

Concept Note for the World Bank Project



AGRI-LEAD: AGRICULTURAL GROWTH THROUGH RESEARCH, INNOVATION, LEARNING, EXTENSION, AND DEVELOPMENT

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Project Proposal

AGRI-LEAD: Agricultural Growth through Research, Innovation, Learning, Extension, and Development

1. Project Summary

The proposed project entitled “AGRI-LEAD: Agricultural Growth through Research, Innovation, Learning, Extension, and Development” aspires to be a transformative initiative for India’s agricultural sector, strategically targeting the interconnected pillars of research, innovations, education, extension and development. It seeks to reimagine Indian agriculture by aligning with national policies, emerging digital technologies and efforts towards achieving sustainable development goals. Specifically, it aims to revitalize India’s National Agricultural Research, Education and Extension System (NAREES) through academic, institutional, organizational and management reforms, digital agriculture and adoption of next-generation technologies aiming at climate-smart and resilient agriculture. It is also aimed to promote innovation and entrepreneurship across agricultural value chain for motivating and attracting youths (including women) in agriculture.

Building on the legacy of successful ICAR-World Bank initiatives like NARP, NATP, NAIP, and NAHEP, the project is designed to align agricultural education with the National Education Policy (NEP)-2020 and agriculture 4.0. Key components include the establishment of world-class Multidisciplinary Education and Research Universities (MERUs), educational reforms such as revisiting land grant system, relevance of ICAR Model Act and its implementation, quality evaluation and accreditation, research in frontier areas, institutional support for agri-startups, promotion of skill-based learning, and the development of robust academia-industry partnerships. It will also strive to strengthen Krishi Vigyan Kendras (KVKs) as main hubs for knowledge sharing, capacity building by being informal education and learning centres, and stakeholders convergence to deliver location-specific technologies for greater adoption, through participatory and inclusive approaches, including promotion of private extension.

The initiative will integrate advanced technologies, including Artificial Intelligence (AI), the Internet of Things (IoT), and Geographic Information Systems (GIS), into agricultural research and field applications. It will also focus on scaling proven agri-technologies, strengthening market intelligence systems, enhancing agricultural value chains and shall ensure multidisciplinary knowledge management and communication systems.

2. Background and Project Rationale

Indian agriculture today stands at a critical juncture, calling for bold, innovative, and systemic reforms across education, research, innovation, and extension services—particularly those centered on entrepreneurship and knowledge-sharing ecosystems. While the sector has

demonstrated remarkable resilience and adaptability, it continues to grapple with complex and evolving challenges: low productivity, fragmented landholdings, degradation of soil and water resources, biodiversity loss, post-harvest inefficiencies, climate vulnerabilities, market distortions, and a persistent gap between research outputs and their adoption on the ground. These structural bottlenecks limit the scalability and impact of agricultural innovations, even as the nation benefits from a growing youth population and rapid strides in technology.

In the past, the Indian Council of Agricultural Research (ICAR), recognizing the pivotal role of agricultural education and research in addressing these challenges, has successfully implemented several major initiatives with financial assistance from the World Bank, such as:

- **National Agricultural Research Project (NARP)** (Phase I: 1979–1985; Phase II: 1986–1993): It significantly strengthened the research capabilities of State Agricultural Universities (SAUs) by decentralizing research to align with the diverse agro-ecological zones of India. The project enhanced location-specific research, improved training infrastructure for scientists, and facilitated the development of improved crop varieties and agricultural practices. These efforts contributed to increased agricultural productivity, improved technology transfer, and farmer empowerment, ultimately supporting food security and rural development.
- **National Agricultural Technology Project (NATP)** (1998–2005): It introduced major reforms in agricultural research and extension systems. It advanced technology-led productivity gains through the development of high-yielding varieties, sustainable agriculture practices (e.g. water conservation and crop diversification) and improved post-harvest management in different production/agroecosystems. The project also promoted commercialization of agricultural technologies, established agro-processing centers and supported skill development programs for rural youth. NATP's decentralized and demand-driven research models enhanced responsiveness to farmers' needs.
- **National Agricultural Innovation Project (NAIP)** (2006–2014): It catalyzed innovation in Indian agriculture by fostering pluralistic and multi-institutional partnerships, including strong public–private collaboration. It adopted consortia-based approaches to address complex challenges and promoted market-oriented research and technology transfer. The project played a pivotal role in commercializing agri-technologies, enhancing institutional revenues, and establishing Business Development Units (BDUs) within ICAR to drive entrepreneurship and innovation.
- **National Agricultural Higher Education Project (NAHEP)** (2017–2024): It revitalized agricultural higher education by integrating digital learning platforms, blended learning models, and comprehensive faculty and student development programs. It enabled dual degree offerings, international academic collaborations, and exposure to global best practices. The project institutionalized facilitative units such as Industry–Institution Interaction Cells, incubation/start-up cells, and placement cells to enhance employability and entrepreneurial opportunities. NAHEP has led to measurable improvements in on-time

graduation rates, placement outcomes, and internationalization of Indian agricultural universities.

These projects have laid a strong foundation for strengthening India's National Agricultural Research, Education and Extension System (NAREES). Over time, the Government of India has also introduced progressive policies and missions to further integrate, modernize, and align NAREES with emerging priorities. Key initiatives such as adoption of NEP2020, Digital Agriculture Mission, National Mission on Sustainable Agriculture (NMSA), Agri-Clinics and Agri-Business Centres (ACABC), National Skill Development Mission, and the Atal Innovation Mission (AIM), collectively provide strong policy alignment for systemic transformation.

