for top-notch teaching and research.

Governments find it hard to release SAUs from the controls imposed on these organizations. Further majority stakeholders are not willing to support the introduction of autonomy legislation in universities while maintaining accountability to improve efficiency and effectiveness. University administrators are often also reluctant to embrace more autonomy, as it implies more responsibility. Nonetheless, many Western and European countries have adopted university autonomy coupled with accountability for enhancing efficiency and effectiveness in universities. Increasing evidence suggests that autonomy is likely to strengthen universities’ ability to improve graduates’ competencies, international attractiveness, research output, and employability provided that an effective quality control system is in place. Autonomy and larger investments in national agricultural research and education system – through transformative education and research contributions by these centres of higher learning to society – are important means to promote academic excellence, sustainable food systems and economic growth.

Strengthening The National Agricultural Education System



The agricultural sector is getting more complex due to globalization, climate change, entry of the corporate sector in the agriculture value chain, expanding demand for processed food, and the need for post-harvest technology

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Agriculture and its allied sectors are the backbone of our nation, employing over 50% of the workforce and contributing to around 20% of India's Gross Value Added (GVA) in 2020-21 (Agricultural Statistics at a Glance 2021). This vital sector not only ensures food security for our vast population but also plays a crucial role in rural development and economic growth.

However, the need for quality human resources in the agriculture sector is ever-increasing. With the growing demand for food and the challenges of climate change, attracting talented young people to agricultural education and research is critical for the sustainability of our food production system.

Early Agricultural Knowledge

While formal agricultural education in India emerged in the 19th century, knowledge of agricultural practices has a much longer and richer history in the country. As per the 2021 policy paper published by the National Academy of Agricultural Sciences (NAAS), agriculture was in the curriculum in the renowned ancient universities of Nalanda and Takshila. This early focus on the science and art of farming demonstrates the deep understanding and respect for agriculture that has been ingrained in Indian culture for centuries.

Formal Education Begins

It wasn't until 1877 that India saw the establishment of its first formal agricultural institute, the Agriculture College at Saidpeth in the erstwhile Madras State (now Chennai). This marked a significant shift towards a more systematized approach to agricultural education. The early 20th century witnessed further progress with the founding of the Imperial Agricultural Research Institute (IARI) at Pusa in 1905, followed by agricultural colleges in Kanpur, Nagpur, Lyallpur (now in Pakistan), Coimbatore, Pune, and Sabour.

Post-Independence Growth

By the time India gained independence in 1947, the country had 17 agriculture colleges, four veterinary colleges, and one agricultural engineering college. Recognizing the crucial role of agriculture in the nation's development, the Indian government soon undertook a series of reforms. The University Education Commission, formed under the leadership of Dr. S. Radhakrishnan in 1947, emphasized the importance of agricultural education and recommended the establishment of rural universities.

Modernization and Expansion

A significant milestone came in 1958 when the University Grants Commission (UGC) granted IARI the status of a Deemed to be University, enabling it to offer postgraduate education leading to MSc and Ph.D. degrees. This marked the beginning of a sustained effort to modernize and expand higher agricultural education in India. Today, the country boasts a vast network of agricultural

universities and colleges, catering to the needs of students across diverse regions and specializations.

Looking Ahead

The journey of agricultural education in India is a testament to the country's long-standing commitment to this vital sector. As we face the challenges of a growing population, climate change, and ensuring food security, robust and innovative agricultural education will remain crucial. By continually adapting and evolving, India's agricultural education system can empower future generations to cultivate a sustainable and thriving agricultural future.

Current Status Of Agricultural Education In India

From fertile fields to cutting-edge labs, India's vast agricultural education system, the National Agricultural Research and Education System (NARES), nourishes future generations of farmers, researchers, and innovators. Built on the Land Grant model, NARES integrates teaching, research, and extension through a robust network of 75 agricultural universities, over 800 Krishi Vigyan Kendras, and 69 All India Coordinated Research Projects. This unique system, the largest in the world, plays a pivotal role in ensuring food security, promoting sustainable practices, and driving agricultural progress in India. But this story is not static. Today, private institutions are joining the fold, and the fight for a greener future continues, fueled by cutting-edge research and the dedication of students, researchers, and farmers alike.

Beyond traditional agricultural universities, private institutions are also venturing into agricultural education, offering diverse courses like Horticulture, Forestry, Food Technology, Veterinary Sciences, and Home Science. State Agricultural Universities receive financial support from both state governments and ICAR's development fund, while Central Agricultural Universities are directly funded by ICAR. While ICAR oversees agricultural education, the Veterinary Council of India (VCI) and the Indian Council of Forestry Research and Education (ICFRE) regulate veterinary and forestry education, respectively. The universities fulfill a crucial triple mandate: research, education, and extension, with a strong focus on empowering farmers. These universities offer a vast array of programs, spanning 11 undergraduate disciplines, 96 postgraduate options, and 73 doctoral specializations (Soam et al., 2021).

Remarkable Expansion Of AUs

India's agricultural universities (AUs) have witnessed a remarkable expansion in student enrolment, with intake capacity skyrocketing from under 5,000 in 1960 to a staggering 64,485



India will need rich human capital of highly qualified, innovated, and well-trained agricultural scientists to meet these emerging challenges of the 21st century



today (Thammi-Raju et al., 2022). Across its expansive network of 350 constituent colleges, these AUs annually welcome a diverse cohort of 40,781 undergraduate students, over 13,798 Master's students, and 4,992 Ph.D. scholars. Furthermore, numerous private affiliated colleges further bolster these numbers, annually enrolling thousands more students eager to delve into the world of agriculture.

India's agricultural education landscape exhibits significant regional disparities in student intake. While states like Karnataka boast impressive undergraduate enrollments of 4300-5200, others like Punjab struggle with numbers below 900. Maharashtra, Uttar Pradesh, and Andhra Pradesh also demonstrate strong student interest, averaging between 3500-4300 and 3600-3500 entries, respectively (Thammi-Raju et al., 2022).

Unfortunately, agricultural education, despite its crucial role in national food security, faces a growing enrollment gap compared to other fields. This gap has widened from 1.0% in 2001-02 to a worrying 0.9% by 2018-19 (Thammi-Raju et al., 2022). This decline can be attributed to two key factors: limited availability of seats and colleges in agricultural and veterinary sciences and the rising costs associated with higher education.

Currently, the combined teaching, research, and extension workforce across Deemed Universities and Agricultural Universities (AUs) stands at around 16,000 scientific personnel. Notably, roughly 52% of students entering agricultural programs come from rural

backgrounds, highlighting a positive connection with the field's core audience (Thammi-Raju et al., 2020).

Need To Strengthen Agricultural Education

As globalization sweeps across the agricultural landscape, India's time-honoured education and extension systems face a critical turning point. The globalization of agriculture poses a significant challenge to India, necessitating a redefinition of both its agricultural education and extension systems. There is a need to strengthen and reorganize the agricultural education system with emphasizing on social sciences. Social scientists from relevant disciplines of agriculture such as rural sociology, agricultural economics, or communication studies has to be created to find solutions to the emerging problems.

Tamboli and Nene (2013) reported that the agricultural sector is getting more complex due to globalization, climate change, entry of the corporate sector in the agriculture value chain, expanding demand for processed food, and the need for post-harvest technology. India thus will need rich human capital of highly qualified, innovated, and well-trained agricultural scientists to meet these emerging challenges of the 21st century. Agricultural education must produce high-quality agricultural graduates equipped with problem solving and creative skills and the ability to think and improve the productivity of the agriculture sector (Verma 2014). Besides the technical and generic skills, our graduates need leadership and entrepreneurship skills to build leading teams, implement innovation, and respond to competitive environments.

National Education Policy 2020

India's New Education Policy (NEP) 2020 marks a paradigm shift in education, ditching content overload for deeper learning and adaptable skills in a dynamic global world. NEP prioritizes fostering critical thinking, creativity, and multidisciplinary mindsets through innovative pedagogy that is interactive, student-centered, and driven by inquiry and discovery. The NEP-2020 ushers the students into the world of collaborative projects, real-world problem-solving challenges, and discussions, sparking analysis and creativity. This transformed learning landscape promises graduates who are not just knowledgeable but well-equipped to think critically, solve problems, and thrive in ever-evolving fields.

Despite comprising 9% of universities, agricultural and allied fields languish with a mere 1% enrollment in India. Recognizing this critical gap, NEP-2020 boldly reimagines agricultural education.

NEP-2020 Highlights

- **Enhanced Capacity and Quality:** Strengthen both infrastructure and faculty expertise to produce better-skilled graduates and technicians equipped to tackle modern agricultural challenges.
- **Innovation-Driven Research:** Foster research that translates directly into practical solutions for farmers, aligning closely with market needs and technological advancements.

- **Market-Linked Extension:** Bridge the gap between research and practice by providing market-oriented extension services and disseminating knowledge and technology directly to farmers.

How NEP-2020 Empowers

- **Holistic Education:** Integration of general education into agricultural and veterinary programs, fostering well-rounded professionals with critical thinking and communication skills.
- **Rooted in Tradition and Innovation:** Equipping graduates to harness the power of local and traditional knowledge while embracing cutting-edge technologies.
- **Addressing Critical Challenges:** Preparing professionals to address critical issues like declining land productivity, climate change, and ensuring food security for a growing population.

Local Impact, Global Vision

Agricultural institutions are no longer isolated entities. NEP-2020 emphasizes their direct contribution to local communities, ensuring their expertise benefits the farmers and rural populations they serve.

National Education Policy envisions an education system that nurtures responsible global citizens rooted in India's rich values. This system strives to:

- **Instill pride in being Indian** by fostering a deep understanding and appreciation for our cultural heritage, traditions, and democratic principles.
- **Empower responsible citizens** by cultivating critical thinking, problem-solving skills, and a commitment to fulfilling fundamental duties and contributing to national progress.
- **Shape global leaders** by equipping individuals with the knowledge, skills, and values needed to champion human rights, sustainable development, and global well-being.

Implementation Strategy

Pursuant to the Central Government's decision, the ICAR formed a ten-member high-level committee to develop an implementation strategy to comply with the various provisions of NEP-2020. After detailed discussions and deliberations with various stakeholders, the committee prepared a roadmap with a timeline up to 2040 for implementing NEP in the agricultural education system. The committee presented its report in 2021.

