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Country Paper -India

3rd Regional Forum on Sustainable Agricultural Mechanization in Asia and the Pacific
3rd ASEAN Conference on Agricultural and Biosystems Engineering
Co-located with the 12th Engineering Research and Development for Technology in Agriculture
9-11 December 2015, Manila, the Philippines

Welcome

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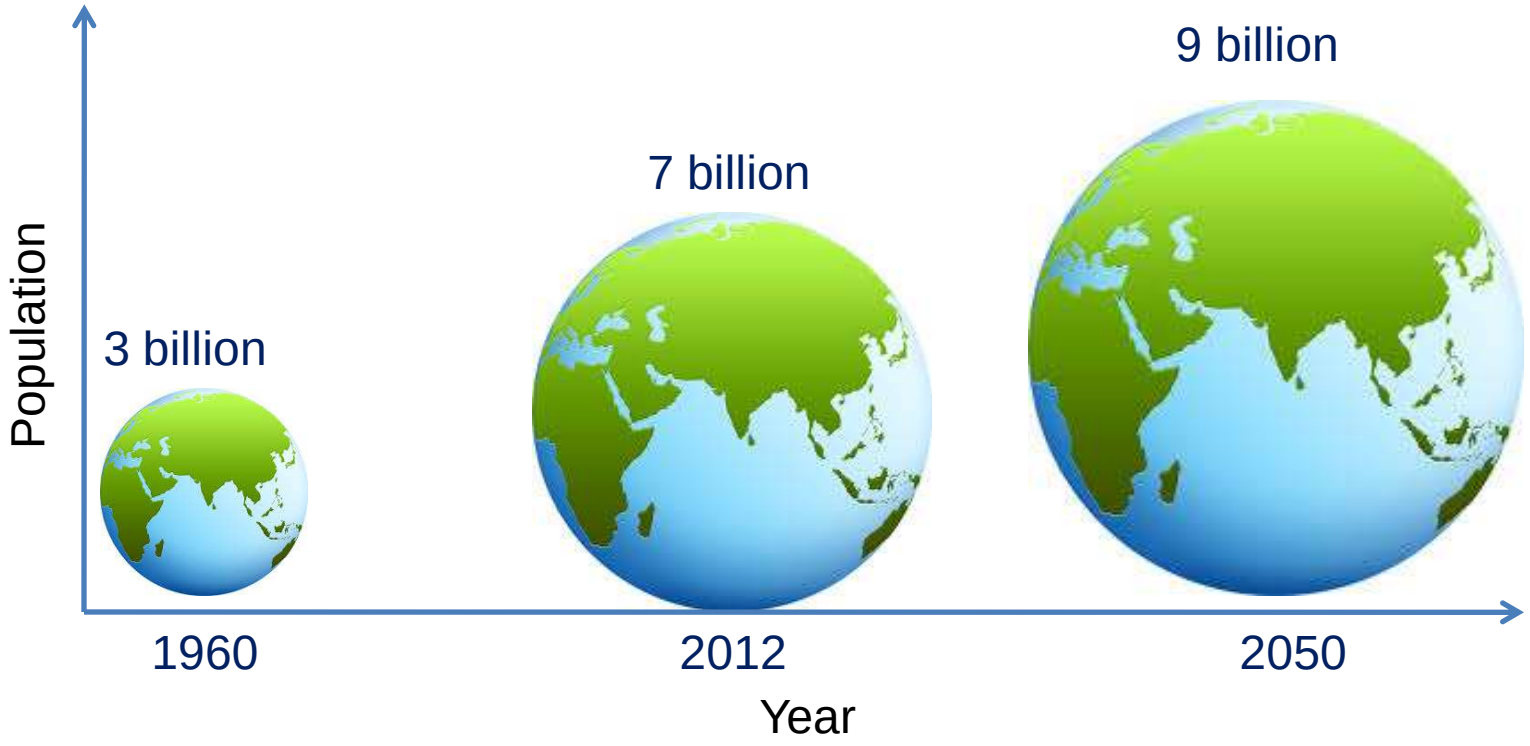
Human Resource Development in Agricultural Mechanisation - India

Introduction



Source:WORLD AGRICULTURE TOWARDS 2030/2050,FAO Publication

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Food Production

The Population projections show that the overall food production should be increased by about 70 per cent.