Moreover, the increasing globalization of agricultural education necessitates the development of highly competent graduates, engagement in collaborative research, and alignment with international trends into academic curricula. Modern agriculture now demands not only technical proficiency in areas such as artificial intelligence (AI), geospatial analytics, IoT, robotics and climate modelling, but also necessary soft skills, entrepreneurial capabilities, and systems thinking to address complex agricultural challenges in a rapidly evolving global landscape.

India has made significant progress in agriculture development, and has now a well-established institutional system in place. However, several new challenges remain to be addressed. These include the need to enhance the quality of agricultural education, integrate cutting-edge science and emerging biosciences with smart, digital, and sustainable technologies, accelerate the pace and effectiveness of extension services, and scale innovations for broader impact. Additionally, there is a pressing need to build human capital, foster entrepreneurial capabilities, and embed future-ready skills, climate-smart technologies, and innovation-driven mind-sets throughout the agricultural value chain. Strengthening organizational effectiveness and modernizing management practices are equally important to ensure systemic transformation. "AGRI-LEAD: Agricultural Growth through Research, Innovation, Learning, Extension, and Development" seeks to leverage these opportunities to build future-ready workforce, reinforcing research and extension systems, and driving sustainable, inclusive and, innovation-driven growth across India's agricultural ecosystem.

In the face of climate change and rising population pressures, science, research, education, and extension must play a central role in addressing the critical challenges of farmers' profitability, food and nutritional security, inclusivity, and the long-term sustainability of both agriculture and the environment.

In the above context, the USA has already transformed its Land Grant Universities into 'World Grant Universities' and has addressed the following four priority areas:

1. Elevate food and nutrition security to a top priority.
2. Align institutional resources and structures for transdisciplinary approaches.
3. Enhance and build the institute-community partnership.

4. Educate a new generation of students to be transdisciplinary problem solvers.

The proposed Project AGRI-LEAD aims to incorporate these goals, building upon the foundation laid by the State Agricultural Universities (SAUs), which were established following the land-grant model introduced with the inception of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, in 1960.

AGRI-LEAD is designed to be the next innovative and logical step after NAHEP to revamp the National Agricultural Research, Education, and Extension System. It envisions a transformative leap for Indian agriculture by revitalizing the National Agricultural Research, Education, and Extension System (NAREES) through institutional reforms, integration of digital and climate-smart technologies, and promotion of innovation and entrepreneurship across the value chain. Building on the legacy of ICAR-World Bank initiatives and aligned with NEP-2020 and Agriculture 4.0, the project focuses on establishing world-class Multidisciplinary Education and Research Universities (MERUs), reforming agricultural education, strengthening Krishi Vigyan Kendras (KVKs), and enhancing academia-industry linkages. It shall ensure multidisciplinary knowledge management and communication systems, foster inclusive growth by motivating youth and women to participate in agriculture, and leverage AI, IoT, GIS, and market intelligence to scale technologies, improve productivity, and ensure sustainable, resilient agricultural development.

3. Project Development Objectives

1. Strengthening Agricultural Research Ecosystem

Promote integrated, multidisciplinary research by embedding new and emerging biosciences alongside advanced digital technologies—such as AI, IoT, drones, Big Data, GIS, and robotics—into agricultural research, education, and extension system. To enable a paradigm shift from ‘Agricultural Research for Development’ (AR4D) to ‘Agricultural Research and Innovation for Development’ (ARI4D), a major transformative and competitive research grant system is essential—one that spans all disciplines of agriculture and prioritizes climate change mitigation, carbon farming, climate-resilient cropping systems, and sustainable agri-food production systems.

Support the development and scaling of data-driven, resource-efficient innovations across the entire agricultural value chain—from production to post-harvest and market access—to enhance productivity, reduce losses, and strengthen food system resilience. Emphasize climate-smart practices, sustainable intensification, policy research and advanced market intelligence to improve environmental and economic outcomes.

To ensure corporatisation and mobilize private sector investment through strategic research-innovations partnerships, drawing on national (EMBRAPA and MARDI) and global models like the EU’s AKIS and the USA co-financing approach. Co-develop technologies in emerging

areas such as: genome editing, biofortification, AI, biofuels, small farm mechanization, livestock breeding and nutrition, inland aquaculture etc. supported by outcome-linked grants. Strengthen collaborations with international institutions to accelerate technology transfer, enhance commercialization, and position India as a global leader in climate-resilient agri-tech innovations across agriculture, natural resource management (NRM), integrated nutrient management (INM), integrated pest management (IPM), efficient farm mechanization, and value addition. Embed strong Monitoring, Evaluation, Learning, and Impact Assessment (MELIA) framework to assess outcomes, track progress, and inform course corrections.

2. Reimagining Agricultural Educational System

To transform agricultural education, curricula and pedagogy must be revisited and realigned with the vision of the National Education Policy (NEP) 2020 and the evolving Land Grant System. This includes introducing comprehensive O&M reforms and converting select agricultural universities into world-class Multidisciplinary Education and Research Universities (MERUs) by integrating global best practices. The Land Grant System itself should be reformed to support the strengthening and creation of Centres of Excellence that will drive cutting-edge innovation and research.

