Development of Agriculture engineering in Pakistan

– a case study of Sindh

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The agriculture engineering not only applies to agriculture but also to animal husbandry, fisheries, dairy industry and food preservation. In any of these fields 95 per cent of the costs involved are engineering in nature and only trained engineers would be able to handle the job.

Beginnings

On the recommendation of the Royal Commission on Agriculture in 1928, the Government of India started executing various schemes in agriculture sector and agricultural engineering became a new as well as an important subject thereby. It was to be developed independently according to the needs of each province, with some central financial assistance from time to time.

Before the establishment of Agriculture Engineering section in Sind the Bombay Government had already started promoting the use of agricultural implements. This was also prelude to opening of Sukkur Barrage and its anticipated requirements. A number of animal drawn implements were introduced, which included various types of moldboard and other ploughs, ridgers, seed drills Cambridge rollers, cultivators etc. A revolutionary implement of that age was Jenkins clod crusher, reported to have been designed by Mr. B.B. Desai, Deputy Director of Agriculture, in 1930 and named after Jenkins the Chief Agricultural Officer of the Bombay Presidency.

Agriculture engineering turns into land reclamation organization

Agriculture Engineering section was established in 1934, with Mr. Cumming as Agriculture Engineer in Sind. After opening of The Sukkur Barrage it was felt that the vast virgin areas newly opened, needed to be broken up by deep ploughing. The first crawler tractor k-3 was imported in 1934.

Subsequently in the same year another tractor RD-3 was procured. In 1938 one RD-7 was added and in 1940 two more D-7s were purchased. All these were Caterpillar machines. The World War-II started in 1939 and the British Government in their own Isles planned large scale mechanization. Similar plans suiting the local conditions were proposed in India. It was in pursuance of this policy that seven Fowler crawlers were ordered in 1940 but they remained

undistributed in Delhi, until 1946. Two Caterpillar D4 and two International Harvester TD-9 were also added in 1942. By then the section owned a fleet of crawlers, 108 ploughing, levelling implements consisting of moldboard ploughs, harrows, disc-tillers, cultivators, rippers and rollover scrappers to break and level the virgin soils.

Post World War-II and Independence

In 1946 it was felt that more than ploughing equipment, bulldozers were needed to level the vast lands under Sukkur Barrage. Two D6 bulldozers were ordered in 1946, two D-8 dozers in 1948, and four D-6 were added in 1950, making a fleet of 20 crawlers. In 1951 under the scheme of Mechanization of Agriculture in Sind, Seven Oliver tractors and two D4 were added. All aimed at levelling the land under Sukkur Barrage. In 1954 dozer blades were ordered for all the then existing crawler tractors and seven new TD-14 dozers were also procured. Thus the total number of working dozers was already 30 in 1955. At this time the One Unit was formed.

Drifting from mechanization to reclamation section

Agriculture Engineering in Sind thus drifted from manufacture of animal drawn implements and supply of tractors for ploughing, to reclamation of land by crawler dozers. Although the Agriculture Engineering section had, manufactured a very large number of animal drawn implements since 1934, for sale to the farmers, through the agricultural extension, but in due course of time it became a commercial organization catering for the farmers needs of and reclamation, rather than any assistance in actual mechanization of agriculture through its various stages. The Government by this time had also realized that the ploughing tractors could be kept busy only, 3 to 4 months a year, whereas, bull-dozers could work round the year and therefore land levelling operation were an economic bargain to the government, specially when, farmers paid full charges in advance. The mechanization of agriculture in its true sense thus got a strong setback. The Engineering section, at the time of formation of One Unit in 1955 had about 200 employees who were busy with bulldozer operations, almost 99% of the time and other aspects of mechanizations were over looked to achieve the reclamation role and run the organization commercially.

Since 1946 no animal drawn implements were manufactured in the agricultural workshop, which first established in Mirpurkhas in 1934 was shifted to Hyderabad in 1942. No trials on the development of the agricultural implements were undertaken and there was complete stagnancy in this field.

Sindh goes for tube wells

The Agriculture Department of the Bombay Presidency had been putting in tube-wells in Maharashtra and Gujarat but such a facility was not extended to Sind in view of large tracts of land to come under irrigation on the Sukkur Barrage. In 1946 the Agriculture Department produced first hand operated drilling rig and in next 7 years it put in only 3 tube wells, all at the Sukrand Agricultural Research Station. There was in fact no demand from rural Sind.