The committee proposed transformation in institutional structure as a new form of multidisciplinary research-intensive higher education institutions, suitably revising curricula, modifying

the academic structure of degrees/diplomas/certificates, introducing the academic credit banking system, partnerships among HEIs, universities, industries, and other stakeholders while continuing the focus on teaching, research and extension system. The report also recommended sufficient funds flow to implement the NEP – 2020 by keeping a provision so that AUs are qualified to receive funds under the Rashtriya Uchchar Shiksha Abhiyan (RUSA) scheme operated by the Ministry of Education Government of India.

Key Recommendations And Roadmap

The key recommendations and Road Map prepared by the ICAR committee for the implementation of NEP-2020 in agricultural education are as follows:

Transforming Institutions:

- **Merging Institutions:** Create large multidisciplinary universities/HEI clusters by 2030, incorporating social sciences and basic sciences alongside agriculture.
- **Phasing Out Affiliation:** Gradually phase out affiliation of private colleges by 2035, bringing them under university governance.
- **Upgrading Deemed Universities:** Elevate ICAR Deemed Universities into research-intensive multidisciplinary institutions.

Restructuring Academics

- A flexible entry-exit system with certificates, diplomas, UG general/research degrees, and 1-2 year Master's is proposed. UG/PG residency requirements are relaxed for seamless entry/exit at any time.
- ICAR will form a Deans' committee to revamp UG curricula per NEP. Universities can adjust intake to maintain degree pass-out numbers despite certificate/diploma exits. The restructured four-year UG program will be implemented by 2025. Separate curriculum and admissions for one-year certificate and two-year diploma programs in Agriculture will be established.
 - Multidisciplinary PG programs with student-chosen majors and minors will be introduced. Ph.D. teaching assistantships will be promoted to address faculty shortages and provide student experience.
 - To boost GER in agricultural universities, ICAR proposes a 10% annual seat increase starting in 2021-22. AUs can utilize common entrance test scores from NTA for UG/PG/PhD admissions, with exams offered in regional languages.

Additionally, they'll comply with the Ministry of Education's Academic Bank of Credits (ABC) system.

Role Of ICAR In Regulation Of Agricultural Education

- ICAR, appointed as the Professional Standard Setting Body for agricultural education under NEP-2020, will drive a uniform academic structure nationwide through its PSSB, governing both public and private institutions.
- As a GEC member, ICAR contributes to shaping agricultural education regulations through the National Higher Education Regulatory Council (NHERC), set to become the first vertical of India's Higher Education Commission.
- NEP-2020 establishes the National Accreditation Council (NAC) as a meta-accreditor, delegating accreditation tasks to qualified institutions. NAC will select qualified institutions, including potentially ICAR's NAEAB, to serve as accredited bodies for agricultural education.
- To achieve "internationalization at home", a dedicated International Students Office will streamline welcoming and support services for incoming students, while ensuring our agricultural education maintains global quality standards.

- Research/teaching collaborations and faculty/student exchanges with high-quality foreign institutions will be facilitated, and relevant mutually beneficial MOUs with foreign countries will be signed.
- With the available alternative modes of quality education, we need to complement/enrich traditional and in-person modes of education.
- Existing platforms like SWAYAM and DIKSHA will be leveraged, and new e-courses in agriculture and allied sciences will be developed.
- The use of two-way video and audio interfaces is valuable for both pandemic-era online learning and reaching a global audience.

Issues And Constraints

One important aspect that needs to be taken into consideration is the understaffing of SAUs. As per Verma (2014), the sanctioned posts in SAUs have come down, while the SAUs have more than doubled from 1988 to 2012. The State Agricultural Universities (SAUs) are established through the enactment of Legislative Acts of the respective States. Through a Cabinet decision in 1973, the Department of Agricultural Research and Education was given the

responsibility of coordinating agricultural education in the country and it has been discharging this function through the Indian Council of Agricultural Research (ICAR). ICAR is equivalent to UGC in the matters of regulating agricultural education in the country. The major financial support to SAUs comes from the respective State Governments, which also exercise the functional and policy controls. The recruitment process of the SAUs is solely governed by the state governments and has often remained neglected. The faculty strength in most of the colleges is at 50 percent or below, and the variations are quite large. Falling faculty strength has a disastrous effect on the composition of cadre distribution. Such depletion of faculty strength without replenishment has further aggravated the situation due to the start of new UG and PG programs at various campuses.

Despite multiple revisions, the 2009 iteration of the ICAR Model Act, aimed at standardizing and empowering State Agricultural Universities (SAUs), has not gained widespread adoption. This persistent implementation gap has hampered SAU development. However, the advent of the New Education Policy-2020 (NEP-2020) presents a crucial opportunity. Empowering SAUs with the autonomy outlined in the Model Act is now more critical than ever for successfully realizing NEP-2020's vision in the agricultural education domain.

The NEP-2020 emphasizes raising educational investments; however, as per the policy paper published by NAAS in 2021, public expenditure on education in India has not come close to the recommended 6% of the GDP. The current public expenditure on education stands at around 4.43% of the GDP. Higher investment is critical for achieving a high-quality, equitable public education system.

Takeaways

Implementing any new agricultural education policy requires robust political commitment and a collaborative approach. State governments play a pivotal role, as all state agricultural universities fall under their purview. Without their full engagement, the ICAR committee report's recommendations may not be realized. Therefore, fostering effective coordination and partnerships between the central and state levels is paramount.

The Constitution places primary responsibility for agricultural higher education with individual states. However, higher education as a whole resides on the Concurrent List, fostering a shared space for policy implementation between the central and state governments. This shared jurisdiction necessitates adjustments in how we approach agricultural education policy. Elevating agriculture itself to the Concurrent List could provide it with the national attention it necessitates. Such a shift would constitute a significant step towards bolstering the nation's higher agricultural education system.



Initiatives of BAU for Strengthening Agricultural Education in Bihar

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Agricultural universities are fostering collaboration between mainstream scientific knowledge and indigenous agricultural practices

Agricultural education plays a crucial role in shaping the future of farming and rural development. As we navigate the complexities of the modern world, the need for the modernization of agricultural education becomes increasingly evident. Strengthening the agricultural education system is pivotal in addressing the evolving challenges and opportunities in the agricultural sector. A robust agricultural education system plays a crucial role in equipping aspiring farmers and agricultural professionals with the necessary skills and knowledge to navigate the complexities of modern agriculture.

One key aspect of enhancing the agricultural education system involves updating and aligning curricula with the latest advancements in agricultural science, technology, and sustainable practices. This ensures that students are well-prepared to adopt innovative approaches and contribute to the overall productivity and sustainability of the agricultural sector.

Bihar Agricultural University (BAU) has taken significant strides in aligning its educational offerings with contemporary needs by implementing value-added and skill development courses. This initiative is a commendable step towards producing graduates who are not only well-versed in traditional agricultural practices but also equipped with the necessary skills to navigate a rapidly evolving agricultural landscape. Furthermore, fostering collaboration between educational institutions, research organizations, and industry players can facilitate the transfer of practical knowledge and real-world experiences. Internship programs, industry partnerships, and exchange programs can bridge the gap between academia and the agricultural workforce, providing students with hands-on experience and exposure to diverse agricultural practices.

Bihar Agricultural University's decision to increase the gross enrolment ratio in all degree programs aligns well with the National Education Policy (NEP) of 2020, which emphasizes the need for expansion and inclusion in higher education. This proactive step by the university reflects a commitment to achieve the target of registering 3000 students by 2026-2027 academic session.

This move is in line with NEP 2020's emphasis on expanding educational opportunities to a broader spectrum of students, fostering inclusivity which will ensure producing a skilled workforce for the agricultural sector. This is particularly relevant given the sector's critical role in the economy and food security. With agriculture being a key driver of rural development, increasing seats in agricultural programs contributes directly to the objectives of NEP 2020, which seeks to address regional imbalances and promote education that caters to the needs of rural communities.

Investment In BAU

Investments in state-of-the-art infrastructure, laboratories, and research facilities are essential to facilitate cutting-edge research and development within the agricultural education system. This not only encourages scientific inquiry but also enables the development of practical solutions to address challenges such as climate change, resource management, and food security. Bihar Agricultural University is actively investing in the modernization of its laboratory facilities. This includes procuring cutting-edge equipment, updating technologies, and creating an environment conducive to advanced research in agriculture. The university has set the ambitious goal of obtaining accreditation from the National Accreditation Board for Testing and Calibration Laboratories (NABL). This accreditation ensures that the laboratory adheres to international standards of quality and competence, boosting the credibility of research conducted at the university.

The need for skilled labour in the agricultural industry is always growing, which highlights the necessity to draw gifted young people to agricultural education and research to ensure the sustainability of food production systems. The greatest talent must be drawn to agriculture education through a variety of tactics and procedures.

Raising Awareness Among Children

Most secondary and upper secondary school students view agriculture and related sciences as low-paying jobs that require travel to remote areas and are best suited for the working class. It is necessary to raise awareness among secondary and upper secondary school students about the professional and entrepreneurial prospects available to graduates in the agriculture field.

Bihar Agricultural University has adopted a residential girl's school named Kasturba Gandhi Balika Vidyalaya and is actively engaged in motivating these students towards agricultural education. The students form an integral part of universities in all academic and co-curricular activities such as sports, cultural, literary, convocation, kisan mela etc. Witnessing the recognitions and achievements of the scientists creates greater awareness

of the benefits of agriculture as a career option, in particular on the emerging opportunities for greater market engagement, innovations in the agriculture sector and farming as a business.

BAU regularly invites the students from nearby schools to showcase its technologies and world class laboratories. Various competitions such as poster making, drawing, cartooning, debate, election, quiz etc. on topics related to agriculture are being carried out throughout the year. Faculty members who are alumni of nearby schools keeps visiting their schools to deliver motivational lectures on topics related to agriculture and its importance in career shaping. In the dynamic world of education, one truth remains constant: not all students learn at the same pace.

Radio Revision Initiative

In order to enhance the academic performance of students a new initiative, the 'Radio Revision' program has been introduced by the university. The program is broadcasted on 90.8 FM Green Radio channel of the university. It focusses on the revision of the entire syllabus a day before the examination.

Students are able to receive the nutshell of complete course while sitting in their hostel rooms. These strategies have been instrumental in transforming their academic performance and enhance confidence in their abilities.

In alignment with NEP 2020, which emphasizes a holistic and multi-disciplinary approach to education, agricultural universities are fostering collaboration between mainstream scientific knowledge and indigenous agricultural practices. This approach acknowledges the rich diversity of traditional farming techniques, crop varieties, and sustainable agricultural methods that have been passed down through generations.

