MANPOWER DEVELOPMENT IN AGRICULTURAL ENGINEERING

IN SELECTED DEVELOPING COUNTRIES

MANPOWER DEVELOPMENT IN AGRICULTURAL ENGINEERING IN SELECTED DEVELOPING COUNTRIES

KREPL,V., Czech University of Life Sciences Prague, Czech Republic

Abstract

The potential and crucial role of agricultural engineering, and therefore of agricultural engineers, in development has not always been recognized. A number of spectacular failures in the past involving poorly adapted schemes of agricultural engineering let planners to neglect and even resist investment in this sector. Yet, to neglect investment in this sector denies a society the possibility of raising its agricultural performance beyond subsistence levels. Manpower development is recognized as being of prime importance for the successful execution of agricultural development programs and continues to constitute a major component of FAO activities

Objective of the project (2007) is based on the project in manpower area in agricultural engineering in Zimbabwe, Tanzania, Republic of Congo and Guinea – Conakry as the FAO follow-up project from 1989.

It is hoped that the ordered approach will allow a more rational analysis of potential problems in the planning and execution stages of training and educational programs, and so, in this way, provide a valuable service towards the future development of trained manpower in agricultural engineering.

Key words: manpower development, agricultural engineering, education and training in LDCs, education – tool against poverty,

MANPOWER DEVELOPMENT IN AGRICULTURAL ENGINEERING IN SELECTED DEVELOPING COUNTRIES

KREPL,V., Institute of Tropics and Subtropics, Czech University of Life Sciences Prague, Czech Republic

Introduction

The potential and crucial role of agricultural engineering, and therefore of agricultural engineers, in development has not always been recognized. A number of spectacular failures in the past involving poorly adapted schemes of agricultural engineering led planners to neglect and even resist investment in this sector. Yet, to neglect investment in this sector denies a society the possibility of raising its agricultural performance beyond subsistence levels.

Manpower development is recognized as being of prime importance for the successful execution of agricultural development programs and continues to constitute a major component of FAO activities. Many developing countries are experiencing high population growths leading to ever increasing food requirements. Adequately trained personnel are essential for tackling this situation and the needs are particularly acute for engineers, technicians and craftsmen, trained in the skills required for the application of engineering to agriculture.

The desirability of balanced and appropriate agricultural mechanization is now recognized as a vital ingredient in agricultural development plans. The engineering introduced must be effective and those charged with the tasks of its management and promotion must be adequately trained and educated. This publication aim to address the problems associated with

planning the manpower resource requirements and the development or establishment of appropriates training facilities and programs.

The development of Agricultural Engineering - the social and economic context

Agricultural engineering is deeply involved in the process of social and economic change and has strongly affected development, as now witnessed in the modern world. Viewed in its broadest context agricultural engineering lay at the heart of the earliest forms of civilization, which developed around the river systems of the Middle East, Egypt and China.

On the mechanical side, agricultural engineering has its roots in the village blacksmiths and artisans making hand tools and equipment. Agricultural engineering is still at the black smiting stage in many developing countries whereas in the developed world, many families of the more progressive artisans of the last century have developed from their village forges into some of the largest national and multinational manufacturers of agricultural machinery.

The striking difference between a modern developing economy and most of the developed nations of the world today is that the developing country, with its developing economy, can choose its path of development. It may either pursue the path of gradual and slowly accelerating progress towards higher levels of agricultural mechanization; or, it may attempt to take immediate advantage of the advances in technology that are available from the developed world.

The process of rural change accompanying agricultural mechanization development is beset with social and economic difficulties. All engaged in agricultural mechanization programs should be made aware of the hazards, possibilities, and successes that have emerged during their establishment.

The introduction of new machines has often brought associated social problems. The Scottish millwright Andrew Meikle patented his threshing machine in 1788 and over the next 30 years, several inventors and craftsmen produced machines in Britain. In 1830, the threshing machine became a target for the large numbers of unemployed returning from the Napoleonic wars, and demanding work and higher wages. Hay barns were burned and about 400 machines were destroyed in two years of violence.

More recently, several distressing examples of severe economic conditions have resulted at least in part from over-hasty and ill-conceived schemes to introduce mechanization. Massive agricultural machinery imports were organized in the 1960's and 1970's to several developing nations. These soon resulted in high levels of machinery breakdowns as the existing servicing facilities and number of skilled machinery operators and managers proved inadequate.

