Human Resource Development for Sustainable Agricultural Mechanization in Pakistan

by

DR MUNIR AHMAD

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Facts about Pakistan Agriculture

- Agriculture accounts for 20.9% of the Gross Domestic Product (GDP)
- It is source of livelihood of 43.5% of rural population
- More than 1.5 million people are directly engaged in agricultural mechanization

Facts about Pakistan Agriculture

- Largest food crop is wheat with annual production of about 25.0 million tons
- Second largest food crop is rice with annual production of 6.8 million metric tons
- Annual production of cotton is about 14.0 million bales, and sugarcane production is 62.7 million tons.

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Status of Agricultural Mechanization

Machinery	1968	1975	1984	1994	2004	% of Tractors
Tractor	18900	35714	157310	252861	401663	100
Cultivator	14338	31619	146863	236272	369866	92
MB Plow	2335	2734	7319	28413	40050	10
Disc Plow	2513	2938	6355	20372	29218	7
Blade	3925	4200	69004	164489	233126	58
Chisel Plow	-	-	712	6535	8514	2
Rotavator	-	-	2101	5594	47919	12
Bar/Disc Harrow	2007	2373	8140	13233	23764	6

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Status of Agricultural Mechanization

Machinery	1968	1975	1984	1994	2004	% of Tractors
Ridger	-	120	4711	10984	71338	18
Grain Drill	563	1174	11251	64126	70810	18
Sprayer	-	473	-	20778	21756	5
Trailer	-	18074	98787	176412	242655	60
Thresher	-	5635	78377	112707	137270	34
Reaper	-	-	-	8073	5341	1
Combine Harvester	-	-	-	395	1524	
Laser Leveler	-	-	-	-	2785	1

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Tractor Manufacturing Industry

TRACTORS MODEL – HORSE POWER (HP)	PRICE / UNIT INCLUDING GST (RS.)	PRODUCTION (IN NOS.) (July-March 2014-15)
M/s Al-Ghazi Tractors		
NH 480-S (55HP)	706,200	3,630
NH 480-S with power (55HP)	717,200	1,285
Ghazi (65 HP)	785,400	5,641
NH 640 (75HP)	998,800	1,182
NH 640 WBD (75HP)	1,009,800	67
NH 640-S (85HP)	1,098,000	34
NH 640-S (WBD) (85 HP)	1,115,400	31
NH 55-56 (55HP)	756,800	3
NH 60-56 (60HP)	841,500	-
NH 70-56 (85hp)	1,424,500	45

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Tractor Manufacturing Industry

TRACTORS MODEL – HORSE POWER (HP)	PRICE / UNIT INCLUDING GST (RS.)	PRODUCTION (IN NOS.) (July-March 2014-15)
M/s Millat Tractors Ltd		
MF-240 (50 HP)	715,000	8,668
MF-350 plus (50 HP)	761,200	50
MF-260 (60 HP)	794,000	4,104
MF-360 (60 HP)	819,500	920
MF-375-S (75 HP)	1,039,500	2,892
MF-385 (85 HP)	1,160,500	920
MF-385 4WD (85 HP)	1,760,000	171
Total:		31,963

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Tractors used in Pakistan

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Agricultural Machinery & Implement Manufacturing Industry

- More then 500 manufacturers are engaged in manufacturing of following machines:

  - Tillage equipments (primary & Secondary)
  - Seed bed preparation equipment
  - Planting and inter-culture equipment
  - Harvesting & threshing equipment
  - Crop protection and haulage equipment

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DISC PLOUGH
MT - 765

OFFSET DISC HARROW
MT-03
MOUNTED CUM TRAILED

POST HOLE DIGGER
MT- 815

Agricultural Mechanization Research

- So far agricultural mechanization research proves to be worth in Pakistan
- Following machines were adapted in Pakistan.
  - Reaper – wind rower
  - Zero-tillage drill
  - Groundnut digger & thresher
  - Throw-in type paddy thresher
  - Pneumatic row crop planter
  - Wheat Straw chopper