Bihar Agricultural University has increasingly recognized the significance of indigenous knowledge systems in the realm of agricultural practices. BAU has taken proactive initiatives to integrate traditional wisdom and local expertise into their academic and research programmes. This process fruits into development of new crop varieties, farm technologies and GI (Geographical Indication). Geographic Indication is a form of intellectual property that identifies a product as originating from a specific geographical location and possessing qualities, reputation, or characteristics unique to that place. Our university has achieved success in obtaining Geographic Indication (GI) with the assistance of a farmers' organization.

Bihar Agricultural University expresses its readiness to actively implement the objectives outlined in the National Education Policy (NEP). The institution is committed to aligning its educational framework and practices with the vision set forth by NEP to enhance the quality and relevance of agricultural education. However, the university underscores the importance of achieving uniformity across all agricultural universities to ensure cohesive and consistent implementation of NEP goals. This collaborative effort will contribute significantly to the advancement of agricultural education and research in the region.

Out of Box Solution

For Parali Burning, Ground Water Depletion in Punjab

Parali burning is in news nowadays as it is affecting the pollution scenario in the National Capital Region and in most of the responses, farmers are being blamed for this. Rice-Wheat cropping system is being blamed for it as well as declining ground water level. Nobody is talking about the compulsion of farmers to stick with the rice-wheat cropping system in view of its profitability and easy to go ahead because of mechanisation.

Some days back, the Supreme Court suggested that those farmers who burn parali should not be given the benefit of Minimum Support Price. The Supreme Court even suggested that rice area should be reduced in Punjab and Haryana in view of depleting ground water. However, none of these steps consider the problem of rice cultivation in Punjab and search for a sustainable solution. During my tenure as Vice Chancellor of Dr Rajendra Prasad Central Agricultural University, I conceptualized a model which became a famous SUKHET Model once the Hon'ble Prime Minister mentioned it in Man Ki Baat in August 2021. This model included collection of all household waste and dung from farmers at their doorstep, making vermicompost, selling it and getting an LPG cylinder refilled once in every month. Those who want to know more about it can google it. Similarly, I designed a ground water recharge cum drainage model for waterlogged areas of Bihar which was very successful in North Bihar plains in reducing extra water of monsoon and using it for recharge of aquifers where ground water level is declining. Based on my experience of Sukhet model and ground water recharge cum drainage structure, my proposal for solving twin problems of parali and declining water table is as follows.

Parali Management Strategy

As per data available, the amount of parali which has to be removed is about 185 lakh tonnes i.e., about 6 t/ha. The average area of rice per village is 250 ha calculated by dividing total number of villages and area of rice so total parali production per village is 1500 tonnes. The average cow dung production per village is 7 tonnes per day i.e., about 2500 t per annum counting cattle population of the state dividing it by number of villages. Now if we create a vermicomposting unit in each village to make vermicompost from stubble and cow dung, the problem of both parali and cow dung management will be solved. The harvesting of stubbles and its transport to a centralised place can be done by an agency appointed for this or ask farmers to do the same. This agency or farmers will harvest stubbles, chaff it and transport it to vermicompost centres.



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The implementation of the program can be entrusted to Panchayats who will be happy to implement it as about 2 Crores investment will come to each village

Executing The Project

For this operation, the agency or farmer can be paid @Rs 2000/- per tonne, i.e., about Rs 12000/- per ha. The total cost for 31 lakh ha will be Rs 3720 Crores and for a village it will be 29.76 lakhs say 30 lakhs. For dung which can be collected at farmers' doorstep, they can be paid @Rs 1/- per Kg.

Thus the input cost of vermicompost for a village will be 25 lakhs for cow dung and 30 lakh for Parali making total annual input cost of Rs 50 lakh per village. Thus each village will produce 2400 t of vermicompost (60% of input material) equivalent to 24 tonnes of Nitrogen, 19.2 tonnes of Phosphorus, and 19.2 tonnes of Potash (1% N, 0.8% P, 0.8% K), making it 96 kg N, 48 kg P and 48 kg K per ha cultivated area of village, which will meet up the nutrient requirement of one season besides big addition in organic carbon to soil which is a major problem for soil health.

The labour requirement as per earlier experience of Sukhet model will be 5 manpower for 250 t unit which means 35 manpower for 2000 t production (the white collar labour requirement for accounting etc can be one only) will be equivalent to annual expenditure of about Rs 63 lakhs. In addition, it will need about 120 lakhs in building infrastructure for composting. So with a capital expenditure of Rs 120 lakhs and revenue expenditure of about 113 lakhs, there will be compost production of 2400 t per annum in each village which with considering only revenue expenditure will cost Rs 4.71 per kg.

If the fertilizer subsidy is transferred to vermicompost, and vermicompost is sold to farmers at 33% subsidy, farmers will readily purchase it at @Rs 3.10 per kg. as it will help soil health besides being available at doorstep.

remaining revenue deficit of Rs 38.64 lakh (say 39 lakhs) per village i.e. about Rs 4875 Crores which can be met by an annual cess on vehicles running in NCR as well as construction activities. By putting cess of Rs 1000/- per vehicle on 2.5 Cr vehicles with varying slabs for different types of vehicles and about 2% cess on construction activities worth 1 trillion rupees, a revenue of about Rs 4500 Crores can be generated and rest will come up from fertilizer subsidy funds. The capital cost of Rs 15000 Crores (@1.2 Crores per village for 12500 villages) can be met from state government exchequer This will create huge employment opportunities for semi-skilled youth in village itself besides enhancing income of farmers which with sale of parali and cow dung will be in tune of more than 5000 Crores per annum. The implementation of the program can be entrusted to Panchayats who will be happy to implement it as about 2 Crores investment will come to each village.

Ground Water Recharge Strategy

For the declining groundwater problem, an out of box solution can be tried. Data revealed that Rice area is 31 lakh ha out of which about 27% area is canal irrigated and rest is tube

well irrigated. Similarly, wheat area is about 32 lakh ha. Thus, it can be safely assumed that the area under Rice- Wheat is about 31 lakh ha, out of which about 22.5 lakh ha is tube well irrigated (27% canal irrigated). Assuming 1000 mm as irrigation requirement for rice and 300 mm for wheat, the total water pumped for Rice-Wheat is approximately 29.25 lakh ha m (1 ha m = 10000 m³) i.e., 29.25x10⁹ m³ (29.25x10⁵ x 10⁴).

As per Government of India reports, annual ground water recharge is 18.94 BCM i.e. 18.94 x 10⁹ m³.

To keep ground water level safe from depleting, about 10.31 x 10⁹ m³ need to be additionally recharged to the aquifer every year. The limited information which could be collected about hydro geology of Punjab showed that there are two confined aquifers with one clay layer between them. The water needs to be recharged to these aquifers.

Checking data of the flood flows of Satluj downstream Bhakra and Ravi downstream Thein dam revealed that flows are 2000 cumec i.e., 70000 cusec in Satlaj and 267.5 cumec i.e., 9400 cusec in Ravi during normal monsoon season. Most of this water flows to Pakistan while as per Indus treaty, we have full right on these waters. If we just divert 400 cumec (20%) from Satluj and 150 cumec (56%) from Ravi during monsoon and divert it to recharge systems created all along river course, it will be 550 m³ per second, i.e., 1950000 m³ per hour which means 468 lakh cubic metre per day.

If the system runs for 100 days, i.e., monsoon period, it will recharge ground water aquifers 4.68 x 10⁹ m³ equivalent to 35.72% of requirement. However if we increase diversion from Sutlej to 50% i.e., 1000 cumec and for Ravi to 75% i.e., 200 cumec, the recharge amount will increase to 9.36 x 10⁹ m³ about 72% of our requirement. This diversion need not be done at one place but spread all along course of different tributaries of these two main rivers.

Thus, it will not affect flow at one place nor will it require a large amount of land at one place. The design developed by the author recharges about 5 ha m at a cost of 0.5 lakhs per ha m for each unit. Thus, to take care of this much amount of water, about 2 lakh units will be required at an investment of about Rs 5000 Crores.

Proactive Approach Needed

It is evident from above, that twin problems of parali burning and declining groundwater can be solved, if we take a proactive approach of dealing the problem head on instead of relying on approaches of diversifying cropping systems or charging electricity which need involvement of each farmer without any immediate tangible benefit. The panchayats can be involved in this whole effort which they will happily take up as each village will get an investment of about two Crores. The investment made will change the natural resource scenario and will go a long way in our efforts of conservation.

Market Intervention Through MSP

And

Market Making Of Agricultural Produce In India



Input subsidies like fertiliser seeds are critical to the availability of food on the table either through the public distribution system or through the open market

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The agricultural ecosystem has many stakeholders and a whole lot of schemes rolled out by the government that to total and aggregate them is a time-consuming task in itself. Few can boast of knowing the entire ecosystem - its Vishalta, the magnitude. The fact that we currently enjoy an ample supply of food is largely attributed to the government's initiatives and infrastructure, and it is essential to commend their efforts in this regard. While it is common knowledge that the Public Distribution System subsidizes nearly 90% of the sale cost, it is noteworthy that even the open market sales conducted by the Food Corporation of India (FCI) in the domestic market, particularly for wheat, incorporate subsidies. This includes the very stock that consumers purchase from retailers, wholesalers, or millers.

Geographic Disparities and Challenges

Commodity yields and prices undergo huge fluctuations in the market, mainly due to anomalies in the weather, climatic and geographical conditions, demand and supply mismatch, political situations, and many other variables. The farmers are never able to estimate the revenue from the sale of agricultural produce with certainty. Data patterns studied from Market to Market, Mandi to Mandi, and an analysis of all the trades on E- National Agricultural Markets tell us that the variances can be quite high. Market prices of some commodities have gone up beyond the minimum support price recently.

Prices between markets vary because we still have not achieved a one-nation one-agricultural market and trading between agriculture markets is still not unified. The reason for this is that agriculture is a state subject. Until a few years ago, the farmer had no option but to sell in the nearest mandi. However, in keeping with the times, commodities in States like Uttar Pradesh and Tamil Nadu can be bought by traders from different parts of the country.

Why MSP?

The concept of minimum support price and the program was launched way back in 1967 during the days of chronic food shortage and during the beginning of the green revolution era. It has gone from price control to price support and intervention.

The detailed analysis of the cost of agricultural produce leads me to conclude that in the face of such volatility, input subsidies like fertiliser seeds are critical to the availability of food on the table either through the public distribution system or through the open market. Therefore minimum support price or

administered pricing will be needed for times to come in both the developed and the developing world. This is similar to interest rate intervention and subvention by Central Banks all over the world. Even in the labour market, the government sets a minimum wage that employers have to give to employees. Therefore, in critical markets like agriculture, the importance of minimum support price cannot be overstated.