An important historical lesson to be learned from developed economies is the close interaction between agricultural and industrial development. In an economy dominated by agriculture it is both natural and necessary for small farmers to obtain their tools and equipment from local manufacturers and artisans, who can not only supply what is required, but can also service and repair the goods they have supplied. The promotion of and assistance towards the local manufacture and servicing of agricultural machinery provides the basis for the eventual development of a more comprehensive indigenous manufacturing industry.

Some early groupings of agricultural engineers

One of the first groupings of agricultural engineers was the formation of the Agricultural Engineers Association by Messrs Ransome, Shuttleworth and Fowler in London on November 2; 1875. The Royal Agricultural Society was founded in 1838, and continues its

tradition of awards for innovative agricultural machines which are still exhibited annually at the Silver Award stand of the UK's Royal Show.

Specialist commercial publications also started to appear such as *Farm Implement News* in 1879, published in the United Sates. The first President of the American Society of Agricultural Engineers (ASAE) took office in 1908. By 1912, another American, Dr Sam Higginbottom had started a specialist course in agricultural engineering when founding the Allahabad Agricultural Institute in India.

Development of agricultural engineering as a profession

Agricultural engineering has most commonly been defined as the application of engineering principles to agriculture. It thus involves many different established branches of engineering and associated disciplines, and progressed to the stage where its own professional institutions are established in many countries.

More recently, specialist groups of agricultural engineers have formed societies to promote professional interchange within their particular discipline - the West Africa Animal Traction Network, the International Commission on Irrigation and Drainage, the Commission Internationale du Génie Rural, the International Society for Terrain-Vehicle Systems are examples of organizations active today.

Members of other Institutions who felt that an area of expertise, which properly belonged to them, was being poached have often resisted the establishment of the new profession of agricultural engineering. The ranks of the Mechanical Engineering profession felt that Power and Machinery lay more appropriately within their domain, while the Civil Engineering profession have claimed that matters of irrigation and water supply are properly the interest of Civil Engineers.

Present status of agricultural engineering

The establishment of agricultural engineering as a profession is thus comparatively recent in many countries and indeed it has yet to take place in many of the developing nations. The professional status of the agricultural engineer varies widely in consequence and continues to be the subject of debate.

The first ever society of agricultural engineers (the American Society of Agricultural Engineers, or ASAE) was formed in the United States more than a I00 years ago, but it is today seriously debating a change of name to reflect the change in emphasis of members' activities. The term biological engineering or bioengineering are amongst those it has been suggested be adopted in the new title. Student enrolment in traditional agricultural engineering courses at the Bachelor's level in both the United States and Britain has dropped markedly over the last 20 years although the specialist courses offered at Diploma and Master's level continue to attract considerable interest.

Many of these courses are however designed for future activities outside the more traditional fields of agricultural mechanization or soil and water engineering. Topics such as agricultural water management, information technology for the rural sector, rural engineering, environmental engineering, experiment station operations management, are but a few of the options currently available at different institutions of education.

Language can further affect the status of the profession within a country. For example the French equivalent of "Génie Rural" normally involves activities of installation and operation of large-scale irrigation schemes, road engineering and rural buildings. A professional however working in environmental control systems, agricultural machinery design or manufacture or perhaps post harvest processing is likely to adopt an alternative title for his profession.

The Spanish equivalent normally used is "Ingeniería Agrícola" which creates great confusion with the professional agronomist who has the title "Ingeniero Agronomo" . In many Hispanic countries this leads to considerable problems in recruiting good agricultural engineers into the public sector as their salary scales are often similar or only marginally higher than those of the "Ingeniero Agronomo". In contrast, if he was classified as an "Ingeniero Civil" or an "Ingeniero Mecánico", the scale would be considerably higher. This situation can of course have an adverse effect on student recruitment into agricultural engineering courses as those with a strong interest in engineering are likely to opt for the mechanical or civil engineering courses offering better prospects.

Specific features of Manpower Development.

The questionnaire test was provided in the end of eighties by the FAO, AGSE Department. For provability the above mentioned test the questioner for year 2007 was modified from original questioner from 1989.

The test was apply for the same country: Zimbabwe, Tanzania, Democratic Republic of Congo and Guinea - Conakry.

Results

The replies received indicated a general agreement to several questions:

- All countries projected in **1989** additional requirements for the number of graduates with employment foreseen mainly in the Ministry and Regional Offices (15%), industry and

agricultural services (28%) and the extension and advisory services (24%).

Results from 2007 presents in the same question move to up in – Ministry and Regional Offices 18% (+ 3%), Industry and Agricultural Services 32% (+ 4%), Research and Development 13% (+ 3%). On the opposite site is Extension/ Advisory Services 17% **(- 7%)!!!**

- Most countries suggested in **1989** a broad coverage of agricultural engineering subjects at the undergraduate level, although their opinions on specialization at the postgraduate level were divided.