Simultaneously, robust investment in faculty development is essential, along with a strong focus on hands-on, vocational, and entrepreneurial training, especially for youth and women. Emphasis must be placed on experiential learning, modular skill-building programs, and industry-aligned education to enhance student employability and promote agri-entrepreneurship.

Efforts should also be directed toward building the capacities of farmers, youth, and women to become effective extension agents, input providers, and market-savvy entrepreneurs. This can be achieved through institutional start-up ecosystems, mentorship networks, and market linkages. Strengthening the Rural Agricultural Work Experience (RAWE) and internship programs will ensure students are directly exposed to real-world agricultural challenges.

Finally, the advanced laboratories and infrastructure developed under the National Agricultural Higher Education Project (NAHEP) should be maintained and continually upgraded to serve as hubs for faculty development and national-level student training programs—thus creating a future-ready, skilled agri-workforce.

3. Revitalisation of Agricultural Extension System

Given the multifaceted challenges confronting Indian agriculture, the sector has become increasingly knowledge, technology, and learning-intensive. To ensure science and technology-led growth that enhances productivity, profitability, and sustainability, a dynamic, bottom-up, and interactive continuum among multiple stakeholders—researchers, frontline extension personnel, youth, and farmers—is essential.

Krishi Vigyan Kendras (KVKs) must be further strengthened as vibrant district-level Scientific Agri-clinic Institute for knowledge dissemination, scaling of innovations, and entrepreneurship development. Their role should evolve to provide real-time, location-specific, adaptive solutions aligned with farmers' needs, effectively bridging the gap between research outputs and ground-level applications. The KVKs as district level nodal agency for sustainable agricultural development will be supported by the upstream partners like universities and research institutions, Government Agriculture and Allied Departments, corporates and startups to drive research and development on priority areas, design scalable solutions, commercialize innovative solutions. The KVKs will act as Centre of Excellence/ Demonstration centres, District hub for advisory & extension, provide Integrated service delivery and act as an important component of feedback loop catalyst. The extension delivery stakeholders would be Village-based institutions (SHGs, PACS), Community-based resource persons (Krishi Sahayaks, Krishi Sakhis), NGOs/FPOs/SHGs/CSCs for applications of innovations and handhold farmers on-ground, develop farmer capacities for technology adoption and promote Smart Business Hubs.

KVKs would extend beyond production to post-harvest processing and value-addition of crops and act as single window solution for agricultural knowledge, resource and capacity development. KVKs to act as business incubation centre and build-up of community business models with technology demonstration and promotion components in PPP mode; development of Incubation-cum-Skill Centres for facilitating entrepreneurs/FPOs/Startups in agri-business; and establishment of Hi-tech Precision Technology Parks and Integrated Farming System models at KVKs.

KVKs can also take on the specialized role of Agricultural Technology Information Centres (ATICs) by enhancing their outreach through the production and distribution of seeds, planting materials, livestock and fishery inputs, value-added products, publications, and small-scale farm machinery prototypes. This approach will not only streamline the feedback loop between research and field but also accelerate technological refinements.

Active participation of stakeholders such as Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), Farmer Interest Groups (FIGs), and para-extension workers is crucial—they can serve as key change agents in strengthening grassroots extension.

Collaborative learning among institutions and stakeholders will foster convergence of resources and shared ownership in addressing localized agricultural challenges. In addition to conventional scientific knowledge, farmer-led innovations must be integrated into real-time, accessible, and scalable solutions through digital agriculture tools, facilitating quicker adoption by end-users.

Extension and skilling programs must be adaptively designed to engage women, youth, and farmers in building socially and ecologically resilient farming systems. Vocational training through KVKs should be prioritized to empower rural youth with employable skills. Digital extension needs to be strengthened through real-time advisory platforms, mobile apps, AI tools,

and training of grassroots agents like Krishi Sakhis and Drone Didis. A robust monitoring, evaluation, and learning system must be institutionalized to capture impact, guide continuous improvement, and scale successful models across regions.

Strengthening KVKs along these lines, in coordination with initiatives like ATMA, can be piloted in high-potential regions to develop scalable extension models and policy frameworks. These can then be replicated across states, ensuring enhanced adoption, productivity, and sustainability across India's diverse farming systems.

4. Promotion of Inclusivity and Gender Equity

To empower women in agriculture, there is a need to integrate Gender Equality and Social Inclusion (GESI) across all dimensions—education, research, extension, and entrepreneurship. This involves embedding inclusive policies, targeted programs, and strong social science insights into institutional frameworks. Implementing ICAR's National Gender Strategy, alongside global initiatives like GFAR's GAP and CGIAR's GENDER Platform, calls for a renewed focus on reducing women's drudgery through gender-responsive technologies, ergonomic tools, and climate-smart innovations. Crucially, there must be coordinated efforts to prioritize the empowerment of women, marginalized communities, and weaker sections by ensuring equitable access to quality education, relevant skills, innovation platforms, funding opportunities, and leadership roles across the agricultural ecosystem.