MSP has begun to be a benchmark price, since in many commodities the market prices are above the MSP today. The minimum support price itself is based on the cost of inputs computed by Commission for Agricultural Costs and Prices (CACP) and a profit margin of 50% is added to it which accounts for imputed labour cost as well as a saving for the farmers. It is important to note that the government reportedly buys almost 60% of the produce in the wheat market and 40% of the produce in the rice market and thus is the largest buyer of agriculture commodities in the country. India is not totally an agricultural country, even though you get periods of surplus. Thus MSP and market intervention are critical to ensure that firstly farm produce has ready liquidity. Secondly, it ensures that producers and consumers see stability in the prices. MSP also plays a very important role in food security and is the stepping stone to move from Food Security to Nutritional Security.

Doubling Farmers Income in 10 Years from 2014-15

The MoAFW has increased the MSP by 5.4 % p.a (CAGR; 9 years) for Paddy and 5.13 % p.a over the last 10 Years. In Jowar, it is even higher @ 8.47 % p.a. Farmer's income has doubled over the last 10 years. MSP, in addition to providing robust price benchmarking help, is a politically sensitive subject. It can also be seen that due to an increase in aspiration and demand, in some commodities like pulses, the market prices are higher than MSP. We are in a deficit as far as pulses like Tur and Moong are concerned and have to resort to imports from time to time. The following table is self-explanatory.

	2014-15	2023-24	P.A	2023-24	
Commodity	MSP	MSP	Inc in MSP	ENAM Modal Prices	MSP vs ENAM
	Rs.Per Qtl	Rs.Per Qtl		Rs.Per Qtl	
Paddy Common	1,360.00	2,183.00	6.05%	2,400.00	9.94%
Wheat	1,450.00	2,275.00	5.69%	2,000.00	-12.09%
Jowar	1,530.00	3,180.00	10.78%	5,400.00	69.81%
Tur(Arhar)	4,350.00	7,000.00	6.09%	9,200.00	31.43%
Masur	3,075.00	6,425.00	10.89%	5,600.00	-12.84%
Moong	4,600.00	8,558.00	8.60%	7,400.00	-13.53%
Urad	4,350.00	6,950.00	5.98%	6000	-13.67%
Chana	3,175.00	5,440.00	7.13%	5600	2.94%

Alternatives to MSP

When the prices are not remunerative enough to warrant a sale, the farmers today have some choices. Some of the avenues like pledge funding of stocks against warehouse receipts to Kisan credit cards that cover pre-harvest expenses ensure that the farmers have liquidity provided they use the facilities given to them. In addition to this, there are NBFCs that also lend to farmers. Most recently the government has created a regulator for warehouse storage called the Warehouse Development Regulatory Authority that regulates the construction and operations of Warehouses through agencies like NeRL and CCCRL. Such warehouses issue Electronic Warehouse Receipts that can be traded by delivery on electronic marketplaces like ENAM.

Use of ENWR receipts

Pledge finance against EnWR is estimated to be around Rs.4,000 Crores. All of the above ensures that the farmers do not have to necessarily sell when prices are not favourable; at the same time, they have liquidity. In addition to the above, I have during my stint as a committee member for enhanced use of ENWR espoused the cause of Market Making-MM. Market-making often improves price discovery as well as the depth of the markets. A Market Maker continuously provides two-way quotes on a commodity. This helps find a benchmarking price, and provides liquidity as the market maker takes positions both ways; he is a buyer and a seller. Incidentally, one of the entities that could effectively play the role of a market maker is the Food Corporation of India (FCI). In fact, FCI procures grains from the farmers at MSP and then either holds food grains for PDS, Food Security, and even does Open Market Sales. FCI also unloads such stock on commodity exchanges. All it

needs is formal recognition and Market Making regulations.

Finally, Farmers will be able to convert Agriculture to Industry only when they scale up Agricultural production and produce value-added products near the farm itself. This is today possible through Food Producer Organizations, like cooperatives and easy availability of grading and packing equipment. Thus, there must be a transition from MSP to MRP.

Crystal Ball Gazing into the Future

As we delve into the future, it is clear that India will see a convergence of Physical, Spot, ENAM, and Future Markets that will ensure perfect pricing over time while keeping the cost to the consumer reasonable. It is inevitable and will happen when regulators collaborate. The Agricultural Sector is seeing significant use of technology in many ways. We see the use of drones, satellite imagery, weather forecasts including micro weather, the internet of things, and sensors that transmit information that ensures big data. However, we are not an Agricultural Surplus country we are exporting and importing Agricultural products that include meeting shortages and for geo-political positions, grain diplomacy, and humanitarian aid. Thus, we are Internationally connected in Agricultural commodities.

In conclusion, while MSP has had a profound impact on the food on our table and crops at the farm, it is time when MSP purchases by the government must be for food security only. Food Rations-PDS could be converted into Credit via Direct Benefit Transfer into the account of the citizen. The food subsidy costs Rs.2 Lakh Crores a year. The rest should be taken over by Market Makers and Market Players in regular times with Government Agencies like FCI acting as Intervenors using MSP for intervention and price benchmarks.



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HIGHER AGRICULTURAL EDUCATION

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Futuristic education should be designed to meet the evolving needs of the agricultural sector, incorporating cutting-edge technologies, sustainable practices, and multidisciplinary approaches



India's agrarian landscape is evolving rapidly, where its higher education is going to play a pivotal role in driving future centric innovation, sustainability, and productivity. To usher in a new era of agricultural excellence, collaborative efforts across multiple relevant sectors are inevitable. It desires to pave path and put sound efforts for bringing together the expertise and resources that exists outside the walls of universities and formal education or knowledge dissemination hubs (R&D institutions, industries, farmers, students, government organizations, NGOs, region-specific traditional wisdom centres).

Proper realization and understandings towards proper denotations in this regard is emerging as a big need of hour. Figure 1(a) reflects certain feasible pathways to attain it by; navigating the futuristic options and prospects to nurture desired growth via various empowering options. Central focus remains focussed more towards adaptive curriculum development, entrepreneurship & innovation ecosystems, rural development, collaborative strategies, farming centric approaches, inclusivity, smarter connectivity, and adoption of next generation tools/technologies/intelligence.

Implementation of NEP-2020

The implementation of NEP-2020, is going to be the best response for all above arguments, where plethora of smart and demand driven action lines reflects the innovative conceptual ingredients.

- It very well includes 10 key prognoses as follows.
- Seamless exchange of knowledge, research findings, and technological advancements via collaborative research platforms (SAUs, Research Institutions, Industry Players),
- Accelerating the adoption of innovative agricultural technologies by facilitating robust technology transfer programs for narrowing the gap between cutting-edge research and practical applications on farms and farming interventions,

- Industry-academia partnerships to play a pivotal role via more intensified internship and training programs cutting across subject lines and offering a blended practical exposure on smart farming practices & technologies for students,
- Getting students well equipped with the skills and knowledge needed to address real-world challenges demand driven joint curriculum development with active collaborations,
- Fostering a culture of continuous learning and collaboration via regular industry-academia conclaves to ease potential challenges, opportunities, and solutions,
- Engaging farmers in agricultural education sphere via smart extension services and farmer's field schools to attain co-creation of knowledge and wisdom,
- Cheering students to explore agribusiness opportunities and contribute to the agricultural value chain via entrepreneurship development plans with adequate hands-on exposures,
- Establishing advisory committees comprising representatives from government organizations, academia, and industry to provide insights and recommendations for policy formulation and implementation at university level,
- Intensive initiatives towards skill development to get align academic programs with evolving needs and demands of farming sector, and
- Community outreach programs with active NGO partnering to fetch funds for research, women empowerment, and inclusive rural development at grass root level.

Digital Agriculture and Technology Integration

Futuristic education should be designed to meet the evolving needs of the agricultural sector, incorporating cutting-edge technologies, sustainable practices, and multidisciplinary approaches. It invites forging the partnerships with leading technology companies to integrate artificial intelligence, data analytics, precision farming, and other emerging technologies into the curriculum is emerging need of hour. Establishing smart farming labs in collaboration with industry leaders may deliver full advantages of such digitization, which may includes erecting interdisciplinary research centres, cross-sectoral collaborations with specialized universities (engineering, data science, environmental science, business etc) and more focused education on solving complex farming challenges via joint efforts with innovative solutions and cross-pollination of ideas. Partnerships with ecological organizations could accelerate climate-smart farming practices, conservation, and other agroecology initiatives.

International Academic Partnerships

Facilitating richer and deeper global agribusiness networking are going to offer students with a worldwide perspective on agricultural trade, supply chains, and market dynamics. Added efforts towards features like student exchanges, joint research projects, and tailored exposure to diverse agricultural practices are potential options. Cultivating a culture of innovation ecosystem is another big opportunity, where the incubators and accelerators will act as true pair of limbs to ensure and safeguard quality of end deliverables. It could be enormously enriched by establishing farming innovation hubs, incubators, and accelerators in collaboration with industry players and venture capitalists for developing mentorship programs to guide and inspire students in launching their own ventures.

Adaptive Curriculum Development

In the dynamic landscape of agriculture, where technological advancements and evolving global challenges constantly reshape the industry, the need for adaptive curriculum development in agricultural education has never been more crucial. An adaptive curriculum has specific elements (Fig. 1 b) which truly responds to the changing needs of the agricultural sector, integrating emerging technologies, sustainable practices, and interdisciplinary knowledge.

This approach ensures that graduates are not only well-prepared for current industry demands but are also equipped with the agility to navigate the uncertainties of the future. Forming university level mechanism on formal agile curriculum committees can help in a great way, where adequate representatives (academia, industry, research) will ensure dynamic and responsive curriculum to meet emerging demands on identified skill gaps or even adaptive curriculum. Extending university resources and expertise to rural communities through outreach programs, knowledge dissemination, and skill-building initiatives; will momentarily enrich the level of adaptive curriculum. At this stage an active collaboration with NGOs/development agencies has great potential to flourish integrated rural development via community engagement programs in curriculum.

Nurturing Entrepreneurship and Innovation Ecosystems

In the rapidly evolving landscape of agriculture, the cultivation of an entrepreneurship and innovation ecosystem within agricultural education institutions is pivotal. This ecosystem serves as a dynamic incubator for cultivating creativity, fostering problem-solving skills, and empowering students to become the architects of change within the agricultural sector. As the demand for sustainable practices, technological integration, and novel solutions intensifies, it becomes inevitable to properly understand its key mechanisms/components (Fig.1c)

Conclusive Inference

Indian higher agricultural education system requires a holistic approach that involves collaboration across various stakeholders, including R&D institutions, industries, farmers, students, government organizations, and NGOs. This comprehensive write-up reflects on few key improvement areas and potential collaborations.