Result from 2007 presents in the same question a similar suggestion, only order of countries is changed.

- All countries suggested in **1989** improvements to the quantity and quality of practical training for educational courses.

Results from 2007 presents in the same question the same suggestion, so that the practical training could be as a part of regular Agricultural Engineering Education Programme.

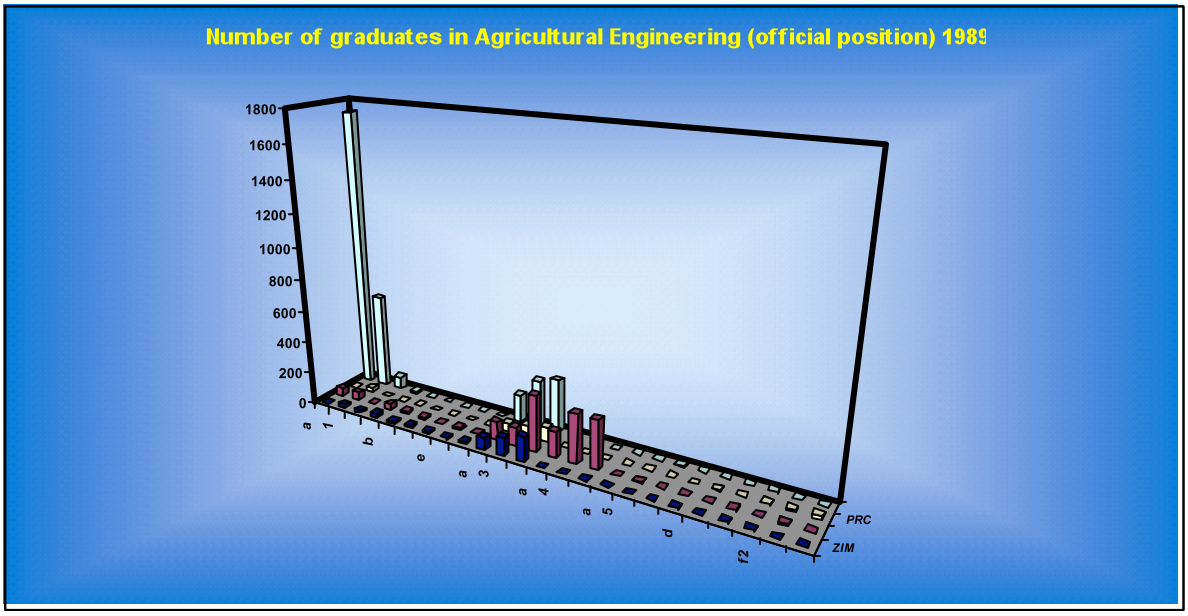
- The majority of countries reported in **1989** that they lacked sufficient technicians at the certificate and diploma levels, although there was a wide variation both in estimates of existing numbers and requirements.

Result from 2007 presents in the same question similar or the same answers. The annotated findings are summarized below.

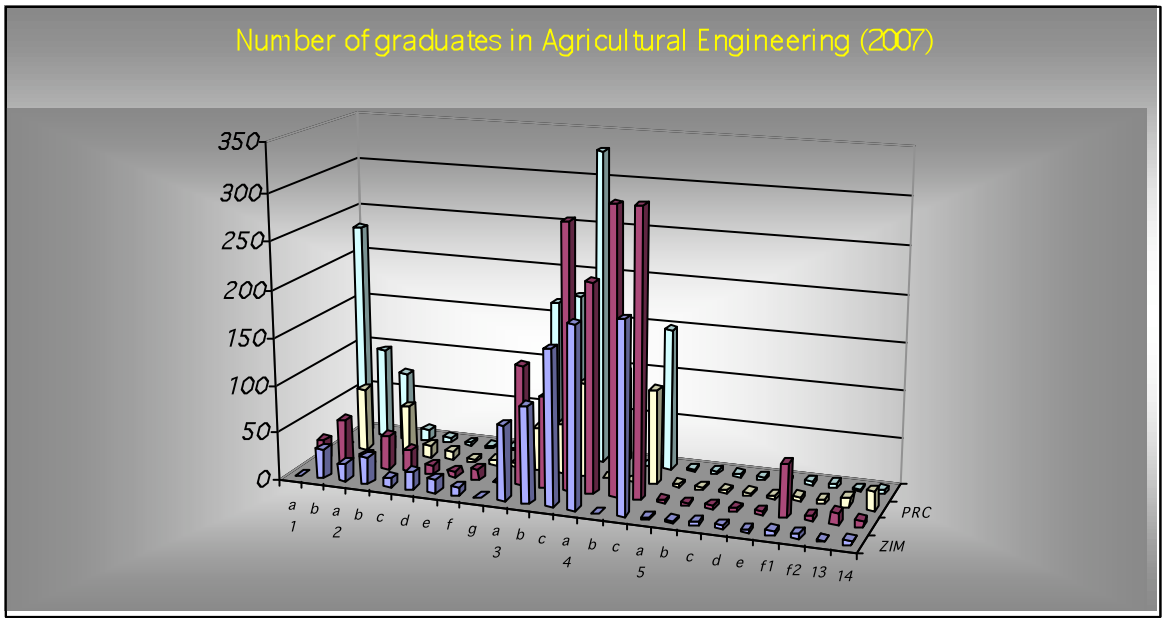
Summary of Country Questionnaire Replies