Agricultural Mechanization Research

- Following machines were developed in the country.
  - Solar-cum-gas fired date dryer
  - Fertilizer band placement drill
  - Mobile seed processing unit
  - Mobile flat bed dryer
  - Seeder for combine harvested paddy fields

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Zero Till Drill

Fertilizer Brand Placement Drill

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Peas Planter

Powered Disc

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Groundnut Thresher

Rice Thresher

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In-Bin Seed Drying & Storage Technology

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Wheat Straw Chopper-cum-Blower

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Solar-cum-gas fired date dryer

Solar Tunnel Dryer

New Areas in Agricultural Mechanization Research

- Precision agriculture
- Alternative energy technologies
- Environmental engineering
- Post Harvest Mechanization
- Livestock Mechanization

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Employment status of Agricultural Mechanization

i. Employment Status in Universities:

Sr. No	University	Faculty/Department	Professors	Associate Professors	Assistant Professors	Lecturers	Assistant Executive Engineers	Technician / Lab Asstt.
1	University of Agriculture, Faisalabad	Faculty of Agricultural Engineering and Technology	6	4	9	30	16	18
2	PMAS - University of Arid Agriculture, Rawalpindi	Faculty of Agricultural Engineering and Technology	2	1	1	4	1	5
3	Bahauddin Zakariya University College of Agriculture, Multan	Department of Agricultural Engineering	0	1	5	5	2	5

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Employment Status in Universities:

4	Sindh Agriculture University, Tandojam	Faculty of Agricultural Engineering	4	2	13	9	0	10
5	Khairpur College of Agricultural Engineering and Technology.	Affiliated with Sindh Agriculture University, Tandojam	1	0	1	6	0	2
6	University of Engineering and Technology, Peshawar	Department of Agricultural Engineering	4	1	4	5	0	8
		Total:	**17**	**9**	**33**	**59**	**19**	**48**

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ii. Employment in PARCs:

Sr. No.	Organization	Division/Institute	Chief Scientist-II	Principal Engineer	Senior Scientific Officer	Scientific Officer	Technician
1	Pakistan Agricultural Research Council	Agricultural Engineering Division	1	2	0	0	0
2	National Agricultural Research Centre	Agricultural and Biological Engineering Institute	0	5	2	15	20
		Total:	**1**	**7**	**2**	**15**	**20**

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Manpower Employed in Departments of Agriculture of Provinces

Province	Organization	Directorates	Director Agri. Engg	Agricultural Engineer	Asstt. Agri. Engineer	Technicians
Punjab	Directorate of General Agriculture (Field)	Directorates of Agricultural Engineering, Multan, Lahore, Faisalabad, Rawalpindi	05	22	107	2348
Sindh	Field Director General Agriculture	Directorate General Agricultural Engineering and Water Management	01	05	22	500

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Manpower Employed in Departments of Agriculture of Provinces

Province	Organization	Directorates	Director Agri. Engg	Agricultural Engineer	Asstt. Agri. Engineer	Technicians
Khyber Pakhtunkhwa	Field Director General Agriculture	Directorate of Agricultural Engineering	1	3	11	240
Baluchistan	Field Director General Agriculture	Directorate of Agricultural Engineering	1	1	3	50
		Total:	**8**	**31**	**143**	**3188**

Employment in Agricultural Machinery Manufacturing Industries

- **Agricultural machinery industry is engaged in manufacturing of tractors, agri. Implements, threshers, and planting machinery. The industry employed about:**

Managers	675
Secretarial staff	623
Foreman / Supervisor	595
Engineers	245
Technicians / Helpers	8775
Total:	**10,913**

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Employment as Tractor Operators and Skilled Laborers in Tractor Repairing Workshop

- About 527,195 tractors are in the country
- About 2500 tractor repairing workshops are in the country
- About 10,54,540 persons are employed as tractor operators, helpers and skilled laborers in tractor repairing workshops.

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Licensing / Regulations of agricultural engineers, operators and technicians

- Pakistan Engineering Council (PEC) is responsible for registering the Engineers in Pakistan including the agricultural engineers.
- About 3737 registered agricultural engineers are in Pakistan.
- PEC also conducts exam to provide the certificate of professional engineers.