Agricultural education needs urgent reforms to become skill-oriented, market-driven, and inclusive, with GESI modules embedded in curricula, regional-language content, safe and supportive infrastructure, and diverse faculty recruitment. Extension services must promote women-led initiatives such as farmer field schools, peer learning groups, and gender-responsive ICT tools, while training extension personnel in inclusive outreach. Dedicated support for women entrepreneurs—including seed funding, incubation, mentorship, and market linkages—will be key to unlocking their full potential in agri-based enterprises. Monitoring systems should include gender-disaggregated indicators to ensure impact and accountability. Strengthening convergence with rural development, nutrition, and health programs, and widely showcasing successful women in agriculture, will help transform mindsets and build a resilient, equitable, and inclusive agri-food system. There is a need for greater visibility and collective advocacy for women in agriculture by raising awareness of their crucial role—from production to processing—and ensuring their needs are publicly recognized.

5. Strengthening of an Integrated Agricultural Knowledge and Communication Management System

To modernize and democratize access to agricultural knowledge, a National Agricultural Knowledge and Communication System powered by Generative AI and multilingual voice interfaces is proposed to harness and organize the wealth of knowledge generated by NAREES. This platform will provide tailored, timely, and actionable information to a wide array of stakeholders—including farmers, researchers, students, policymakers, and educators—ensuring inclusivity and relevance. Parallely, ICAR's digital publishing ecosystem will be

strengthened with a robust, AI-enabled platform that enhances the quality, integrity, and visibility of scientific publications. Capacity building for authors, editors, and reviewers, along with global-standard peer review mechanisms and collaborations with international publishers, will promote impactful and policy-relevant research dissemination. These initiatives will be supported by the systematic implementation of ICAR's communication strategies, ensuring consistent, high-quality messaging across platforms and audiences.

To expand public engagement and outreach, ICAR will enhance the digital presence of DKMA by building strong social media capabilities and launching multilingual mass media campaigns, region-specific storytelling, and behavioural change communication initiatives. The renovated Agricultural Science Museum will offer interactive, technology-enabled experiences to inspire youth and farmers alike. Seamless data-sharing among institutions (ICAR institutes, SAUs, KVKs, MERUs, and ministries) through interoperable systems will support collaborative innovation. A structured feedback ecosystem—linking farmer experiences to research, extension insights to curriculum, and field outcomes to policy—will promote adaptive learning and institutional responsiveness. To lead this transformation, DKMA shall be elevated to the 'Indian Institute for Agricultural Knowledge Management', functioning as a national-level training and capacity-building hub for scientific communication, knowledge management, and stakeholder engagement.

4. Key Components and Activities

Component 1: Strengthening Agricultural Research Ecosystem

- **Promote and support multidisciplinary and inter-institutional competitive grant system for research** in frontier and priority areas such as carbon farming, vertical and protected agriculture, regenerative practices, climate and simulation modelling, and market-responsive innovations. Emphasis to be placed on developing climate-resilient crop varieties, integrated farming systems, and addressing critical challenges in rainfed agriculture, on-farm water management, and holistic soil, plant, and animal health.
- **Establish a Private Sector Co-Investment Consortium/Platform for Research Commercialization** – In collaboration with industry associations and agri-tech leaders, develop a platform to commercialize technologies with clear environmental and export value (e.g., feed innovations, water-saving equipment, zero-energy cold chains). Target at least **US\$200 million in private R&D co-financing** over the life of the project.
- **Establish 'Smart Agriculture Labs', Technology Parks and 'Agri-Tech Demonstration Hubs'** in selected institutes/universities to provide hands-on exposure to digital tools and emerging technologies applied in real-time agricultural settings (e.g., drone-based spraying, AI-based soil health prediction). Equip select institutes/universities with AI-powered decision support systems, IoT enabled greenhouses and field plots, drone flying zones and simulators, and soil health sensors, climate stations, and other precision tools.

- **Support and expanding Centres of Excellence (CoEs) and advanced laboratories** in agricultural institutes/universities to foster cutting-edge research, interdisciplinary collaboration, and high-end skill development. These Centres will serve as hubs for innovation, technology validation, and capacity building in emerging areas such as genomics, biotechnology, precision agriculture, climate science, and agri-automation.
- **Strengthen collaborations with international institutions** to leveraging global knowledge networks and innovation ecosystems so that India can fast-track the adoption of sustainable agricultural technologies, improve productivity, and contribute meaningfully to global food and climate security.
- **Develop a national framework for technology integration standards and ethical deployment** (specially around data privacy, AI ethics, and environmental safety). The framework must involve multi-stakeholder consultations—including scientists, policymakers, industry, and civil society—to ensure that technological interventions are inclusive, accountable, and aligned with national priorities. By institutionalizing such standards, India can foster public trust, encourage responsible innovation, and ensure that digital transformation in agriculture benefits all stakeholders equitably and sustainably.