Modernizing tutoring and training curriculum is becoming inevitable to attain specific purposes, which include the following.

- Developing HR capabilities,
- Producing and applying research to address needs of agricultural production, markets, and end users, and
- Smart transmissions of research and technology to small/marginalized stakeholders to expand food security and livelihoods.

Components/characteristics of an innovative agricultural education program pronounced herein may serve as food for thought for renovation and transformation of higher agricultural education systems in India under the active implementation phases of NEP-2020; with an ultimate goal of prosperous farms, farmers, and farming.

The described swings in educational spheres are certainly going to uplift the face of rural life, sustainability, livelihood and wholesome rural developments in India.

Agricultural educators and organizations must change their mindset and gears to prepare students to be successful in their professions and offer a lifetime of informed choices in global agriculture, food, fibre and natural resources systems. Futuristic HRD must focus more on developing engaged rural citizens, who have demand driven insights on adaptive challenges of rural India.

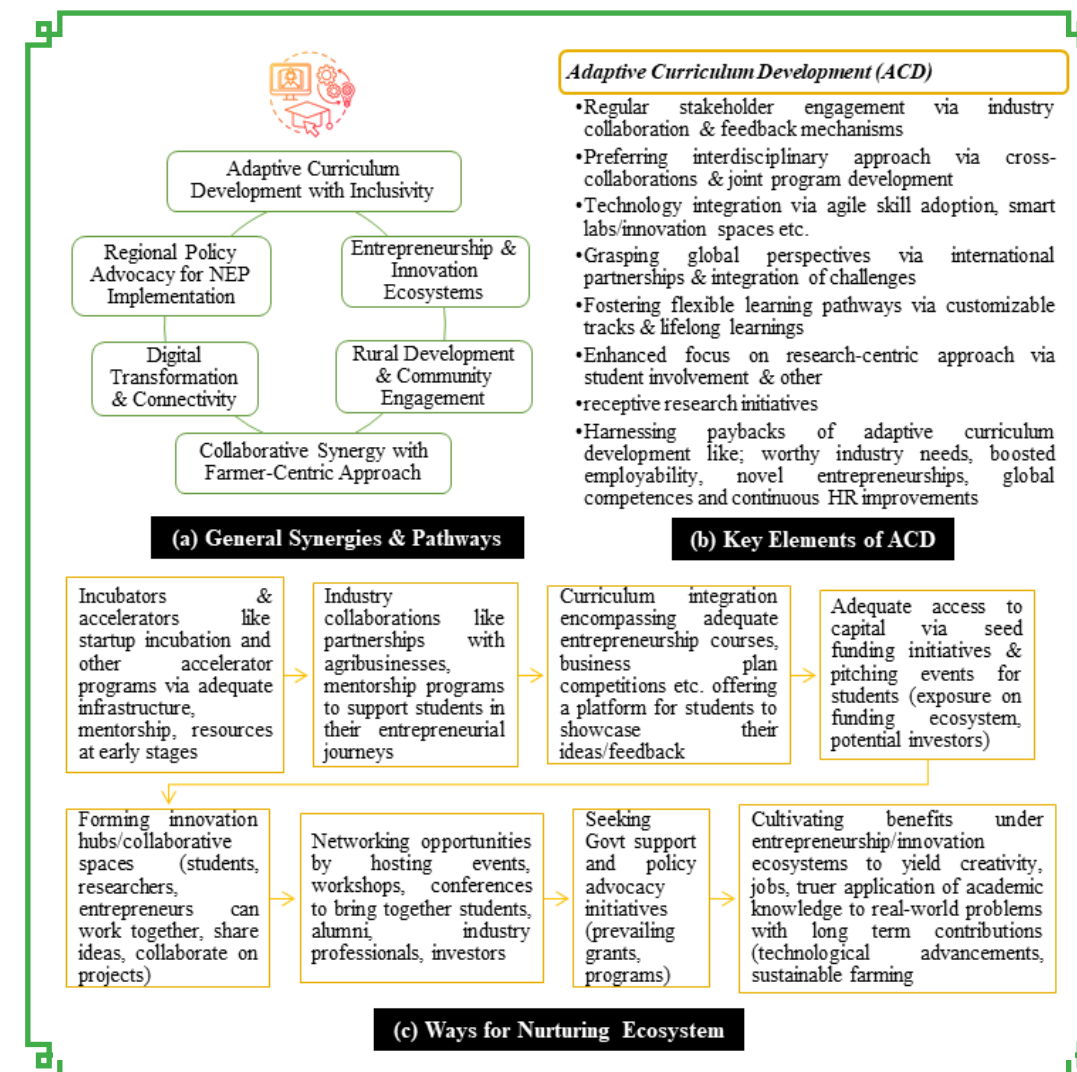


Fig.1 A Portrayal Depicting Potential Pathways for Developing Curriculum and HR for Inclusive Rural Development under NEP-2020 Umbrella

NATIONAL AGRICULTURAL EDUCATION SYSTEM

PREPARED FOR INDIA'S GROWTH STORY

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The agricultural sector is indispensable for the economic growth and progress of the nation. The agricultural education system plays a vital role in the progress of the agri-sector in terms of enhancing the quality of human resources and promoting research and innovations to address current and future challenges. Strengthening and streamlining the national agricultural education system is especially important in developing countries where most of the population is involved in farming. For farmers to produce high-quality crops and livestock while preserving the environment, and enhancing their standard of living, agricultural education and training are essential. Additionally, current India's status as the most populous country can be a boon as this has a great demographic advantage.

The focus must be on exploiting benefits from the available demographic dividend. There is a need to attract more youth and stakeholders into agriculture. India is going to be the provider of the largest workforce in the world. There is enormous potential for innovation and entrepreneurship or agribusiness in the agriculture sector.

In this regard, it is necessary to promote agricultural education in the country along with proper planning and coordination of systems to enhance the quality of education. Financial and policy support is required for agriculture higher education and especially to revamp the education sector in rural areas to realize the potential of rural students and youth. These attempts can also help to create awareness among rural people about sustainability, and economic developments.

Agricultural Education

Agricultural education encompasses a broad range of activities to equip individuals with the knowledge, information, skills, leadership qualities, and attitudes needed to pursue success in agriculture. Despite its importance, the agricultural education system confronts several obstacles such as resource limitations, inadequate curriculum and teaching materials, and limited access to training and new technologies, especially in rural and remote areas that may reduce its effectiveness. Insufficient investment in agriculture education results in inadequate facilities and teaching faculties and outdated or irrelevant curricula affecting the quality of agricultural education. Significant improvements have been observed in Indian agri-education system over the years.

Agricultural Education Division of the Indian Council of Agricultural Research along with deemed, central state agriculture universities have set visions of strengthening and developing higher agricultural education in India. It is focusing on human resources development for leadership roles in agricultural sciences and improving quality of agricultural education through innovative approaches in teaching, research, and outreach activities.

Key Strategies

India's geographical diversity with various agro-climatic zones, biodiversity, population with demographic dividend, rural areas, diverse cropping system, and allied sectors are some of the great advantages when we consider the global scenario to achieve rapid and sustainable development in agriculture production as

well as agricultural education. However, regular upgrading and improvisations in agri-education are the need of the hour to realize the full potential domestically as well as to attract international students to pursue their higher education in our Indian institutions. Several key strategies can be undertaken to enhance and fortify the national agricultural education system starting from curriculum enhancement, and infrastructure development to collaboration with agri-based as well as non-agriculture industries. Some of the key strategies are as follows.

Curriculum Enhancement: Regular updating of the curriculum is a must to align with current industry trends, technological advancements, and sustainable farming practices. Keeping in view the goals of NEP 2020, interdisciplinary courses must be included that cover aspects of skill development such as agribusiness, technology in agriculture, environmental sustainability, natural resources management, precision agriculture, climate-smart agriculture, and rural development.

Practical Training and Hands-on Experience: Establishing partnerships with agricultural enterprises, farms, and research institutions to provide students with practical exposure and hands-on experience. Setting up of demonstration farms or agricultural training centers where students can apply theoretical knowledge in real-world scenarios.

Technology Integration: Integration of modern technologies such as precision farming, drones, and IoT (Internet of Things), gene editing and other modern biotechnological tools into the curriculum to prepare students for the evolving agricultural landscape must be undertaken. Providing access to cutting-edge agricultural tools and software for research and learning purposes can enhance the quality of agri-education systems.

Research and Development: Encourage and support agricultural research within educational institutions to address local challenges, increase productivity, and promote sustainable farming practices. Foster collaboration between academia, research institutions, and industry for applied research projects.

Industry Collaboration: Establishing constant partnerships with agricultural businesses, NGOs, and government agencies to facilitate internships, guest lectures, and industry exposure for students. Involve industry experts in curriculum development to ensure relevance and practical applicability and solution to the present-day problems.

Infrastructure Development: Invest in state-of-the-art laboratories, research facilities, and technology infrastructure to support advanced agricultural research and experimentation. At the same time, the upgradation and maintenance of existing facilities must be done to create a conducive learning environment.

Entrepreneurship and Business Skills: Entrepreneurship and business management courses should be integrated into the curriculum to equip students with the skills needed to start and manage their own agricultural enterprises. Training programs on financial management, marketing, and business planning must be conducted regularly. ICAR initiatives such as Student READY

(Rural Entrepreneurship and Awareness Development Yojana) are in implication to provide rural entrepreneurship awareness, and practical experience as well as to impart analytical skills and the capability to work independently. Such programs must be promoted for adaptation on a large scale.

Extension Services: Extension services are already taking care of disseminating knowledge and technology from educational institutions to farmers in rural areas. Further strengthening of the extension system is required to cater to the needs of remote and marginalized areas of the country. Regular training of agricultural extension workers must be done to update them with information on recent trends and technologies as they act as intermediaries between researchers and farmers.

Continuous Professional Development: Providing opportunities for faculty and staff to engage in continuous professional development to stay updated on the latest advancements in agricultural sciences and education methodologies can help to enhance the agri-education standards.

Promote Inclusivity: It is very important to attract and support students from diverse backgrounds, including women and marginalized communities. Programs must be implemented to create an inclusive and supportive learning environment to encourage the participation of students from various socio-economic backgrounds.