As early as 1934, Sind had developed the fear of shortage of water due to building 6 more barrages in the Punjab and this had lead to the Sind - Punjab Water Agreement of 1945. Due to starting of work on the Bakhra Canal System in India in 1948, it was now certain that there would be water shortages and from 1953 onwards agricultural engineering set up in Sind, had decided to extend tube wells all over the whole province. The progress was slow simply because of plentiful of land in the Sukkur Barrage and release of new lands in Kotri and Guddu Barrages, land owners preferred extensive cultivation to intensive one. By early 60s the installation of tube wells in Sind gained some momentum and by 1966, the Agricultural Engineering section had already 65 hand drilling rigs and 7 power drilling rigs.

In addition Agriculture Development Corporation of Guddu Barrage also had 3 power drilling rigs and 10 hand drilling rigs. By 1966 tube well operations had come to stay in Sind, where small sweet water belt was. All subsequent schemes for land development in Pakistan for Thal, Guddu and Kotri barrages and Soil Conservation scheme at the Sogn Valley or Baluchistan, NWFP and rain fed areas of the Punjab owe their origin to this long experience of Sind with crawlers.

Agriculture engineering set up in other provinces in 1955

Situation in the Punjab was altogether different as like UP and Bombay Presidency there was more scope for development of sweet ground water The Agricultural Engineering section in the Punjab therefore was tube-well oriented. Bahawalpur had been copying the Punjab and Baluchistan had been using the example of Sind for soil conservation with the help of bulldozers. The NWFP agriculture engineering section was virtually nonexistent except one officer to run some wheel type tractors. The Punjab had used some wheel type tractors received from Australia under Colombo Plan for ploughing. Bahawalpur, Baluchistan and Frontier had done the same but all of them showed poor results as tractors were needed only during the two ploughing seasons, which were limited to about six weeks each and during the rest of the nine months of year, tractors were idle.

Sindh and Bombay follow British tradition on recruitment of agriculture engineers

Sind had followed the example of Bombay Presidency, which had been copying the trends in England for their agricultural organizations. The British in England had expanded Agriculture Engineering activities to a very large degree during the World War-II. Manpower required for the new key positions consisted of mechanical engineers trained on the job. American had done the same in mid 30s, but they had already established many schools in Agricultural Engineering. Bombay recruited mechanical engineers to work as agricultural engineers. The most of the Indian provinces did the same. The Punjab did not need mechanical engineers for drilling and therefore they were indecisive. Baluchistan and Frontier satisfied themselves by handing over the wheel type tractors and equipment to graduates of agriculture and designating them as Mechanized Cultivation Officers. Bahawalpur recruited a one year diploma-holder in civil engineering for drilling operations. Sind followed the example of Bombay, very strictly, as they had the maximum amount of field equipment in terms of crawler machinery and recruited only qualified mechanical engineers.

A policy to blow the development of agriculture engineering

This determined the future agriculture engineering in Pakistan. Although West Pakistan Government in the beginning had insisted that only the mechanical engineers would become agriculture engineers but their existing staff coming from various provinces had to be accommodated by law and therefore the number of agricultural engineers having mechanical engineering background were always in minority. Attempts were invariably made to make graduates of agriculture as agriculture engineers and later on graduates of agriculture with honours degree in agriculture engineering were taken up as agriculture engineers. There was nothing done to correct the situation i.e., by either taking up mechanical engineers and sending them abroad for degree in agriculture engineering with more emphasis on agriculture, as well as engineering as applied to agriculture or to pick up graduates of agriculture and give them extensive training abroad on mechanical aspects of agriculture engineering. This gave a serious blow to the future development of agriculture engineering on correct lines.

Non-participation of agriculture engineers in the plant protection set the clock back by two decades

There were certain activities of the agriculture department in which agriculture engineers could have played a better role from the beginning but this was denied to them due to lack of foresight, for example plant protection equipment was introduced in Sind in 1954. Although the Central Government wanted the equipment to be owned and operated by Agriculture Engineering section, and the extension department was to work as a client as well as exercise field

supervision, the latter insisted to own and maintain the equipment themselves under their own arrangements. It was not a question of only maintaining it, but it was primarily the question of selection of correct type of equipment. The most suitable type of sprayers which could have succeeded in Pakistan's conditions were being marketed in mid 60s world over, but the extension officers who, by this time knew and understood only hand operated sprayers, knapsack hand sprayers and wheel barrow manual sprayers, could not accept anything more complicated. The trend continued up to mid 80s. If at all there has been a minor change it is only trolley power sprayers and knapsack power sprayers which were introduced any way in late 60s. All manual sprayers are meant for only kitchen gardens and all small power sprayers for very small holdings. None of them is meant for large scale spraying of field crops like cotton or orchards. This simple mistake committed 30 years ago has had far reaching consequences for Pakistan during these three decades. In my opinion the plant protection programme is an utter failure, in spite of claims to the contrary. The author has on his small farm written off at least 10 sprayers in past 20 years, and what he states is with full confidence. We are yet two decades behind, in introducing proper type of sprayers, which, could work satisfactorily. Incidentally even in all the advanced countries, not a single tractor or implement manufacturer is a sprayer manufacturer. The simple reason is that the tractor and implements technology, although mechanical in nature, is altogether different from agriculture sprayer technology. With this background country must give a thought to this unusual problem.