Component 2: Reimagining Agricultural Educational System

- **Curriculum modernisation** – Revision of curriculum in line with NEP-2020, global sustainability goals (SDGs), and market needs. Develop competency-based frameworks with exit and entry flexibility (aligned with the National Credit Framework).
- **Establishment of MERUs (Multidisciplinary Education and Research Universities)** – Transform selected central/SAUs and deemed universities into world class MERUs. Facilitate partnerships with global top-tier universities for joint research, dual/joint/twinning degree programs, and faculty/student exchanges. Promote regional diversity by identifying geographically distributed MERU hubs. Improve the efficiency of university accreditation system through policy reforms.
- **Faculty Development and Pedagogical Reforms** - Design and implement continuous professional development (CPD) programs. Introduce faculty exchange programs and global exposure opportunities. Establish CoE for faculty development to provide competency-based training on modern/advanced pedagogies. Build a dedicated team to develop curriculum toolkits and act as think tank for integrating new-age themes into agricultural education. Develop a national certification framework for faculty excellence in teaching and learning.
- **Academic-Industry Linkages and Global Collaborations** - Institutionalize industry advisory boards for curriculum co-design and employability mapping. Facilitate internships, apprenticeships, and joint research projects with agri-tech firms, FPOs, and food processing companies. Promote credit recognition for MOOCs and global learning platforms through open learning integration.
- **Strengthen Vocational and Modular Skill Development Programs** by designing and implementing credit-based vocational courses in collaboration with agricultural

universities considering the provision for exit in the National Education Policy and needs of the stakeholders. Develop National Skills Qualifications Framework (NSQF) aligned curricula and promote dual education models (classroom + industry) and stackable micro-credentials to enhance flexibility and learner mobility.

- **Inclusive Access and Equity Enhancement** - Leverage digital delivery (e.g., blended learning platforms, e-learning platforms and Virtual Classrooms) to improve access to quality content to all learners across agricultural universities and develop content in regional languages.
- Launch “**Agri-Youth Fellowship**” and “**Agri-preneur Start-up Bootcamps**” across states to inspire rural innovation. Collaborate with private sector, State Rural Livelihoods Missions (SRLMs), and financial institutions to offer access to credit, seed grants, and business mentoring for building rural youth employability and entrepreneurship capacity.
- Introduce **innovation challenges and hackathons** focused on rural problems. Provide seed funding, mentoring, and market access for student start-ups. Seed grants, innovation bootcamps, and business mentorship for students and rural youth.
- Foster lifelong learning by institutionalising **Agri-Learning Passport and e-portfolio system** to track individual progress and institutionalising Recognition of Prior Learning (RPL) to formalize the skills of experienced farmers and workers.
- Maintenance and upgradation of facilities created under NAHEP.

Component 3: Revitalisation of Agricultural Extension System

- **Mapping and engaging multi-stakeholders for convergence**

Problems in agriculture is complex in nature, and one-fit size all approach serve little purpose. This needs vibrant convergence with multi-stakeholders involving KVKs, Scientists-Students, Women and Youth from across the system engaging farmers, researchers, extension agents, FPOs, and NGOs for joint planning and executions considering KVKs as hub for Knowledge dissemination and Entrepreneurship Development. Reimagining and strengthening KVKs to be the nodal institute at the district level for agricultural technology dissemination and greater impacts. KVKs as leading institution for technology dissemination should also create and maintain district level database and identify district specific needs, primary and secondary factors/biotic and abiotic causes of each prioritized problem and plan for appropriate interventions. KVK should function as a frontline extension system, whereas, ATMA to act as a field extension agency for large scale technology dissemination/adoption. While KVKs would work in a “cluster mode”, the district level ATMA functionaries could take lead in outscaling of successful technologies/innovations through large-scale demonstrations and further verification/validation. KVK would have major responsibilities for technology verification and its upscaling, ATMA could play an important role for large scale dissemination through involvement of mass media (ICT, Radio, TV etc), farmers’ organizations, NGOs and private sector.

KVK would assume specific role of ATIC through public private partnership for enhancing its outreach through production of seeds, planting materials, livestock materials, fingerlings value-added products, publications, prototypes of small implements, etc. KVKs would develop interventions keeping in view of Comprehensive District Agriculture Plan (CDAP) developed in convergence with all related stakeholders.

- **Adaptive extension to deal with complex and system-based issues**

Adaptive agricultural extension refers to the process of tailoring agricultural extension services to address the specific challenges and opportunities presented by changing environmental conditions, particularly those related to climate change. It involves equipping farmers with the knowledge and skills to adapt their farming practices and technologies to these changes, enhancing their resilience and ensuring sustainable agricultural production. Farmer-led adaptive trials (OFTs) shall be organized to validate technologies under real field conditions.

- **Skilling and capacity building to strengthen peer knowledge and that translate knowledge in action**

The capacity building is one of the core functions of KVKs to build human capital across the stakeholders especially youth, for better agricultural development. The conventional model of skilling the farmers and other stakeholders rolling around “*what is*” (knowledge), the “*how to do this*” (skill) part needs urgent change. To ensure these, the activities would be taken up in all the zones.

- **Strengthening the digital extension**

Digitise extension service delivery by developing and disseminating platforms for real-time advisory, deploying mobile apps/AI powered chatbots/Interactive Voice Response Systems for integrated crop, livestock management, efficient pest control, value addition, marketing and weather alerts. Local extension agents such as Krishi Sakhis, Drone Didis and youth will be trained to support last-mile outreach.

- **Strengthening monitoring & evaluation for enhanced learning & insights**

Developing a robust monitoring and learning system to track progress, document outcomes, and support scaling up successful models across regions.