Diverse Initiatives

Agriculture and educational institutes play a major role in creating awareness about agricultural education, carrying out agricultural research and innovations as well as extending the effective innovation to implement at the farmers' field. In other words, agriculture education, research, and extension are the three main mandates of agriculture institutes. As a reputed State Agriculture University (SAU), Chaudhary Charan Singh Haryana Agricultural University, Hisar has taken several initiatives on agriculture education, agri-startups, research and innovations such as 6-year B.Sc Agri Hons. to facilitate opportunities for rural students, agri-business management courses, ABIC (Agri Business Incubation Centre), innovations in the field of natural farming, organic farming, crop residue management, pest management alternatives, farm mechanizations have been recognized on the global stage. The university regularly arranges training for students, farmers, stakeholders, as well as its faculty members.

CCHAU also organizes national and international conferences as well as have made several international collaborations which are providing opportunities for Indian students and attracting international students to pursue their higher education in this institution. These initiatives can act as a road map and large-scale implementation of such approaches and attempts are need of the hour to strengthen the agriculture education system.

In a nutshell, by strategic planning and careful implementation, a nation can build a robust agricultural education system that not only meets the current needs of the sector but also prepares future generations for the challenges and opportunities in agriculture.



National Agricultural Education System for

ATMA NIRBHAR BHARAT

India has a comprehensive agricultural education system aimed at developing human resources and promoting research and innovation in the agricultural sector. Agricultural education in India started with the establishment of Imperial Agricultural Research Institute (IARI) in 1905 at Pusa in Bihar during the British rule. Later, in 1936, it was relocated to New Delhi and renamed as The Indian Agricultural Research Institute (IARI). The Indian Council of Agricultural Research (ICAR) was established in 1929, but its role expanded significantly after independence.

ICAR serves as the apex body for coordinating and guiding agricultural research and education in the country. The establishment of State Agricultural Universities (SAUs) began in the 1960s as a response to the Green Revolution and the to boost productivity.

The Krishi Vigyan Kendra(s) (KVKs) were established to bridge the gap between research and farmers. KVKs operate at the district level and focus on disseminating agricultural technologies and knowledge to farmers through training, demonstrations, and advisory services. Over the years, the agricultural education system in India has expanded to include a network of similar universities and research institutes offering undergraduate, postgraduate, and doctoral programs in multifarious agricultural disciplines.

Extension services are also provided to propagate research findings and innovative practices to farmers. The ICAR established an Accreditation Board in 1996 for a comprehensive process of accreditation of State Agricultural Universities (SAUs) to assure accountability and quality education. The agricultural education system continues to play a vital role in addressing challenges and contributing to the sustainable development of Indian agriculture.

Challenges

While India's agricultural education system has made significant strides, it faces several shortcomings and challenges; firstly, it is not integrally related to development programmes. Secondly, it tends to isolate graduates from the farming community, making them more of an administrative rather than a service group.

Earlier, agricultural education was sought and preferred by wards of farm families. Inclusivity within an educational curriculum and as a professional qualification, based on merit with limited number of seats in public sector is skewed in favour of the students from the urban middle class.

While an enhanced interest among the students from higher social strata towards agricultural education is a welcome trend, yet it simultaneously produces a need to protect the interests and prospects of the students from rural areas.

Some other problems include a near negligible scope for student's creativity in the present agriculture education system; static curriculum for decades rather than a dynamic intervention at frequent intervals; lack of soft skills among students as required for present job market and a fast paced industry; little emphasis on developing entrepreneurial skills, increasing student-teacher ratio, limited infrastructure including laboratories, research facilities, and libraries in some agricultural universities and colleges; shortage of qualified faculty; narrow industry linkages; insufficient research funding and low private sector participation.

Addressing These Challenges

Addressing these challenges requires concerted efforts from policymakers, educational institutions, industry stakeholders, and other relevant actors. Continuous investment, collaboration, and innovation are essential to strengthen the Indian agricultural education system to ensure an effective addressal of evolving needs of the agriculture sector. Some of the strategies are mentioned below:

Regular Curriculum Review and Update

ICAR being the custodian of agriculture research and education, conducts regular reviews of the curriculum to ensure that it aligns with current agricultural practices, technological advancements, and emerging challenges.

National Education Policy (NEP) 2020 also highlights the need to design of agricultural curriculum to shift towards professionalization including sharpening use of local and traditional knowledge, emerging technologies and integrates the modules for climate-smart agriculture, sustainable practices, and precision farming techniques. To address this, ICAR constitutes Deans' Committees for periodical review and revision of course curricula at both undergraduate and postgraduate levels.

Interdisciplinary Approach

Further, the proposed NEP 2020 aims to promote an interdisciplinary approach to address complex challenges, integrating fields such as data science, biotechnology, and



The creation of globally competitive infrastructure in agricultural universities will certainly help producing skilled graduates to meet rapid demands of a growing world

environmental science. It fosters collaboration between agricultural and non-agricultural disciplines to provide holistic solutions.

Research and Innovation

Encourage and support research initiatives that address current challenges, including climate change, resource scarcity and market dynamics. Establish research incubators within educational institutions to foster innovation and entrepreneurship. Provide access to ag-tech platforms, data analytics and farm management software.

Professional Development

Facilitate exchange programs, collaborative research, and partnerships with international agricultural institutions to expose students and faculty to best global practices. Provide opportunities for faculty members to engage in continuous professional development to stay updated on the latest research, technologies, and teaching methodologies.

Skill and Entrepreneurship Development

Introduce skill development programs to equip students with practical skills such as farm management, agribusiness, and



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entrepreneurship. Provide hands-on training and exposure to the latest agricultural technologies and machinery. Create, nurture, and sustain enabling ecosystem for entrepreneurship development, to make graduates more employable. Involve students in extension activities, enabling them to interact with farmers and gain practical insights.

Industry Collaboration

Strengthen partnerships with the private sector to incorporate industry-relevant practices into the curriculum. Facilitate internships, on-the-job training, and joint research projects with agricultural industries.

Adaptation to Regional Needs

Tailor educational programs to address the specific needs and challenges of different regions, considering variations in climate, soil types and cropping patterns. Involve local farmers and experts in curriculum development to ensure regional relevance.

Inclusive Education

Addressing gender disparities and promoting diversity. Develop programs that cater to the needs of small-scale and marginalized farmers.

Monitoring and Evaluation

Establish mechanisms for continuous assessment of educational programs for their contemporary effectiveness. Seek feedback from stakeholders, including students, faculty, industry partners and farmers to make necessary improvements. Regular feedback loops and a dynamic, responsive approach are crucial to adapting agricultural education to the evolving needs of the sector.

Some of the recent initiatives aim at improving and enhancing agricultural education and addressing the above-mentioned issues. NEP 2020 has also given key recommendations on Agricultural Higher Education Curriculum.

It highlights the need to revive agricultural education with allied disciplines by rewarding innovative research and market-based extension linked to technology & practice, offer doctoral and master's programs in emerging core technology areas integrating other promising technologies, such as machine learning, artificial intelligence, virtual and augmented learning, targeted training in 'low-expertise' tasks for supporting the Artificial Intelligence value chain, increase impetus on grants for independent innovation and research, stress on 'holistic and multidisciplinary education'.

The students would be given the flexibility to choose multidisciplinary subjects with 'multiple exit options' and appropriate 'certification' during the course tenure, credit bank of academic progress to keep track of the credits earned, strengthening of Digital Infrastructure across HEIs to include e-content, digital library etc. to meet the learning needs of students, increase access, equity and inclusion of students through online education and Open Distance Learning (ODL), focus on setting-up incubation centres and greater industry-academia linkages.

National Agricultural Higher Education Project (NAHEP)

The National Agricultural Higher Education Project (NAHEP), launched with the funding support of the World Bank and implemented by Agricultural Education Division of ICAR, aimed to strengthen agricultural education in India. Under its different components, it focused on improving infrastructure, faculty development, and overall educational quality in agricultural universities. NAHEP focussed on enhancing the educational relevance and quality through Institutional Development Plan (IDP), which was started in 22 different SAUs. The IDP was linked to performance and quality enhancement. These SAUs have become a model for guiding the ICAR to introduce reforms in other agricultural universities.

Institutional Initiatives

In this pursuit, the efforts of Dr YS Parmar University of Horticulture and Forestry, Solan (YSPUHF) under IDP led to enhanced institutional and system management effectiveness

through student and faculty development. Faculty development activities included global exposure through faculty exchange programmes, establishing linkages and tie-up with foreign universities.

A total of 81 faculty members and 147 students were provided overseas training in different countries like Australia, Germany, South Korea, Israel, France, Canada, USA, Philippines, Indonesia, Thailand, Nepal, etc, wherein the mentors from overseas institutes/universities have generously appreciated the visiting students and faculty. Different vocational courses were undertaken.

Instructional farms were established/upgraded for the better exposure of UG students. Smart classrooms, virtual classrooms and language lab were also established for quality enhancement of teaching infrastructure. YSPUHF also initiated efforts towards establishing and leveraging alumni networks both nationally and internationally through establishment of Alumni Engagement Centre. Alumni network is being involved in mobilizing resources, forging linkages, encouraging entrepreneurship and student placements. There was improvement in learning outcomes, employability, and entrepreneurship of students.

Fostering Collaborations

The YSPUHF has been successful in fostering collaborations with entrepreneurs/industries for preparing students for the job market. The students are being exposed to real world challenges under Experiential Learning Programs and industrial placements. Such partnerships are instrumental in creating a bridge between the academic and business worlds, benefiting both sectors. Frequent interactions/sessions are being organised with progressive growers, industry experts and entrepreneurs to promote entrepreneurship.

The university has been handholding Farmer Producer Organisations/Companies (FPOs/FPCs) and students are also being involved in technology upscaling through their involvement in the production process and also giving them exposure to start-up environment. YSPUHF is also involved in developing curriculum for Sustainable Food Systems starting from the budding stage (school level) to UP/PG level and developed certificate courses on Natural Farming and Agri-Entrepreneurship. The YSPUHF has also been organising various programs for school level children to attract young minds in agriculture. It is also giving major emphasis on integration of co-scholastic activities, personality development programmes and emotional well-being in the regular curriculum.

An upsurge in agriculture education ecosystem in the country has been yielding many benefits. The creation of globally competitive infrastructure in agricultural universities will certainly help producing skilled graduates to meet rapid demands of a growing world thereby increasing self-sustainability, informed decision-making, economic sustainability, interdisciplinary career opportunities, natural resources awareness and conscious food appreciation. The focus thus, requires speeding the momentum to sustain visible initiatives of the current agriculture education system in a global context.