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Licensing / Regulations of agricultural engineers, operators and technicians

- Technicians are trained in different technical and vocational training schools.
- Tractor operators are trained in agricultural machinery training schools and in technical training centers.
- But majority of tractor operators and technicians are self couched by attaching themselves with the experienced one.

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Institutions of higher learning in agricultural mechanization human resource development

- University of Agriculture, Faisalabad
- University of Engineering & Technology, Peshawar
- PMAS – University of Arid Agriculture, Rawalpindi
- Sindh Agriculture University, Tandojam
- Bahauddin Zakariya University College of Agriculture, Multan.
- College of Agricultural Engineering, Khairpur, Sindh

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Annual Enrolment in Institutions of Higher Learning

Sr. #	University	Faculty / Department	Degree Programs		
			B.Sc. Agricultural Engineering	M.Sc. (Hons.) Agricultural Engineering	PhD Agricultural Engineering
1	University of Agriculture, Faisalabad	Faculty of Agricultural Engineering and Technology	217	70	12
2	PMAS - University of Arid Agriculture, Rawalpindi	Faculty of Agricultural Engineering and Technology	51	12	7
3	Bahauddin Zakariya University College of Agriculture, Multan	Department of Agricultural Engineering	63	18	-

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Annual Enrolment in Institutions of Higher Learning

Sr. #	University	Faculty / Department	Degree Programs		
			B.Sc. Agricultural Engineering	M.Sc. (Hons.) Agricultural Engineering	PhD Agricultural Engineering
4	Sindh Agriculture University, Tandojam	Faculty of Agricultural Engineering	198	50	10
5	Khairpur College of Agricultural Engineering and Technology.	Affiliated with Sindh Agriculture University, Tandojam	60	-	-
6	University of Engineering and Technology, Peshawar	Department of Agricultural Engineering	36	15	5
		Total:	**625**	**165**	**34**

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Technical Education and Vocational Training Authorities

- **Punjab Technical Education and Vocational Training Authority (TEVTA) was formed through an ordinance (No xxiv of 1999) promulgated by Governor of the Punjab which has now been replaced by TEVTA Act x of 2010. Forty-six TEVTA Centers offered courses in Auto and Farm Machinery.**

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Technical Education and Vocational Training Authorities

- **Under the administrative control of TEVTA Punjab, a Center for Agricultural Machinery Industries is operational at Mian Channu. This center was established with technical and financial assistance of the Royal Netherland Government in 1992. It offered technical courses in different trades, and provide services related to common manufacturing facilities to agricultural machinery industry in the area.**

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Technical Education and Vocational Training Authorities

Persons trained in TEVTA (Punjab) Centers from 2009 to 2015

COURSE	2009	2010	2011	2012	2013	2014	2015	Total
Auto and Farm DAE (36 M)	63	83	118	170	119	94	58	705
Auto and Farm (G-II) (24M)	69	21	91	95	115	138	25	554
Auto and Farm Machinery (G-III) (24M)	67	105	103	125	80	85	9	574

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Technical Education and Vocational Training Authorities

- **Sindh Technical Education and Vocational Training Authority were established to undertake and manage TEVTA institutions in the province**

- **There are 250 training centers being managed by Sindh TEVTA, but only one center at Khairpur is offering training courses in Auto and Farm Machinery with annual enrolment of 25 students.**

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Technical Education and Vocational Training Authorities

- **Khyber Pakhtunkhwa Technical Education and Vocational Training Agency (TEVTA) was established under the TEVTA ordinance XXXVIII of 2002. There are 100 training centers / technology colleges are being managed by this agency, but not even a single center is offering course related to Auto and Farm Machinery /Tractor Operators.**

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Need assessment of human resource development

Need assessment of PhDs.

Sr. No.	Area of Specialization	Level of Training	Number to be Trained
1	Agricultural Engineering with specialization in precision Agriculture	PhD	10
2	Agricultural/Energy system engineering with specialization in wind, solar and biomass energy	PhD	15

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Need assessment of human resource development

Need assessment of PhDs.