Component 4: Promoting inclusivity and gender equity

The GFAR (the Global Forum on Agricultural Research and Innovation), and CGIAR have gender policies or initiatives focused on promoting gender equality, particularly within the context of agriculture and food systems. GFAR, through its Gender in Agriculture Partnership (GAP), works to integrate gender into agricultural research and innovation, fostering inclusive

mechanisms and promoting gender equality in food systems. CGIAR has a strong focus on gender equality, with its GENDER (Generating Evidence and New Directions for Equitable Results) Impact Platform at the forefront. CGIAR's research aims to address gender inequality in various aspects, including access to resources, participation in decision-making, and the impact of climate change on women. CGIAR also has initiatives like the Gender and Breeding Initiative, which focuses on developing gender-responsive breeding strategies. The recommendations and policies of such organizations need to be reviewed for their implementation in NAREES.

- **Institutional Integration and Policy Mainstreaming** by developing and enforcing GESI policies across agricultural institutions, appointing GESI focal points and conduct periodic inclusion audits and integrate social science and gender insights in planning and decision-making.
- **GESI-Responsive Research and Innovation** by supporting gender-inclusive and socially relevant research, mandate gender-disaggregated data in research and include social scientists in agri-R&D teams.
- **Inclusive Agricultural Education** by organizing bridge courses, and infrastructure support for women and marginalized groups, embedding GESI modules in curricula; promote diversity in faculty recruitment and ensuring regional language e-learning and inclusive teaching content.
- **Gender-Sensitive Extension and Advisory Services** through promotion of women-led farmer field schools and peer networks, training extension staff on gender-responsive approaches and developing inclusive ICT tools and materials.
- **Inclusive Entrepreneurship and Innovation Support** through launching targeted start-up and innovation programs for women and marginalized groups, providing seed funding, mentorship, and market access and ensuring inclusive participation in incubation and challenge grants.
- **Capacity Building and Leadership Development** by organizing leadership and skills training for women and underrepresented youth, institutionalizing lifelong learning programs and Recognition of Prior Learning (RPL) and offering fellowships and exposure visits.
- **Monitoring, Evaluation, and Learning (MEL)** by use of GESI-sensitive indicators and gender-disaggregated tracking tools.
- **Convergence and Advocacy** through collaboration with rural development, health, and nutrition programs and running awareness campaigns and promote success stories to shift norms.
- To implement the ICAR-national gender strategy in agriculture for advancing an equitable, resilient, and sustainable agri-food system.

Component 5: Strengthening of an Integrated Agricultural Knowledge and Communication Management System

- Develop and establish a **National Agricultural Knowledge and Communication System** powered by Generative AI and multilingual voice enabled interfaces to harness and organize the vast repository of knowledge generated by NAREES, including research outputs, new technologies and publications. The portal will enable customized, need-based dissemination of information to diverse stakeholders—policy makers, think tanks, farmers, students, researchers, educators, and practitioners—ensuring targeted access to relevant, timely, and actionable agricultural knowledge. Generative AI capabilities will support personalized content delivery, while multilingual interfaces ensure inclusivity and accessibility
- Strengthening of online publication system for ICAR and scientific societies/organizations related to agriculture. This involves the development and deployment of a robust, user-friendly digital publishing platform that supports end-to-end processes—from manuscript submission and peer review to editing, publication, and archiving. Integrating advanced tools for plagiarism detection, citation management, and AI-assisted editorial workflows will improve the quality and integrity of publications. Capacity building for editorial boards and technical teams, alongside regular audits for quality and performance, will be key to maintaining global standards. This transformation will position ICAR and associated societies as leaders in transparent, timely, and high-impact scientific communication.
- Enhance capability of publication of quality books and journals. This involves upgrading editorial standards, peer review mechanisms, and publication infrastructure to meet global benchmarks. Investments should be made in capacity building of authors, editors, and reviewers, as well as in adopting modern digital publishing platforms to improve accessibility and visibility. Encouraging interdisciplinary and policy-relevant publications, ensuring timely releases, and fostering collaborations with reputed international publishers can significantly boost the credibility and reach of ICAR publications.
- Building social media capabilities of the DKMA. By strengthening DKMA's presence across major social media platforms—such as X (Twitter), Facebook, YouTube, Instagram, LinkedIn, and emerging Indian digital networks—ICAR can more effectively engage with diverse audiences including farmers, students, researchers, policymakers, and the general public. This includes building dedicated content creation teams skilled in multimedia production, data visualization, and storytelling to translate complex scientific information into accessible, engaging formats such as infographics, short videos, reels, podcasts, and live Q&A sessions. Real-time updates on technologies, success stories, weather advisories, and policy developments can enhance awareness and adoption. Additionally, leveraging social media analytics tools will help DKMA monitor audience engagement, feedback, and impact, enabling more targeted and evidence-based communication strategies.

- Renovation and use of Agricultural Science Museum for better visibility and awareness of school children, farmers and other stakeholders. Upgradation efforts should include the incorporation of digital exhibits, interactive kiosks, augmented and virtual reality experiences, and hands-on learning modules to make agricultural science more engaging and accessible. Thematic galleries showcasing milestones in agricultural research, success stories of farmers, climate-resilient practices, and emerging agri-technologies can inspire curiosity and foster appreciation for the role of science in food and environmental security.
- Enable **seamless data-sharing and integration across institutions** (SAUs, ICAR institutes, KVKs, MERUs, and ministries) through interoperable systems.
- The project will ensure the systematic implementation of **ICAR’s communication strategies** to enhance knowledge dissemination, stakeholder engagement, and public awareness through integrated digital, print, and mass media platforms.
- Promote **Evidence-Based Feedback-Driven Organizational Learning** – design feedback mechanisms linking farmer experiences to research priorities, extension learnings to curriculum updates and policy outcomes to institutional reforms. This feedback ecosystem will enhance agility, accountability, and responsiveness of institutions.
- **Development of communication guidelines, multilingual knowledge portals**, mass media campaigns to increase visibility of NAREES. Collaborate with media and influencers to create region specific, culturally relevant storytelling and behavioural change communication campaigns around sustainable practices, climate-smart agriculture, and agri-entrepreneurship.
- **Build Organizational Capacity for Knowledge Management**- Elevation of DKMA to ‘Indian Institute for Agricultural Knowledge Management’ as central unit within ICAR to train institutional teams in scientific writing, editing, publication best practices, knowledge management, digital communication, and stakeholder engagement.