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“**SKUAST-K has demonstrated the impact of changing SAU’s engagement from a regional player to an internationally engaged institution establishing strong linkages with globally accredited academic and research institutions**”



ABOUT THE AUTHOR

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Interventions & Initiatives

For Strengthening **Our Agriculture Education Structure**

India’s National and State Agricultural education, research, and outreach system has demonstrated substantial potential to help India emerge as a resilient agricultural economy. However, the challenges, priorities and opportunities for Indian Agriculture are different and multipronged. Present global economic order is far more competitive and emerging economies like India need to be much more versatile to stay relevant in global order.

India’s Indian National Agricultural Research & Education System

India’s Indian National Agricultural Research & Education System (NARES) is one of the largest in the world and has demonstrated its strength in creating a competent human resource as well as creating products and services that have shaped country’s phenomenal growth in agriculture. With India aiming to be the Knowledge Superpower, and Shrestha Bharat, there is a need for transformative system of education that seeks to create innovators, creators, nation builders, leaders and change makers.

It is with this pursuit that India brought a new education policy (NEP-2020) with an aim to help India take a quantum lead in the next century through a highly competitive and flexible science education system that will be driven by innovation, discovery and knowledge and has a visible impact in discovery landscape of the world. The policy aims at creating a globally competitive system of education driven by innovation, discovery and technology development that will help India not only improve its human resource output but also capture the global technology and services market.

In order to overcome the structural and functional bottlenecks that have precluded the progress of NARES, there is a need for an education system that is transformative and innovative across all the levers: from curricula and pedagogy to the use of technology to partnerships, governance, recruitment and funding, as well as embracing new frontiers such as AI, ML, Big Data analysis, Biotechnology, nanotechnology, Sensors, Communication revolutions etc.

Holistic Education System

India has developed one of the finest models based on the land grant pattern of the USA. SKUAST-K is the best demonstration of such a university research and education system that has helped the state in fulfilling its commitments to human resource development as well as food and nutritional security imperatives.

SKUAST-K has been a proud partner in the national initiative of developing a holistic education system that is led by innovation, discovery, technology development and entrepreneurship by creating a learning environment that is inclusive, stimulating with a wide range of learning experiences.

Towards Reformed Agricultural Education: SKUAST-K Initiatives As Stepping Stones

SKUAST-Kashmir’s institutional progress is driven by disruptive thinking in all spheres of activity. The policy and action framework developed by SKUAST-K has been recognised at the national level as a model to emulate. The model is perfectly aligned to NEP-2020 as well as rallies over the futuristic educational model that is flexible,

tech-driven and embraces new frontiers of science & technology as drivers of future growth in agriculture. SKUAST-K demonstrated the flexibility and institutional will to develop a working model that was driven by the mantra of creating a globally competitive and socially responsible human resource that embraces the spirit of creativity, innovation, discovery and leadership and contribute towards the broader national goal of becoming a Knowledge Superpower. The model of agricultural education of SKUAST-K has four major levers viz.,

- Excellent education through outstanding teaching and learning driven by pedagogical innovation, flexibility and choice for students,
- Impactful Research that drives innovation and discovery for science-based solutions,
- Leadership and management skills to ideate, prioritise, strategize, and execute educational and research imperatives of state, and
- Building Professional Practice and competence.

Developing the New Normals in Agri. Education

SKUAST-K's broader shift in mindset and action was based on the premise that to be impactful, higher education must come out of classrooms and do away with the structural bottlenecks. The institutions need to move away from existing systems towards adopting new normals such as Creativity, Innovation, Discovery, and Technology.

Some of the major Foundations of SKUAST-K Model are as follows.

- A connected network of domains and stakeholders: Our model has based on the premise that education is not a stand-alone institution and cannot deliver unless it is connected by domains as well as players. The connections increase the outcome by making the system responsive. Our model seeks to integrate education, research, industry, and stakeholders such as farmers, consumers, and governments to deliver solutions.
- Flexibility of curriculum: Our model has an inbuilt curated semester system comprising mainstream academic courses, as well as other courses for upskilling and reskilling. We have created a broad-based and diverse cafeteria of courses for students to choose from. with complete freedom to choose from such cafeteria courses and accounted them through another innovative toolkit viz., NextGen© transcript.
- Innovation and Discovery driven education: SKUAST-K poised itself to be the first innovation-led farm university in India with academic and research programmes aligned towards translational research to develop technology-based solutions to farm sector problems. We have demonstrated that creating an enabling ecosystem led

by institutional policy can lead to significant changes. Beginning 2019, we have so far got 15 patents and filed more than 40 applications.

- Policy initiatives for entrepreneurship and Startups: SKUAST-K has the privilege of being the first SAU in India to draft policy frameworks such as Startup Policy and Business Incubation Policy that created an enabling ecosystem for promoting entrepreneurship and Startups at both faculty and student level. Under the policies we created institutional mechanisms for benefit sharing and IP holding rights, resulting in multiple faculty student led companies being established. SKUAST-K has already demonstrated the impact of such institutional initiatives through a dedicated SKIEE Center aimed at promoting innovation, incubation, and entrepreneurship.
- Assessment Reforms: SKUAST-K has made far-reaching changes in the assessment system with a focus on fostering the development of cognitive faculties in students and helping them build analytical skills, critical thinking as well as problem-solving skills that will create future change-makers. We are embarking on an ambitious system of paperless examination across all faculties.
- Increasing global visibility: SKUAST-K has demonstrated the impact of changing SAU's engagement from a regional player to an internationally engaged institution establishing strong linkages with globally accredited academic and research institutions. SAU's need to work in both directions viz., swarming global institutions through student and faculty ambassadors as well as attract foreign students by promoting country's ambience, values and multicultural diversity.
- Greater Investment for improved Institutional capacity including state of art Smart classrooms, Tech-enabled video conferencing systems, a state of art Discovery and Innovation Centre that will serve as a hub of innovative pursuits for developing technology-based solutions. SAU's need to invest in building infrastructure, facilities, and options in technology integration for building stronger institutions that offer greater opportunities for growth.
- Building impactful Universities through greater autonomy Future universities will progress through disruptive thinking that needs greater autonomy. The institutions of eminence in India and abroad demonstrated strong performance indicators in teaching, research, student performance and research and innovation output. The universities as such should be allowed to leverage greater freedom and autonomy in all domains of their functioning to help them grow and fulfil their mandated commitments in the national development.



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Interventions To Strengthen *Agriculture Education*

In the contemporary landscape of education, the paradigm shift from traditional knowledge-centric models to a holistic approach encompassing both knowledge and skills has become increasingly pronounced. Higher education, once predominantly focused on imparting theoretical knowledge, is now evolving to meet the demands of a rapidly changing world. This transformation is driven by the imperative to equip students with the practical skills necessary to serve not only the industry but also the broader needs of society.

The traditional model of education has long been criticized for its emphasis on rote learning and theoretical knowledge, often leaving graduates ill-prepared for the practical challenges of the professional world. Recognizing this gap, educational institutions are now integrating skill development seamlessly into their curricula. This shift acknowledges the symbiotic relationship between knowledge and skills, emphasizing that a well-rounded education is crucial for success in today's competitive job market. NEP 2020 aptly emphasises on these issues.

Stronger Ties With Industries

As industries evolve and adopt cutting-edge technologies, the demand for a workforce equipped with relevant skills has surged. Higher education institutions are responding by forging stronger ties with industries to understand their needs. Collaborations with businesses and industrial experts enable educators to tailor curricula that not only instil theoretical knowledge but also cultivate the practical skills demanded by employers. This proactive approach ensures that graduates are not only academically proficient but also industry-ready.

The advent of technology has transformed the way education is delivered. Virtual classrooms, online resources, and interactive learning platforms have become integral components of higher education. These technological advancements facilitate not only the dissemination of knowledge but also the development of technical and digital skills. Students are now exposed to real-world applications of their learning, ensuring a seamless transition from academia to the professional realm.

Hi-Tech Evolution Of Agriculture Education

The agriculture sector, long synonymous with traditional practices, is experiencing a profound transformation as it embraces cutting-edge technologies. The integration of artificial intelligence (AI), data science, blockchain, traceability, precision agriculture, hydroponics, and aeroponics signifies a paradigm shift towards a hi-tech era in agriculture. Recognizing the need for

multidisciplinary skills, education is evolving to prepare the next generation of farmers and agribusiness professionals.

Artificial Intelligence and Data Science

AI and data science have emerged as game-changers in agriculture. These technologies enable farmers to analyse vast datasets, optimize crop management, and make data-driven decisions. AI-powered tools predict weather patterns, identify crop diseases, and optimize irrigation schedules, contributing to increased efficiency and sustainability. Integrating AI and data science into agricultural education equips students with the skills needed to navigate the complexities of modern farming. According to a report by MarketsandMarkets, the AI in agriculture market is projected to reach USD 4.0 billion by 2026, growing at a CAGR of 25.5%.

Blockchain and Traceability

Blockchain technology ensures transparency and traceability in the agricultural supply chain. From seed to table, blockchain enables the recording of every transaction, guaranteeing authenticity and quality. Incorporating courses on blockchain and traceability in agricultural education ensures that future professionals understand and can leverage these technologies to enhance accountability and build trust in the industry. The global blockchain in agriculture and food supply chain market is expected to reach USD 429 million by 2025, according to a report by MarketsandMarkets.

Precision Agriculture

Precision agriculture involves the use of GPS technology, sensors, and data analytics to optimize field-level management. This results in enhanced crop yields, reduced resource wastage, and improved environmental sustainability. Education in precision agriculture equips students with the skills to implement precision farming techniques, making them stewards of sustainable and efficient agricultural practices. The precision agriculture market is estimated to reach USD 13.6 billion by 2025, growing at a CAGR of 13.0%, as reported by Grand View Research.

Hydroponics and Aeroponics

Soilless cultivation methods, such as hydroponics and aeroponics, are revolutionizing crop production. These technologies minimize water usage, eliminate soil-related issues, and allow for year-round cultivation. Integrating courses on hydroponics and aeroponics into agricultural education provides students with hands-on experience in alternative cultivation methods, ensuring adaptability to future farming practices. The global hydroponics market is projected to reach USD 17.9 billion by 2026, according to a report by Research Nester.

Inclusion In Educational Curricula And Impact On Students

The incorporation of these technologies into educational curricula is essential to prepare students for the evolving landscape of agriculture. Practical experience, through internships and hands-on projects, is equally crucial. Educational institutions must collaborate with industry experts and agricultural enterprises to ensure that the coursework remains relevant and aligned with the demands of the hi-tech agricultural sector.

Enhanced Employability

The integration of skills into higher education translates to increased employability for graduates. Employers are increasingly seeking candidates who possess a combination of theoretical knowledge and practical skills. Graduates who have experienced hands-on learning, internships, and industry exposure during their academic journey are better positioned to contribute meaningfully from day one on the job.