Sr. No.	Area of Specialization	Level of Training	Number to be Trained
3	Agricultural/Food Engineering with specialization in post harvest processing and food Engineering	PhD	15
4	Agricultural Engineering with specialized in livestock Mechanization	PhD	5

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Need assessment of human resource development

Need assessment for training of technicians.

Sr.No.	Trade for Training	Number to be Trained
1	Machinist	2000
2	Welder	2000
3	Welder (gas& other types)	1000
4	Fitter	1000
5	Jigs and Fixture designer	500
6	AutoCAD	100
7	Agricultural Machinery Operators	50,000

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Challenges and constraints faced for human resource development of agricultural mechanization in Pakistan

- Country-wide schools does not exist for training of agricultural machinery operators. However, where schools exist, the resource poor people do not send their off springs for training because of limited resources in hand.
- Untrained manpower is the major cause of the inefficient use of farm machines. Most operators of tractors, threshers, drills, and sprayers are self coached. Their knowledge about the use of these machines is very poor. There is legislation that tractor operator must get the driving license, but in rural areas this legislation is not being implemented.

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Challenges and constraints faced for human resource development of agricultural mechanization in Pakistan

- Because of economic reasons, the resource poor people do not send their off springs in training centers, rather they prefer to attach them with any agricultural machinery manufacturing industry for training.
- As there is no legislation to ensure quality of locally produced machines, therefore, agricultural machinery manufacturers do not bother to hire Professional Engineers and trained technicians at their premises.

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Challenges and constraints faced for human resource development of agricultural mechanization in Pakistan

- There is no scholarship program for university graduates for higher education in agricultural mechanization in technological advanced countries.
- There are no visit exchange programs for academicians, researchers, and agricultural machinery manufacturers even in the regional countries.

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Solutions and suggestions for human resource development for sustainable agricultural mechanization:

- Scholarships may be provided to the students of various centers of technical education and vocational training authorities, who are engaged in providing training related to operation and maintenance of agricultural machinery.

- A project can be initiated to train PhDs from agricultural research institutions in various disciplines of agricultural mechanization from the institutions of technologically advanced countries.

- The man power of the Faculty of Agricultural Engineering of various Universities may be trained from technologically advanced countries in the area of Precision agriculture, renewable energy, post-harvest processing and Food Engineering.

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Solutions and suggestions for human resource development for sustainable agricultural mechanization:

- Training schools for agricultural machinery operators may be established at District level and scholarships may be provided to students of these schools during their training program. In addition, the existing schools may be strengthened.

- Centers for Agricultural Machinery Industries may be established at District level (similar to already been established in Mian Channu) for:

  - Training man power in different technical trades.
  - Assisting local agricultural machinery industry in manufacturing critical parts of agricultural machinery and in providing heat treatment and other facilities.

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Solutions and suggestions for human resource development for sustainable agricultural mechanization:

- Small scale on-farm value addition units in production catchments may be established for training of rural masses in various value added technologies.

- Regional industrial visit programs may be arranged in order to enhance the knowhow of the small scale manufacturers of agricultural machinery industry.

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Solutions and suggestions for human resource development for sustainable agricultural mechanization:

- Regional visit exchange programs may be arranged for academicians and researchers in regional countries in order to initiate cooperation in different fields of agricultural mechanization.
- There is need to develop linkage among the universities, R&D institutions, and local manufacturing industry, in order to improve the quality of graduate engineers.
- There is need for legislation to enforce local agricultural machinery manufacturers to hire qualified engineers and technicians.

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Conclusions:

- There is need to train human resource in agricultural mechanization in fields such as precision agriculture, post harvest processing, on-farm value addition, and renewable energy resources.
- There is need to review the performance of technical / schools and centers and necessary measures should be taken to increase their enrolment and quality of trainings.
- There is need that an integrated approach may be adopted involving all stakeholders both at national and regional levels to improve the education at universities, technical and vocational colleges and training schools related to agricultural mechanization.

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Thank you very much