

Futuristic Agricultural Education & Skills Development in India

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Introduction

Indian agriculture has transformed from subsistence agriculture to market led agricultural production perspectives from over the period of last 6 decades. At the same time, the emerging technological revolutions, climate and other issues in agriculture in India requires more technology-driven, competency-based, interdisciplinary, experiential, and industry-oriented human resources. So, the future agricultural human resources development through promotion of agricultural graduates not only for conventional farming and extension but also use and apply the emerging opportunities in Agricultural technologies, artificial intelligence, precision agriculture, digital agriculture, climate-smart farming, agribusiness, entrepreneurship, and rural innovation. For this purpose, the following areas inclusion is much needed for modernizing agriculture for the futuristic perspectives.

AI-enabled Agricultural Extension and Education

The era of agricultural extension advisories and education have transformed with the support of Generative AI, AI tutors and adaptive learning platforms to support multi-disciplinary, accurate knowledge led advisories; hence, inclusion of AI –enabled curriculum in academic and content development in training programs are much needed for the futuristic agricultural Education & Extension.

Digital & precision agriculture

The agricultural input use efficiency and natural resources management are the key concerns in Indian Agriculture. Hence, appropriate digital and precision farming technologies adoption are the need of the hour. The recent technologies such as agricultural drones, Internet of Things (IoT), geographical Information System (GIS) based agricultural application and crop production systems, remote sensing, sensors and farm-management platforms will be highly supportive to effectively utilize the available resources and to get maximum production to address the emerging food and energy requirement of the country.

Experiential learning

Field-based agricultural experiential learning is very much needed for enhancement of practical skills and application with respect to field reality. The recent innovations such as simulations and AR/ VR based virtual laboratories and problem-based projects can be also supported to enhance the experiential learning exercises and

practical skill sets in the agricultural production enhancement purposes.

Industry-academia collaboration

The agricultural industry plays an important role in economic development in India. The commercial agriculture and international trade aspects in agriculture also depend on agro- industries performance. Hence, stronger engagement with AgTech companies, agricultural start-ups, Farmer Producer Organizations, agribusinesses corporations and research organizations connection and collaboration support to enhance the industry perspective knowledge and employability and entrepreneurial connection to agricultural graduates. It also supports the development of the skills and entrepreneurial launching competencies of the agricultural graduates. In extension perspectives, it supports the entrepreneurial skill development of various industry stakeholders and entrepreneurial aspirants.

Entrepreneurship & employability

The private led agricultural entrepreneurship and employability enhancement are the key pillars of the future agriculture. Hence, the futuristic agricultural curriculum should emphasize on developing innovation, agricultural business promotion perspectives, agricultural business communication strategies, leadership development process and digital competencies.

Climate-smart agriculture

The climate change impact is one of the major factors that affect the agricultural production systems. Being a developing economy, India still depends majorly on the seasonal monsoon rainfalls. Hence, the monsoon failures, drought and other climate impacts seriously affect agricultural production. So, the futurist agricultural education should be focused on climate resilience, water management and resource conservation for the sustainable and enhanced agricultural production.

Online and blended learning

The NEP 2020 policy is highlighting the importance of inclusion of MOOCs, LMS platforms, digital content, micro-credentials and flexible learning pathways for enhancing online based education. It supports global orientation and multiple benefits, inter institutional collaborations and development through blended, flexible learning platforms. It also supports students' friendly personalized learning opportunities for the upcoming need based futuristic agricultural education.

Data-driven agriculture

The agricultural production and marketing data supports to assess the trend of demand and supply of the agricultural production, resources use pattern and effective marketing and processing and international trade perspectives. Hence, training in data analytics, farm data management, modelling and decision-support systems are much needed to the students of agricultural universities for the effective competency development in the area.

Global and interdisciplinary learning

The Information and Communication Technologies effectively support agricultural sectors through integration of agriculture with technology, management, economics, environment and social sciences for the effective data driven effective management. Hence, these areas are much needed for the agricultural graduates' competency development.

Lifelong learning

Agricultural studies are continuous in nature. Hence, continuous professional development for faculty, farmers, extension personnel and agricultural professionals are much needed for the human resources development in long term perspectives. Further, frequent updates in curriculum and pedagogy also support enhancing the agricultural graduate's professional development process.

Conclusion

The future of agricultural education and human resource development in India requires a paradigm shift from conventional, discipline-oriented education towards a technology-driven, competency-based, experiential, interdisciplinary, and industry-oriented learning ecosystem. The integration of Artificial Intelligence, digital and precision agriculture, data analytics, climate-smart technologies, experiential learning, entrepreneurship, and blended learning can significantly enhance the employability, innovativeness, and professional capabilities of agricultural graduates. Stronger industry-academia-research-extension linkages, supported by AgTech enterprises, start-ups, Farmer Producer Organizations and other stakeholders, are essential for connecting academic knowledge with real-world agricultural challenges and opportunities. At the same time, lifelong learning and continuous professional development

should be promoted among faculty, farmers, extension personnel and agricultural professionals to keep pace with rapidly evolving technologies and global challenges. Thus, modernizing agricultural education through AI-enabled, digitally connected, globally oriented, industry-linked and continuously evolving learning systems will be critical for developing future-ready human resources capable of contributing to sustainable, resilient, competitive and inclusive Indian agriculture.

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