Entrepreneurial Mindset

Beyond serving the needs of the job market, the evolving higher education model is nurturing an entrepreneurial mindset among students. Emphasizing creativity, critical thinking, and problem-solving skills, educational institutions are shaping graduates who can not only adapt to change but also drive innovation. This entrepreneurial spirit is essential for addressing the complex challenges faced by society today.

Remarkable Transformation

The contemporary higher education landscape is undergoing a remarkable transformation, shifting from being a mere purveyor of knowledge to a dynamic ecosystem that integrates theoretical learning with practical skills. This evolution is a response to the demands of both industry and society for a workforce that is not only knowledgeable but also adept at applying that knowledge in real-world scenarios. As we navigate the future, the continued synergy between education, industry, and societal needs will be pivotal in preparing the next generation for success in an ever-changing world.

As the agriculture sector embraces a hi-tech future, education must play a pivotal role in shaping the skillset of the next generation of agricultural professionals. AI, data science, blockchain, precision agriculture, hydroponics, and aeroponics are not just buzzwords but integral components of the evergreen revolution. By integrating these technologies into educational curricula, we empower students to become pioneers in sustainable and technologically advanced farming practices, ensuring a prosperous and resilient agricultural future.

“The continued synergy between education, industry, and societal needs will be pivotal in preparing the next generation for success in an ever-changing world”

ABOUT THE AUTHOR

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Agricultural Trends Shaping 2024 and Beyond

Amidst the global imperative of ensuring food security, the future of agriculture is undergoing significant changes to meet the escalating demand for sustenance. Fueled by extensive research, investment, and innovation within the fresh produce supply chain, five key trends – reducing waste through circular economy practices, embracing data-driven decision-making, enhancing supply chain transparency, adopting sustainable and organic farming practices, and improving cold chain and road infrastructure – are poised to shape the sector in the coming decades. Here's a closer look at the meaning of these trends, what's propelling them, and their potential impact on the future of fresh produce to meet surging demands.

Circular Economy and Waste Management

One of the primary challenges facing agriculture, globally, and perhaps more so in India has been the issue of waste management. In recent years, there has been a growing emphasis on reducing agricultural waste and promoting circular economy practices in farming. Circular economy principles prioritize the efficient use of resources, minimizing waste and recycling materials to create a closed-loop system.

Farmers are increasingly adopting techniques such as composting, where agricultural waste is converted into nutrient-rich compost to enhance soil fertility. Additionally, the use of crop residues for bioenergy production is gaining traction, contributing to both waste reduction and clean energy generation.

Furthermore, circular economy practices extend beyond the farm gates. Initiatives are being undertaken to create networks where farmers can exchange by-products and collaborate on waste management strategies. This not only reduces the environmental impact of farming activities but also creates economic opportunities within the agricultural community and could prove to be defining for the times to come.

Data-Driven Decision Making

In the Uber-technology era that we have come to inhabit, modern agricultural practices too are embracing new innovations to usher in a more resilient and tech-savvy era of farming. Data-driven decision-making has become a cornerstone in this transformative shift. The adoption of data analytics and artificial intelligence (AI) is witnessing a surge, enabling farmers to make informed decisions for better productivity and resource optimization. Predictive modeling is being utilized for crop yield estimation, disease detection, and precision farming.

By leveraging satellite imagery, weather data, and soil sensors

farmers can gather real-time information about their fields. AI algorithms analyze this data to provide insights into optimal planting times, irrigation schedules, and the use of fertilizers. This not only has the potential to enhance productivity but can also minimize resource wastage.

Several countries, including India, have been exploring and adopting drone technology for monitoring crops and livestock. Drones are proving useful in not only providing a bird's-eye view of the farm but also other valuable data, including crop health, pest detection, and precision agriculture. The technology can aid in early detection of crop diseases, and thereby enable timely intervention, reducing the need for excessive pesticide use. Drones are poised to be instrumental in shaping the future of agriculture, serving as a crucial tool for stakeholders to empower farmers. Addressing factors like regulations, infrastructure, and awareness will be essential in facilitating farmer adoption of these transformative technologies.

Supply Chain Transparency:

In an age where consumers are increasingly conscious of the origin and quality of their food, supply chain transparency will continue to be a critical aspect of agriculture. Establishing consumer trust necessitates furnishing verifiable information concerning the origin and journey of food products. For instance, a transparent supply chain that details the precise locations of where produce is sourced, the methods of cultivation employed, and the transportation process is likely to instill confidence in consumers. When shoppers can trace the path of their food, from farm to table, it will only enhance transparency but also foster a sense of reliability in the products they choose.

Globally, blockchain technology is being employed to create transparent and traceable supply chains. Each stage of the production process, from planting to harvesting and distribution, is recorded on a blockchain, ensuring that consumers can access accurate information about the food they consume. This not only fosters trust but also helps in identifying and addressing any issues in the supply chain quickly. Additionally, innovative solutions in the market are leveraging blockchain for last-mile delivery, connecting consumers directly to farmers through a network of resellers. This approach enhances transparency and reliability in the final stage of the supply chain, ensuring the timely delivery of fresh and chemical-free produce of items such as fruits, vegetables, and dairy to consumers' doorsteps.

Moreover, certification systems for organic and sustainable



When shoppers can trace the path of their food, from farm to table, it will enhance transparency and foster a sense of reliability in the products they choose

practices are gaining prominence. Farmers adhering to environmentally friendly and socially responsible methods can showcase their certifications, giving consumers confidence in the sustainability of their food choices.

Sustainable and Organic Farming Practices

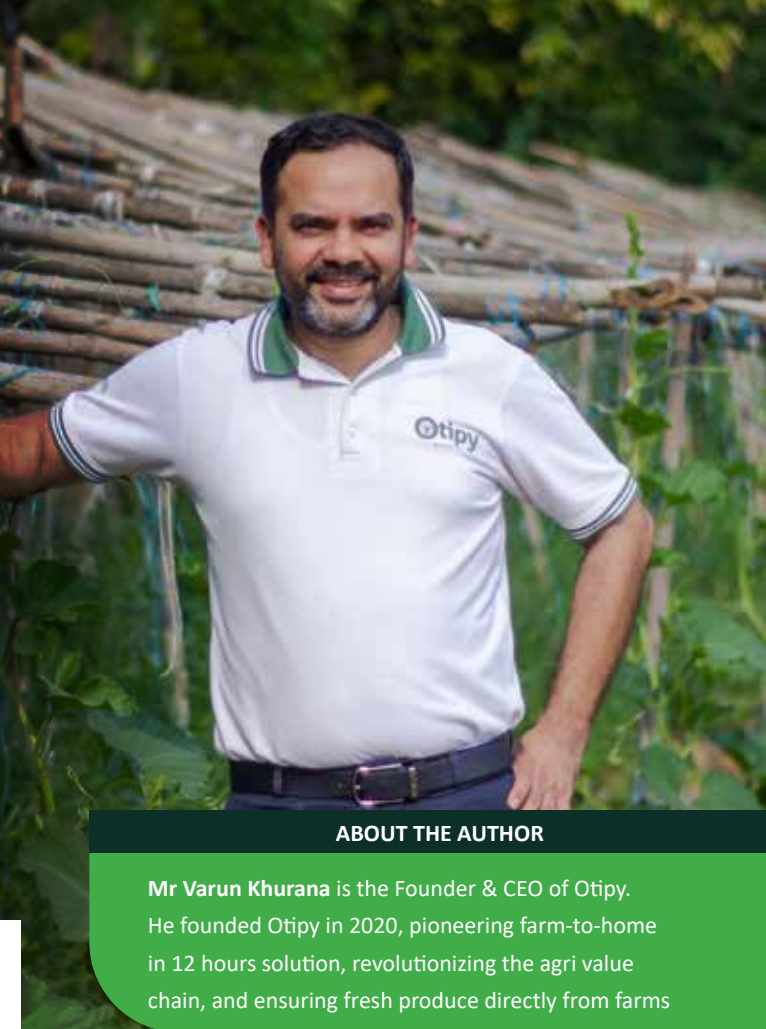
Sustainability will be at the forefront of agricultural practices going forward. Farmers across the world are embracing sustainable and organic farming practices to ensure long-term environmental and economic viability. Water-saving technologies, such as drip irrigation and rainwater harvesting, are being implemented to optimize water usage, a critical consideration in a country like India where water resources are often scarce.

Regenerative farming practices are also gaining momentum, focusing on rebuilding soil health and fertility. Cover cropping, crop rotation, and minimal tillage are integral components of regenerative agriculture, promoting biodiversity and reducing soil erosion. These practices not only enhance the resilience of the land but also contribute to mitigating climate change by sequestering carbon in the soil.

Government initiatives and educational campaigns will help farmers to shift towards organic farming, reducing dependency on chemical inputs. There is growing recognition that organic farming will not only produce healthier and more nutritious food but will also foster biodiversity and support ecosystem services, all of which are crucial for future-proofing the planet.

Improved Cold Chain and Road Infrastructure

The post-harvest phase of agriculture is as crucial as the cultivation process. To ensure that the produce reaches the



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market in optimal condition, there is a growing focus on improving cold chain infrastructure. This includes better storage facilities, refrigerated transportation, and processing units to prevent post-harvest losses.

Investments in road infrastructure will also play a pivotal role in connecting rural areas to markets efficiently. Well-maintained and expanded road networks can facilitate the smooth transportation of agricultural produce, reducing transit times and minimizing spoilage. Additionally, the integration of technology in logistics, such as real-time tracking and monitoring, can enhance the efficiency of the supply chain.

The evolution of agriculture in 2024 and beyond is poised to demonstrate a dedicated approach to sustainability, technological integration, and enhanced transparency. Circular economy practices, efficient waste management, data-driven decision-making, transparent supply chains, sustainable and organic farming techniques, and upgraded infrastructure collectively will likely guide the agrarian landscape toward resilience and eco-friendliness. Undoubtedly, amid India's endeavor for agricultural prosperity, it is inevitable to face challenges, spanning from ensuring universal technological accessibility for farmers to navigating the delicate balance between modern and traditional farming methods. Successfully overcoming these challenges will underscore the intricate nature of securing both food security and environmental sustainability in the nation.

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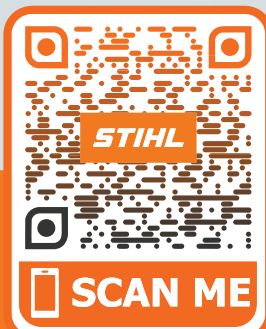
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