5 Expected Outcomes

1.	Strengthening Agricultural Research Ecosystem	• Generate a pipeline of at least 60 innovations through interdisciplinary research in climate-smart agriculture, carbon-neutral farming, and regenerative practices. • Develop, validate and disseminate 50+ climate-resilient crop varieties, 25 integrated farming models, and scalable solutions for rainfed and resource-efficient agriculture. • Establish Smart Agriculture Labs and Agri-Tech Demonstration Hubs in 50% of institutions,
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		enabling hands-on training in AI, IoT, GIS, robotics, and drones. • Upgrade infrastructure with real-time data tools, AI-powered decision systems, and precision farming technologies across participating institutions. • 25 CoEs established or upgraded in genomics, biotechnology, agri-automation, and climate science. • 10,000+ researchers and students trained in advanced skills via these CoEs annually. • 150+ research papers, patents, or prototypes generated from CoE-supported innovation. • Implement a national digital governance framework, including uniform standards for AI, IoT, data privacy, and environmental safeguards. • Create 50,000+ high-quality jobs across research, agri-tech start-ups, digital extension, and agro-processing value chains. • Support 10,000 rural youth-led agri-enterprises, with targeted inclusion of women and marginalized communities through skilling and incubation. • Realize a 20–30% increase in high-value agri-exports from target zones through enhanced market intelligence, traceability, and cold chains. • Ensure 15% of competitive research and commercialization initiatives are co-financed by the private sector to enhance sustainability and scale.
2.	Reimagining Agricultural Educational System	• 100% of agricultural universities adopt revised, competency-based curricula aligned with NEP-2020, SDGs, and National Credit Framework by 2030. • All UG and PG programs offer entry/exit flexibility and integrate skill-based modules by 2030. • 07 MERUs established by transforming central/SAUs into multidisciplinary hubs by 2028. • 20+ global partnerships forged for dual degrees, faculty/student exchanges, and joint research projects.

		• University accreditation reforms implemented to reduce evaluation time by 30% and improve institutional accountability. • National Centre of Excellence for Faculty Development established and operational by 2028. • 5,000+ faculty trained annually under CPD programs with modern pedagogy certifications and global exposure. • National certification framework for teaching excellence rolled out and adopted by at least 70% of agricultural universities. • Industry advisory boards established in all agricultural universities for curriculum co-design and employability mapping. • 10,000+ students annually engaged in internships, apprenticeships, and industry-linked research by 2030. • Credit recognition for MOOCs and global learning platforms institutionalized across 100% universities by 2032. • 20+ credit-based vocational courses rolled out by 2030, aligned with NSQF and stakeholder needs. • Dual education models implemented in at least 40% of institutions. • Blended learning platforms adopted by 100% universities with at least 20,000 students accessing online content annually by 2030. • Agri-Youth Fellowship launched in all states, benefiting 25,000 rural youth annually with seed grants, credit linkages, and mentoring. • Agri-preneur Bootcamps conducted in all states annually, supporting 1,000+ start-ups by 2032. • 200+ student and rural youth-led start-ups receive seed funding and market access support by 2030. • Agri-Learning Passport and e-Portfolio system operationalized for tracking learner progress across all institutions by 2032. • Maintenance and upgradation of facilities created under NAHEP in all Ag. Universities.
3.	Revitalisation of Agricultural Extension System	• KVKs as self-reliant hub for Knowledge dissemination and Entrepreneurship Development