The global resources are sufficient but the production depends up on the local resources in each country.

More prominence lies on the Developing countries particularly in the Asian countries where there is a rice-based diet and needs will be more than double the average for the world.

India with a population of over 1.271 billion people, is the second most populous country in the world. Already containing 17.5% of the world's population, India will be the most populous country in the world by 2030.

Year	Country	Population	Percentage growth	Percentage of world population	World Population	Rank
2015	**China**	**1,401,586,609**	0.61%	19.13%	7,324,782,225	1
	India	**1,282,390,303**	1.24%	17.51%	7,324,782,225	2
2030	**India**	**1,476,377,903**	0.80%	17.52%	8,424,937,474	1
	China	**1,453,297,304**	0.06%	17.25%	8,424,937,474	2

Source: www.worldometers.info

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India is the second largest producer of Agricultural product contributing 7.68 % of total global output.

The GDP contribution through Agricultural sector was about 17.8 % which is very much higher than the world's average of 6.1 %. But it is declining continuously from 1950.

The decrease in the share in GDP of the country in comparison to other sectors is on account of structural changes due to a shift from a traditional agrarian economy to industry and service dominated one. There is movement of Agricultural workers to higher productivity sectors.

During the period from 2004 to 2012, there was an increase in the size of total work force in the country, but the size of Agricultural work force reduced by 30.57 million people.

Indian Agriculture is not remunerative and sustainable.

The factors may be many like

- *low productivity,*
- fragmented land holdings,
- poor irrigation facilities,
- rudimentary market infrastructure,
- poor application of technology,
- destitute use of good practices,
- weak HRD base and
- poor extension services.

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If immediate measures are not taken to reduce labour requirement, productivity of farms may get affected.

Key stakeholders like farmers, industry and government need to take necessary steps to alleviate the problem of labour shortage.

Techniques that can replace and/or reduce the requirement of human labour such as **mechanization,** promoting use of labour reducing seed technology are to be adopted

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Agricultural Mechanization has played a major role in increasing production and productivity, profitability of farming, through appropriate mechanization inputs for production and post production agriculture. To put forth complete use of Agricultural Mechanisation, at the milieu of increasing demand of food, strategies and policies are to be formulated to achieve the food production. The concept of this very conference "***An integrated approach involving all the key stake holders at national and regional levels is necessary in the form of University and College education, Vocational training programmes'*** is hence relevant.

The structure of agricultural education and training are important for effective, efficient and skilled positional work force and economic growth.

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Higher education and research institutions that offer Agricultural Engineering/ Mechanization Programme and their Programme settings in India

To empower Indian Agriculture, the Indian Council of Agricultural Research (ICAR) was established during 1929 at New Delhi. It is an autonomous oragnisation under the Department of Agricultural Education and Research(DARE), Ministry of Agriculture and Farmers Welfare, Government of India.

The council is the zenith body for coordinating, guiding and education in Agriculture including, Horticulture, Fisheries and animal sciences in the entire country. There are 101 ICAR Institutes and 71 Agricultural Universities spread across the country. This is one of the largest Agricultural systems in the world. There are 56 State Agricultural Universities in India, 4 Central Universities (having agriculture faculty) and 1 Central Agricultural University.