All activities of agriculture engineering organizations are not other than land reclamation

Since late 50s the other provinces of Pakistan copying the example of Sind went into land reclamation by bulldozers and today they are preoccupied only with it, rather than any other major field. The tube well drilling has turned into second-class duty in these organizations.

Agriculture engineering research started decaying in Sindh with the death of Mr. Cumming and finally died in mid sixties

As per decision taken in 1934 agriculture engineer in Sind was to carryout research on tractors, animal drawn implements and other innovations in agriculture engineering. This aspect remained neglected to a large degree, due to more emphasis on land reclamation. Although this appears to be apparently the main reason but it was actually the non-availability of suitable research minded engineers. Such persons cannot be recruited by the Public Service Commission's advertisements and interviews. They have to be searched, persuaded to join and work on their own conditions. At the existing salary structure of the

Government, it will be impossible to get such a person. To carryout research enormous facilities are required, which may involve some highly precision type of lab facilities and fleet of staff. Carrying out field trials on imported equipment is no sober research and manufacturing of some imported implements by copying them is also not research, although such attempts have resulted into grant of awards, rewards and titles. With such happenings the agriculture engineering research came to a complete halt in mid 60s. It has never been able to take off again.

The other important branches of agriculture engineering

The agricultural engineering includes a large number of subjects besides simple farm power and farm machinery. Following are a few examples of important fields.

Field irrigation: The irrigation Department's responsibility ends as soon as water is supplied at the head of water course from a canal, branch canal or minor canal. The field irrigation which play important role has never come up in Pakistan and is little understood. *Lining of watercourses* is just one simple application of field irrigation. How about *sprinkler irrigation, trickle irrigation, drip irrigation, precision irrigation*, leaving aside ditch and furrow irrigation? We would save water from something like 40% to 80% by proper irrigation techniques but this is nobody's baby so far. There is no guidance available. There are no designers for field layout, if these water saving techniques are introduced.

Storage of grain: It is another important agriculture engineering technology. This is not being given sufficient thought and presently some silos having concrete structure have been constructed instead of G.I sheet silos. The civil engineers designing such structures have no idea of the exact requirements of the agricultural produce to be stored and maintenance of silos with regard to temperature, circulation of air, humidity control and protection against insects pests, fungus etc.

The agriculture engineering not only applies to agriculture but also to *animal husbandry, fisheries, dairy industry* and *food preservation*. In any of these fields and specially *in fish farming, dairy industry, animal feed, food processing, meat processing, cold storage for food products etc. 95% of the costs involved are engineering in nature* and only trained engineers would be able to handle the job.

A close examination of above types of projects in Sind will show that none of them has been able to take off, in spite of past 3-4 years.[?]

All agro-industrial projects are part of agricultural engineering.

Farm and animal waste management including agro-industrial waste management is within the scope of agricultural engineering.

Fuels from bio-mass i.e., biogas, producers gas, thermal gasification of farm wastes is being handled by National Institute of Agricultural Engineers in U.K., where as in Pakistan it is being handled by Ministry of Petroleum's Energy Cell, with no participation of agricultural Engineers. Results are obvious. 26 biogas plants were recently installed at Pir Pagaro Saheb's village Pir-jo-goth. None is working.

Conclusion

The humble conclusion is that the issues discussed above need thorough probing examination and favourable consideration. What deserved to be the first rate engineering has been pushed into third rank. It needs salvaging not for its own sake but for the good of the country.

The agriculture engineering activities should include the following fields

1. Tractors and implements.
2. Farm electrification.
3. Drying and storing of grains and crops and ventilation.
4. Plant protection equipment.
5. Farm buildings structures and silos.
6. Environmental engineering as applied to rural areas.
7. Farm waste management engineering.
8. Livestock equipment and structures.
9. Poultry housing and equipment, handling and transport.
10. Forage harvesting, handling, treatment and conservation,
11. Horticultural engineering.
12. Aqua cultural environment management and structures.
13. Agricultural engineering instrumentation and control.
14. Refrigeration and cold storage as applied to agricultural produce preservation.
15. Food and feed processing engineering.
16. Agro-industry.

(This article is dedicated to the memory of Mr. J Comming, the first Agricultural Engineer in Sind - 1934 - 1939).

This article was first published in March 1985 issue of the monthly 'Pakistan Agriculture'.