Question	ZIM	URT	PRC	GUI
No. of agricultural engineering graduates				
- National University	0	23	0	21
- Foreign University	32	48	67	97
Where employed: (percentages)				
Ministry & Reg. Offices	19	12	12	73
Industry & Agro. Services	29	36	53	12
Extension/Advisory Services	9	23	13	6
Teaching	19	10	9	3
Research and Development	14	6	3	2
Farming	9	12	5	3
Other	1	1	5	1
Total number of Agricultural Engineering graduates in the following years:				
1990	80	127	46	168
1991 - 1995	102	97	53	177
1996 - 2000	163	279	99	331
Where they worked 1991 -1995 (percentages)				
- Ministry & Regional Offices	15	12	16	33
- Industry & Agricultural Services	57	44	23	17
- Extension/Advisory Services	19	17	14	22
- Teaching	5	7	12	15
- Research and Development	13	17	14	8
- Farming	8	12	14	8
- Other	1	2	--	2
Are there any officially estimated requirements for Agricultural Engineering graduates?				
(Ministry figure)	190	220	No	100
(University figure)	No	300	No	No
(FAO figure)	200	300	100	150
Priority sectors of Agricultural Engineering (1 = highest):				
- Agricultural mechanization	2	3	3	3
- Soil and water engineering	2	3	3	3
- Storage and processing	4	4	3	3
- Rural structures	4	4	3	3
- Management and planning	3	4	3	4
- Other: Agro-industries	5	5	5	5
Renewable energy	5	6	5	6

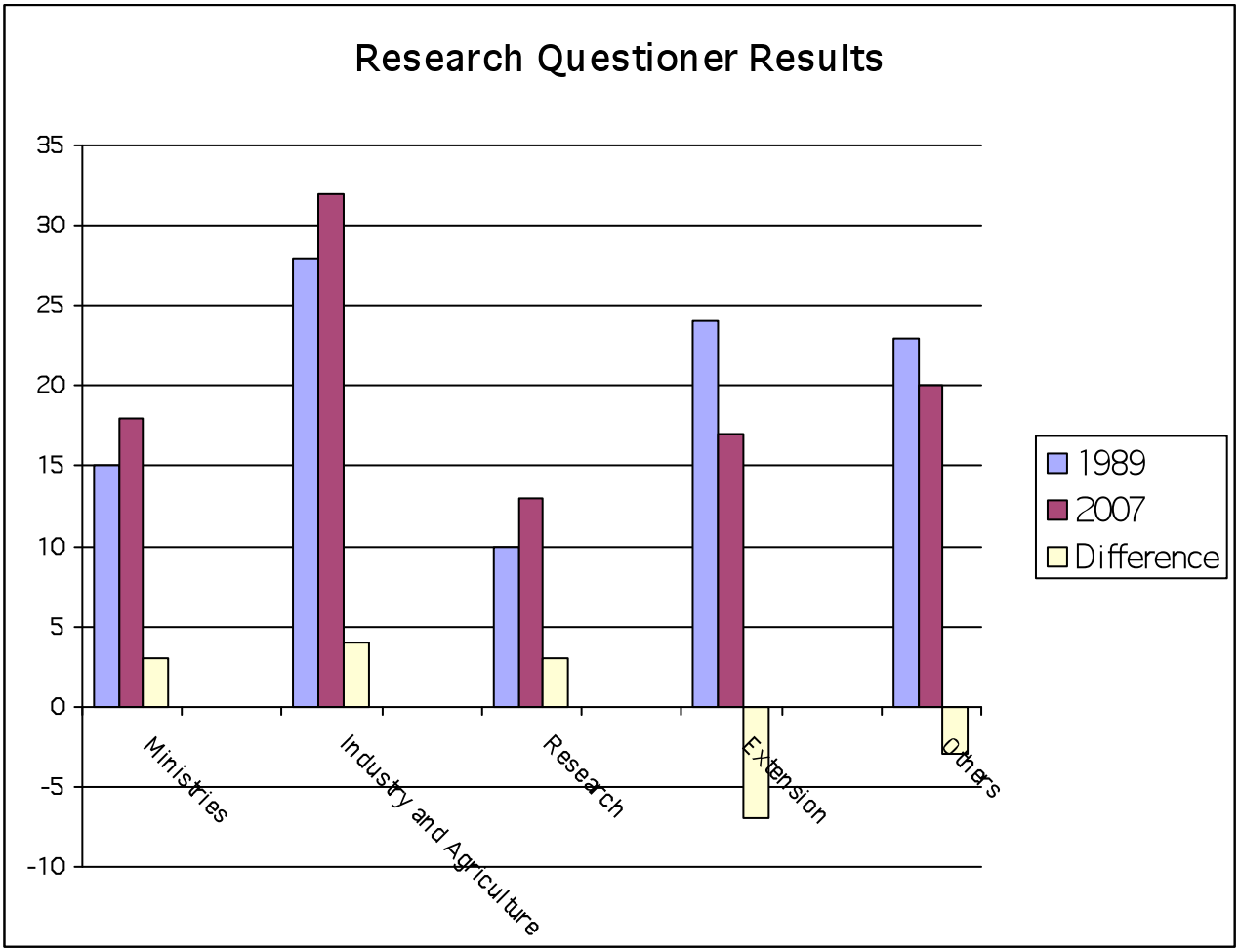
Graph No.1
Number of graduates in Agricultural Engineering according to placement 1989