Union Minister of Agriculture Ex-Officio President

Minister of state for Agriculture,DARE

Secretary DARE and Director General,ICAR

8 - Deputy Director Generals

24 - Assistant Director Generals

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Divisions

- Crop Science
- Horticultural Science
- Natural Resource Management
- Agricultural Engineering
- Animal Science
- Fisheries Science
- Agricultural Education
- Agricultural Extension
- Knowledge Management
- Administration
- Finance

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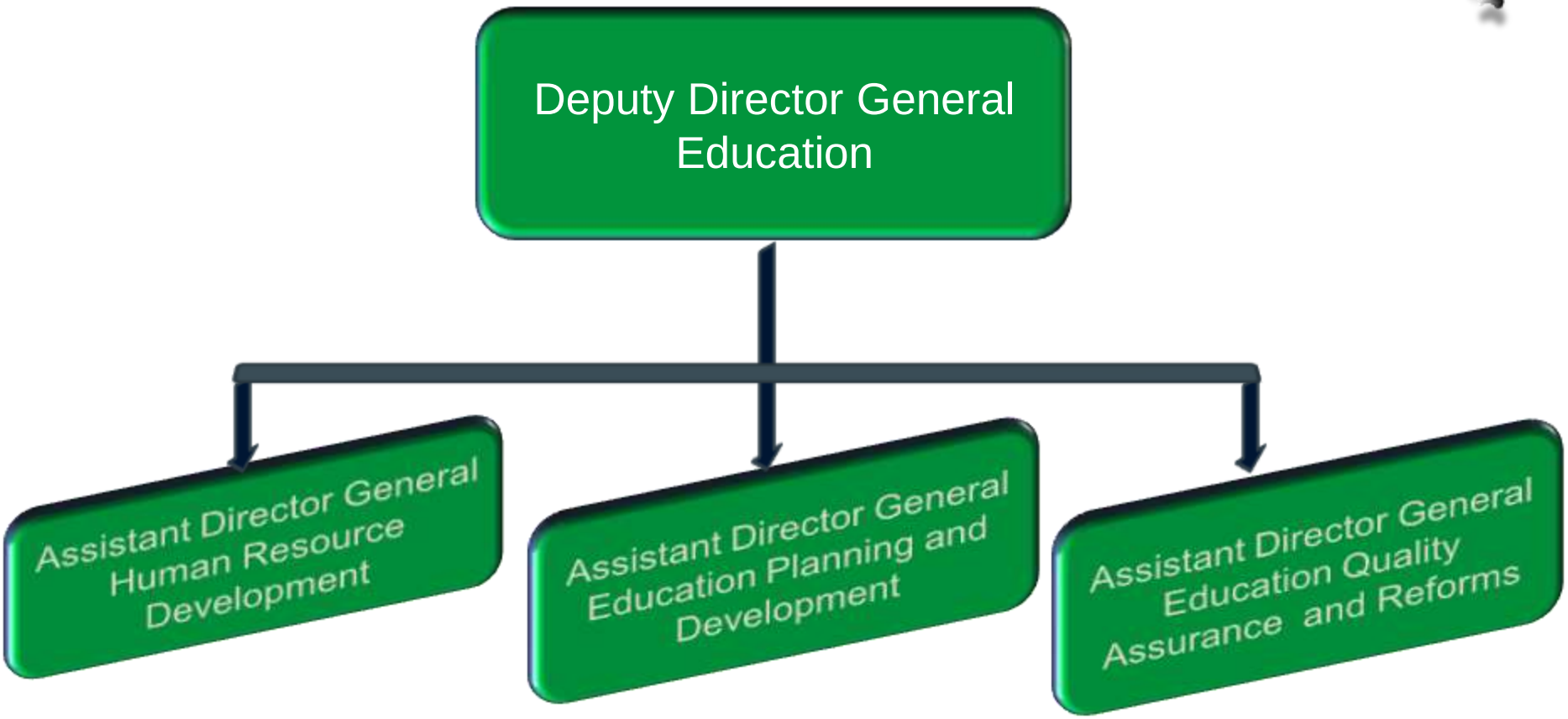
Deputy Director General
Education
Assistant Director General
Human Resource
Development
Assistant Director General
Education Planning and
Development
Assistant Director General
Education Quality
Assurance and Reforms