		• Greater convergence among the stakeholders (KVK, ATMA, FPOs/Farmers Associations etc.) • Mapping and developing ~ 200 multi-institutional and multi-stakeholder platforms across the country. • Transforming about 50 KVKs into DISA hubs through PPP mode, equipped with smart demo farms and digital infrastructure. • Conducting 5,000+ farmer-led adaptive trials (OFTs) across diverse agro-ecological zones to validate technologies in real conditions. • Preparing at least 500+ inventory of technologies which are adaptive to diverse social-ecological systems and resource-endowments • Screening and validating/refining ~ 200 unique farmers innovations meeting the challenges of present agriculture • Developing at least 35 village knowledge bank/hub (institutional innovations) led by knowledge leaders (farmers) to deal complex issues in agriculture and enhance technological diffusion • Skilling of ~ 1,00,000 farmers on climate-smart and adaptive practices through structured training and exposure programs. • Skilling of ~ 10,000 FPOs/FIGs/SHGs members to enhance skill on business plan and entrepreneurship • Capacity-building of farmers/other stakeholders through 25,000 exposure visits/field days/travelling seminars to enhance their adaptive capacity/decision making ability. • Deployment of digital advisory tools (mobile apps, AI based tools, etc.) to reaching ~ 1 million users with timely agro-advisories. • Training ~ 50,000+ local extension agents (e.g., Krishi Sahayaks, Krishi Sakhis, Drone Didis) to support grassroots extension and last-mile service delivery • Customized ~ 200 digital knowledge products in multi-languages to cater the needs of multi-stakeholders and cartelize the technology dissemination process
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		• Developing a robust monitoring and learning framework/system to track the progress, document the outcomes, and support scaling up successful models across regions. • Evidence based insights to help policy planners of states for the large-scale applications of tested models, approaches and framework tested through KVKs and associated stakeholders.
4.	Promotion of Inclusivity and Gender Equity	• Adopt and implement GESI policies across NAREES institutions, with designated GESI focal points and periodic inclusion audit (100%) • Review and align with GFAR and CGIAR gender frameworks, including the GAP and GENDER Impact Platform, for integration into NAREES. • Mandate gender-disaggregated data collection and inclusion of social scientists in agri-R&D teams. • GESI Focal Points appointed in at least 90% of institutions. GESI modules embedded in 100% of revised agri-education curricula. • 50% of digital learning content made available in regional languages. • Minimum of one inclusion audit conducted annually per institution. • 30% of project-funded plans incorporate social science or gender analysis. • Gender-disaggregated data collection mandated in 100% of research projects. • Establishment of 500+ women-led Farmer Field Schools and peer learning networks. • 25,000 extension workers trained in gender-responsive advisory services. • 10,000 women and marginalized youth trained in leadership, business, or technical skills. • Launch of 1,000 women- and youth-led start-ups supported with seed funding and mentorship. • 50+ formal partnerships established with rural development, health, or nutrition programs. • Ensure implementation of ICAR's National Gender Strategy to advance equity, resilience, and sustainability in agri-food systems.

5.	Strengthening of an Integrated Agricultural Knowledge and Communication Management System	• Launch a National Agricultural Knowledge Portal with Generative AI and multilingual voice interfaces for customized, inclusive information access. • Digitize and archive research outputs, technologies, and publications from NAREES institutions. • Strengthen ICAR's online publication system with AI-supported editorial tools and quality assurance mechanisms. • Enhance book and journal publishing capacity through upgraded peer review, training, and collaborations with global publishers. • Expand DKMA's digital outreach via social media platforms, multimedia content, and real-time communication strategies. • Modernize the Agricultural Science Museum with interactive digital exhibits and AR/VR experiences. • Establish interoperable data-sharing systems across ICAR, SAUs, KVKs, MERUs, and ministries. • Create feedback mechanisms linking farmer experience to research, extension, curriculum, and policy. • Develop communication guidelines and multilingual campaigns to increase visibility and engagement. • Implementation of communication strategies if ICAR • Upgrade DKMA as the Indian Institute for Agricultural Knowledge Management for training and capacity building.
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6. Implementation and Financing

The project will be implemented over a five-year period from FY2026-27 to FY2031-32. The total estimated cost is ₹4,200 crore (approximately USD 500 million), with equal financing contributions from the Government of India and the World Bank. Implementation will be led by the Department of Agricultural Research and Education (DARE), with execution support from ICAR with its institutes, agricultural universities and KVKs.

- **Lead Institutions:** ICAR Institutes and Agricultural Universities

- **Technical Partners:** Private sector AgriTech firms, NGOs, KVKs, FPOs
- **Funding and Evaluation:** World Bank, Ministry of Finance, Ministry of Agriculture & Farmers Welfare [Department of Agricultural Research and Education (DARE)]. A robust Results-Based Monitoring and Evaluation (RBME) framework will be established, using KPIs such as a number of students trained in emerging tech, Start-ups incubated and commercialized, technologies disseminated and adopted, Farmer income and resilience indicators.
- **Budget Estimate (Tentative)**

Component	Estimated Cost (USD Million)
Digital and Sustainable Technology Mainstreaming in Agricultural Research	100.00
Academic and Human Capital Development for Future-Ready Agri-Innovation and Entrepreneurship	125.00
Advancing Agricultural Extension through Digitalization and Eco-Innovations	100.00
Promoting inclusivity and gender equity	100.00
Strengthening Organizational, Knowledge, and Communication Management Systems in Indian Agriculture	75.00
Total	500.00

7. Conclusion

This mega project aligns seamlessly with ICAR's vision to transform the National Agricultural Research, Education, and Extension System (NAREES) through a comprehensive approach encompassing formal and informal education, cutting-edge research and innovation, robust extension services, intellectual property rights, entrepreneurship development, and strong public-private partnerships. By integrating quality education, research, extension services, human resource development, and scalable entrepreneurship, the project aims to make Indian agriculture more resilient, profitable, and youth-driven that benefits rural communities across India. This mega initiative will be a landmark in shaping the *Atmanirbhar Krishi Bharat*.

The AGRI-LEAD initiative also aspires to position India as a global leader in agricultural technology for smallholders, extending ICAR's innovations to at least 25 developing countries through CGIAR and South-South partnerships. By integrating private sector co-financing, scaling climate-smart innovations, and leveraging international spillover benefits, the project sets the stage for a globally visible, environmentally sustainable, and economically inclusive transformation of India's agricultural research and innovation ecosystem.