Graph No. 2 Number of graduates in Agricultural Engineering according to placement 2004



Graph No. 3 Research questioner results



References:

- APPLEBEE, A. N. 1996. Curriculum as conversation: transforming traditions of teaching and learning. Chicago, IL, USA, University of Chicago Press.
- ARGYRIS, C. & SCHON, D. A. 1998. Organisational learning II: theory, method and practice. Reading, UK, Addison-Wesley.
- BAGCHEE, A. 1999. Agricultural extension in Africa. World Bank Discussion Paper No. 231. Africa Technical Department Series. Washington, DC, World Bank.

- CLEAVER, K. M. 2003. A strategy to develop agriculture in sub-Saharan Africa and a focus for the World Bank. World Bank Technical Paper No. 203. Washington, DC, World Bank.
- CURRY, B. K. (ed.) 1999. Instituting enduring innovations: achieving continuity of change in higher education. Report Seven, Syracuse, NY, USA, ASHE-ERIC Higher educational Reports.
- FAO. 1998.Rerport of the global consultation on agricultural extension. Rome, FAO.
- FAO. 1999. Training for agriculture and rural development. Economics and Social Development Series No. 54. Rome, FAO.
- KOLB, D. 2001. Experiential learning: experience as a source of learning and development. Englewood Cliffs, NJ, USA, Prentice Hall.
- KRANZ Jr., R. G. 1999. A theoretical context for designing curricula in the agricultural and life sciences. In Lunde, J.L., Baker, M., Buelow, F.H. & Hayes, L.S. (eds.) 1995. Resharping curricula: realization programmes at three Land Grant Universities, p. 4-12. Bolton, USA, Anker Publishing Company.
- KUNKEL, H.O., MAW, I.L. & SKAGGS, C.L. (eds.) 1996. Revolutionizing higher education in agriculture: a framework for change. Ames, IA, USA, Iowa University Press.
- MACADAM, R.D. & BAWDEN, R.J. 1995. Challenges and response: developing a system for educating more effective agriculturists. Prometheus, 3(1).
- SHORT, K.G. & BURKE, C. 2002. Creating curriculum: teachers and students as a community of learners. Portsmouth, NH, USA, Heinemann.
- STEELE, R.E., ONYANGO, C.A., KEREGERO, K.J.B. & DLAMINI, B.M. 1999. Preparing African agricultural and extension educators to meet future challenges: an analysis of university programmes in Kenya, Tanzania

Authors' address:

Doc. Ing. Vladimir KREPL, CSc.
Czech University of Life Sciences Prague
Institute of Tropics and Subtropics
165 21 Prague 6 Suchdol
Czech Republic
krepl@its.czu.cz

word count: 2511