The National agricultural education system has several activities through a major scheme entiltled ***"Strengthening and Development of Higher Agricultural Education in India"*** which includes

1. Development and Strengthening of Agricultural Universities, Niche Area of Excellence, Experiential Learning and Library strengthening,
2. Educational Quality and Reforms
3. Human Resource Development and
4. Modernization of Agricultural University Farms

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The National Academy of Agricultural Research Management (NAARM) a constituent component of the Division facilitates capacity-building of the National Agricultural Research System (NARS).

Further, a time-bound special initiative, Indo-US Agricultural Knowledge Initiative (AKI) has also been steered for targeted capacity-building by the division.

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Indian Council of Agricultural Research

(Institutes, Bureaux, Project Directorates and National Research Centres)

• 49 ICAR Institutes • 6 Bureaux • 25 Project Directorates • 17 National Research Centres
• 78 AICRPs/AINPs • 589 Krishi Vigyan Kendras (KVK) • 46 State Agricultural Universities (SAUs)
• One Central Agricultural University and 4 Central Universities having faculty of agriculture

Entity ID	Headquarters
1	Indian Council of Agricultural Research, New Delhi
	ICAR Institutes
2	Indian Agricultural Research Institute, New Delhi
3	Indian Agricultural Statistics Research Institute, New Delhi
4	National Academy of Agricultural Research Management, Hyderabad, Andhra Pradesh
5	Central Research Institute for Dryland Agriculture, Hyderabad, Andhra Pradesh
6	Central Soil Salinity Research Institute, Karnal, Haryana
7	National Dairy Research Institute, Karnal, Haryana
8	Central Avian Research Institute, Bareilly, Uttar Pradesh
9	Indian Veterinary Research Institute, Bareilly, Uttar Pradesh
10	Central Institute for Cotton Research, Nagpur,
11	Central Institute for Research on Buffaloes, Hisar, Haryana
12	Central Institute for Research on Cotton Technology, Mumbai, Maharashtra
13	Central Institute of Fisheries Education, Mumbai
14	Central Institute for Research on Goats, Mathura, U.P.
15	Indian Institute of Sugarcane Research, Lucknow, U.P.
16	Central Institute for Subtropical Horticulture, Lucknow, U.P.
17	Central Institute of Agricultural Engineering, Bhopal, M.P.
18	Indian Institute of Soil Science, Bhopal, Madhaya Pradesh
19	Central Institute for Arid Horticulture, Bikaner, Rajasthan
20	Central Institute of Brackishwater Aquaculture, Chennai
21	Central Institute of Post Harvest Engineering & Technology, Ludhiana, Punjab
22	Central Institute of Temperate Horticulture, Srinagar, J&K
23	Central Marine Fisheries Research Institute, Cochin
24	Central Institute of Fisheries Technology, Cochin
25	Central Plantation Crops Research Institute, Kasaragod
26	Central And Zone Research Institute, Jodhpur, Rajasthan
27	Central Potato Research Institute, Shimla, H.P.
28	Central Research Institute for Jute and Allied Fibres, Barrackpore, West Bengal
29	Central Inland Fisheries Research Institute, Barrackpore
30	Central Rice Research Institute, Cuttack, Orissa
31	Central Sheep and Wool Research Institute, Avikanagar
32	Central Soil and Water Conservation Research and Training Institute, Dehradun, Uttarakhand
33	Central Tobacco Research Institute, Rajamundry, A.P.
34	Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala
35	ICAR Research Complex for Eastern Region, Patna, Bihar
36	ICAR Research Complex for Goa, Goa
37	ICAR Research Complex for NEH Region, Ri Bhoi,
38	Central Agricultural Research Institute, Port Blair, A&N
39	Indian Grassland & Fodder Research Institute, Jhansi, U.P.
40	Indian Institute of Horticultural Research, Bengaluru
41	National Institute of Animal Nutrition and Physiology, Bengaluru, Karnataka
42	Indian Institute of Natural Resins and Gums, Ranchi
43	Indian Institute of Pulses Research, Kanpur, U.P.
44	Indian Institute of Spices Research, Marikunnu, Kerala
45	Indian Institute of Vegetable Research, Varanasi, U.P.
46	National Institute of Research on Jute and Allied Fibre Technology, Kolkata, West Bengal
47	National Institute of Abiotic Stress Management, Malegaon, Pune, Maharashtra

Entity ID	ICAR Institutes
48	Sugarcane Breeding Institute, Coimbatore, Tamil Nadu
49	Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, Uttarakhand
50	Central Institute of Freshwater Aquaculture, Bhubaneshwar, Orissa
	Bureaux
51	Agriculturally Important Micro Organisms, Mau Nath Bhanjan, Uttar Pradesh
52	Agriculturally Important Insects, Bengaluru, Karnataka
53	Animal Genetic Resources, Karnal, Haryana
54	Fish Genetic Resources, Lucknow, Uttar Pradesh
55	Plant Genetic Resources, New Delhi
56	Soil Survey & Land Use Planning, Nagpur, Maharashtra
	Project Directorates
57	Maize Research, New Delhi
58	Floricultural Research, New Delhi
59	Seed Research, Mau Nath Bhanjan, Uttar Pradesh
60	Wheat, Karnal, Haryana
61	Animal Disease Monitoring and Surveillance, Bengaluru
62	Farming Systems, Meerut, Uttar Pradesh
63	Cattle, Meerut, Uttar Pradesh
64	Foot and Mouth Disease, Mukteshwar, Uttarakhand
65	Poultry, Hyderabad, Andhra Pradesh
66	Oilseeds Research, Hyderabad, Andhra Pradesh
67	Rice Research, Hyderabad, Andhra Pradesh
68	Cashew Research, Dakshina Kannada, Karnataka
69	Onion and Garlic Research, Pune, Maharashtra
70	Groundnut Research, Junagarh, Gujarat
71	Medicinal and Aromatic Plants Research, Anand, Gujarat
72	Mushroom Research, Solan, Himachal Pradesh
73	Oilpalm Research, West Godavari, Andhra Pradesh
74	Sorghum Research, Hyderabad, Andhra Pradesh
75	Soybean Research, Indore, Madhya Pradesh
76	Weed Science Research, Jabalpur, Madhya Pradesh
77	Women in Agriculture, Bhubaneshwar, Orissa
78	Rapeseed-Mustard Research, Bharatpur, Rajasthan
79	Cold Water Fisheries, Bhimtal, Uttarakhand
80	Water Management, Bhubaneshwar, Orissa
81	Information and Publications of Agri., Pusa, New Delhi
	National Research Centre
82	Agricultural Economics and Policy, New Delhi
83	Integrated Pest Management, New Delhi
84	Plant Biotechnology, New Delhi
85	Agroforestry, Jhansi, Uttar Pradesh
86	Banana, Thiruchirapalli, Tamil Nadu
87	Citrus, Nagpur, Maharashtra
88	Equines, Hisar, Haryana
89	Grapes, Pune, Maharashtra
90	Litchi, Muzaffarpur, Bihar
91	Orchids, Gangtok, Sikkim
92	Meat, Hyderabad, Andhra Pradesh
93	Camel, Bikaner, Rajasthan
94	Mithun, Dimapur, Nagaland
95	Pig, Guwahati, Asom
96	Pomegranate, Solapur, Maharashtra
97	Seed Spices, Ajmer, Rajasthan
98	Yak, West Kameng, Arunachal Pradesh

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Source:http:www.icar.org.in

State Agricultural universities

The Bachelor's degree offered in the State Agricultural Universities covers all the basic engineering courses and agricultural sciences in the first two years and goes on to teach Agricultural engineering specifically in the rest of the course tenure. These undergraduate courses are generally four year courses.

At Post graduate level, specialization in the constituent fields like farm machinery, crop process engineering, soil and water conservation and irrigation practices are dealt with.

The Ph.D programmes are offered only in a few colleges.

About 1400 students are graduating each year. Out of these only few are preferring higher education, most of them are employed in Private and Government sectors.

Agricultural Engineering Colleges

S.No.	State	Number of Colleges
1.	Andhrapradesh	13
2.	Arunachal Pradesh	1
3.	Assam	1
4.	Bihar	4
5.	Chhatsigarh	3
6.	Delhi	1
7.	Gujarat	5
8.	Haryana	2
9.	Jammu and Kashmir	1
10.	Karnataka	2
11.	Kerala	2
12.	MadhyaPradesh	2
13.	Maharashtra	13
14.	Manipur	1
15.	Orissa	2
16.	Punjab	1
17.	Rajasthan	5
18.	Sikkim	1
19.	Tamil Nadu	2
20.	Telangana	1
21.	UttarPradesh	25
22.	Uttarakhand	1
23.	West Bengal	1
		90

Tamil Nadu Agricultural University (TNAU) rated as the Best Agricultural University in India by Indian Council of Agricultural Research, New Delhi is an institute of excellence for higher education in Agricultural and allied subjects. It was established in the year 1868 as an Agricultural school at Chennai, Tamil Nadu. It was later relocated at Coimbatore as Madras Agricultural College. During 1971, Tamil Nadu agricultural University was established.

The University is offering Thirteen Undergraduate Degree Programs, Forty Graduate Degree Programs and Twenty six Doctoral Programs in 14 Colleges distributed in 11 campuses all over Tamil Nadu. TNAU has 36 Research Centers for agrotechnology development and 14 Farm Science Centers for outreach.

Agricultural Engineering College and Research Institute, Coimbatore is one of the constituent colleges of the Tamil Nadu Agricultural University. This is the first college started in South India for providing agricultural engineering education in 1972. The mission is to help the farming community in improving their levels of living, by developing and disseminating Agricultural Engineering technologies through quality research, education and training.

Masters degree programmes in Agricultural Engineering were started during the year 1977 and Ph.D. in Agricultural Engineering was started in the year 1987.

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The college was shifted to Kumulur, the only constituent College of Tamil Nadu Agricultural University offering B.Tech.(Agrl.Engg) and Masters and Doctoral programmes in Farm machinery and soil and water conservation engineering

The total number of seats offered in the B.Tech(Agrl.Engg) programme are 80.

For ICAR candidates 15 seats are allotted, 10 seats are allotted for Non Resident Indians and 10 seats under Industrial sponsorship, with an aim to coordinate with industrial people in human resource development.

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The college at Coimbatore offers four-year degree programme in B.Tech. (Food Process Engineering) started in the year 1998 and B.Tech. (Energy and Environmental Engineering) was started as first of its kind in the entire country in 2004. Masters and Doctoral programmes in the field of Food and Agricultural Processing and Bio Energy are offered in the Coimbatore campus.

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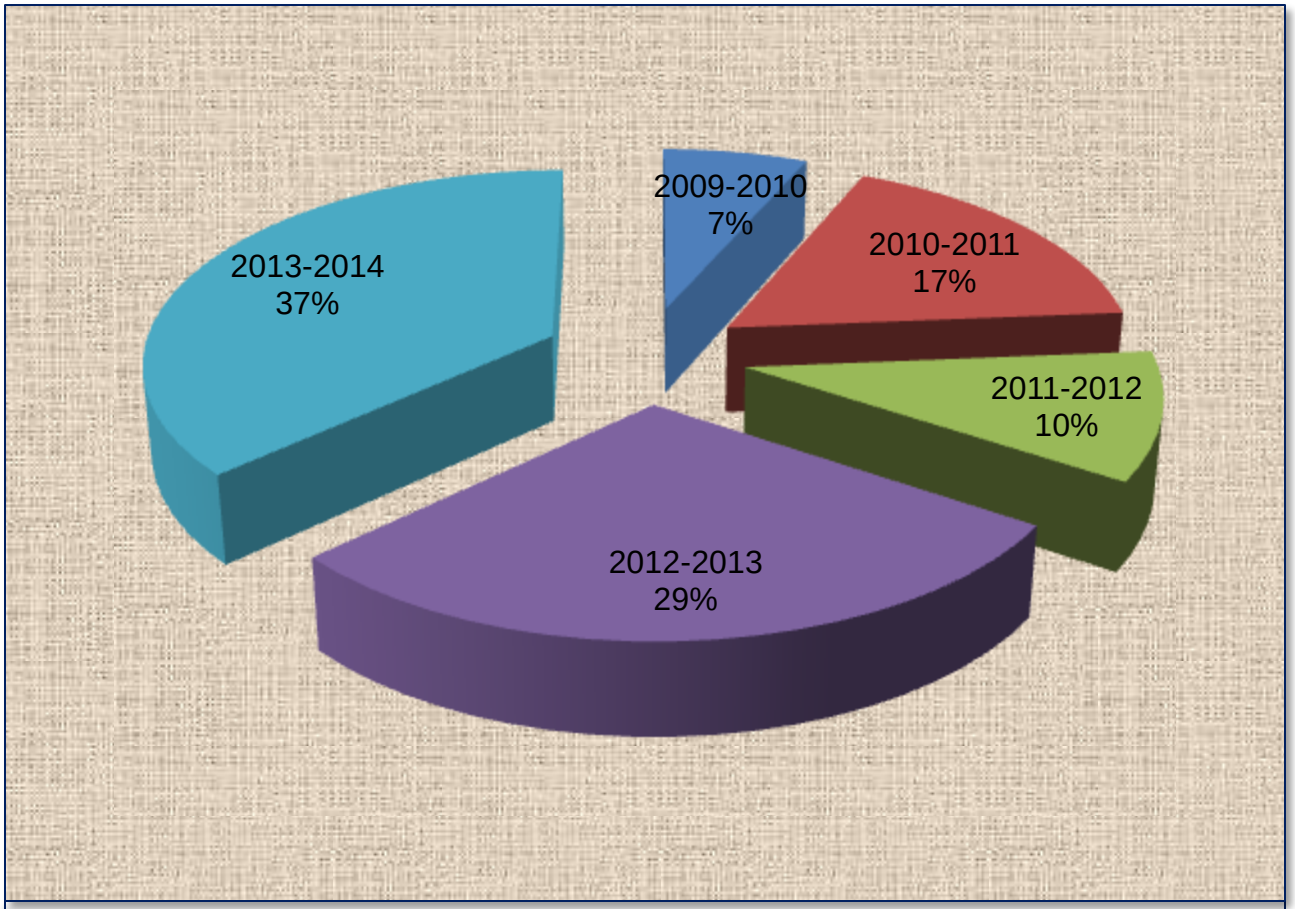

Students joined in Higher studies during 2009-2014 from AEC&RI, TNAU

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Need assessment, challenges and constraints faced of the higher education and research institutions for human resource development of agricultural mechanization in India

Agricultural Mechanisation should be farmer friendly. The development in this field should be in synchronization with the developments of other disciplines of science and engineering. With increase in number of Engineering colleges all over the country from 1,511 colleges in 2006-07 to an amazingly high 3,345 in 2014-15, other disciplines of Engineering, like mechanical, electrical, electronics, robotics, are eager to do research in Agricultural engineering.

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But unfortunately, since of their lack in exposure to agricultural crops and practices as taught in Agricultural engineering, they are not able to succeed in their effort in developing useful machinery.

Though the syllabus content of Agricultural engineering has been formulated with inclusion of all the basic engineering courses, knowledge in specialized subjects such as automation is not possible. So human resource development in Agricultural engineering in the evolving scenario of our country is a challenge. However relevant knowledge on these subjects are being added periodically to the ag engng curriculum.

Fortunately this is happening in many of the State Agricultural Universities. Over the past two decades, India has transformed higher education in to a low cost/high class education for students of all levels.

But India's higher education institutions are not the best in the world. However, India's post secondary education system is reasonably good leading to the fact that India has emerged as the regional hub of education and attracts learners from all over the world.

These higher virtues of education can be imparted in Agricultural engineering also.

The mission of higher education is to provide employability, quality, justice and to create a knowledgeable society and economy.

Constraints

- The education system is staff-centric rather than student-centric.
- The evaluation of colleges and teachers should be done periodically.
- There should be better sharing of resources between universities
- Financial constraint.
- The funds are to be spent effectively.
- There should be more smart class rooms and virtual laboratories
- The syllabus should be revised regularly.
- The digital connectivity should be enhanced and Meta Universities are to be established.

Suggestions for regional cooperation on higher education and joint research of human resource development of agricultural mechanization

The twelfth five year plan(2013-2017) for higher education offers three challenges namely excellence, equity and expansion to improve teaching and learning, involving all category of people in the society and scaling up the capacity in existing institutions.

To meet the future needs,

- A learner centered paradigm of education should be adopted
- Industry oriented courses are to be included in the syllabus.
- The research and education should be in collaboration with international institutes.
- There should be conducive research environment with high quality research oriented faculty members.
- The infrastructure development plays a major role to improvise high quality higher education.
- Low cost, high quality education can be provided through MOOCs(Massive Open Online courses) platform.
- These require contact practical classes where it was found to be very effective in real class rooms.

Contributions from Tamil Nadu Agricultural University for regional cooperation

Many of the scientists of Tamil Nadu Agricultural University have been trained abroad under Swedish International Development Cooperation Agency and Agricultural Human Resource Development Project funded by the World bank.

There is also student's exchange programme with Canadian Universities like McGill University and Cornell University in USA

Students from South African countries like Nigeria, Kenya and also from Iran are pursuing higher studies in Agricultural Engineering at Tamil Nadu Agricultural University. Many programmes are being devised to empower the students to meet the global needs.

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Conclusions

The human resource base has to be improved to meet the global as well as local demands. Necessary initiatives have to be taken for intensifying this and the role of Universities is vital in strengthening the skill and knowledge base. The capacity building may go with international collaboration in teaching and research activities.

Digital learning techniques through ICT enabled system, Open Educational resources and MOOC platforms where the students can access the best teaching materials are to be strengthened.

The teachers are to be trained to handle the Flipped class room model where the class room can be used for higher level understanding and skill development.

With regional cooperation and revised policies of the Government in improving higher education, India will become the major talent resource for the world and best Regional Education hub for higher education at low cost, attracting learners from all over the world.

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During the past twenty years, due to retirements there is a generation gap opening up and human resources development has not been given much importance. There should be more investment in this sector

A lot can be achieved with new technologies, but only if we have dedicated and earnest people who develop them, make sure that they meet farmers' needs, and bring them to farmers.

The developments in other fields like Robots, computers or smart phones cannot do that. They are supportive paraphernalia, but not the primary means for enacting behavior change in the complex world of agriculture.

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My sincere gratitude to

The Participants and Organisers

Head, Centre for Sustainable Agricultural Mechanization,China

Director General, ICAR, New Delhi, India

Deputy Director General(Agrl.Engg), ICAR, New Delhi

Assistant Director General,(Farm Engg),ICAR,New Delhi

Vice Chancellor, Tamil Nadu Agricultural University, Coimbatore

Dean, Agricultural Engineering College and

Research Institute, Coimbatore

Others who helped me in this endeavor

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