APPROPRIATE TECHNOLOGY FOR DEVELOPMENT IN THE THIRD WORLD

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Working Paper 10/84

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November 1984

This paper was presented at the Commonwealth Engineers' Council Seminar in October 1983.

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SUMMARY

From earliest times man has attempted, with the resources available to him, to satisfy his basic needs of food, shelter, security and self satisfaction. From Stone Age and Iron Age, through the development of tools and energy, the story is generally well known how modern industrialised man in cold climates has come to be.

However, in Zimbabwe and similar countries of the hot dry overcrowded Third World, the situation is very different, with a labour surplus, and often little idea of alternative options to poverty and apathy.

The men, woman and children of such a socialised economy must be able to appreciate a good reason for change with no social disadvantages before they will begin to change.

Man's technology in the past has always reflected his social environment, where designer and user are part of the same environment.

The new engineer for Africa must accept the criteria of Africa if his creativity is to be appropriate and acceptable.

This paper will use a case study and examples to illustrate the need for engineers to participate in new rural and urban technology.

A Bibliography is added for those wishing to study the subject in greater detail.

INTRODUCTION

Civilization, as we know it today, owes its existence to the engineers. They are men and women who, down the centuries, have learned to exploit the properties of matter and the sources of power for the benefit of mankind, to satisfy his needs for food, shelter, security, self satisfaction and dignity (1). The story of the development of modern industrialised man in his social, physical and economic environment in Europe and North America is well documented (2).

Until recently developing countries have been trying to follow the same linear model of development as the developed countries but with increasing concern for alternative energy sources, environmental degradation, employment needs and equity. That there is now an estimated 800 million people living in absolute penury suggests that there is a need to replace the industrial development strategy model with a post industrial model (3).

Successive meetings of UN organizations express concern for the application of new existing technologies to relieve the plight of an increasing population of poor people in the world. The emphasis is changing from a strategy focussed primarily on increasing the GNP to one concerned with equity (4).

This change has been highlighted by Professor Meredith Thring, who recently retired from the Chair of Mechanical Engineering in Queen Mary College, London. He has written a book entitled "The Engineers Conscience" and gave the prestigious James Clayton Lecture for 1982, entitled "Engineering for Humanity" (5).

THE THIRD WORLD

The term Third World became popular after World War II to describe the world's poorer countries. The concept began with a political connotation separating the power of countries from either the capitalistic west or the ideological east (6).

The concept changed to an economic one as development theory recommended massive transplants of western type energy and technology in the 1960's. When this strategy failed to show any significant improvement, the aid donors concentrated on sociological aspects of development in the 1970's, and now in the 1980's the emphasis is on technology.

The countries of the Third World have little in common other than poverty. They vary in historical background, ecology, export potential, oil, availability, language and anthropology. They stretch from Central and South America, across Africa into Asia.

Third World people are characterised by a highly socialised way of life, strong community norms, ignorance of technology alternatives to their existing technology which for various reasons can no longer support them in a fast changing world. They are highly disadvantaged, lacking education, training, finance resources and infrastructure. They need a technology that is appropriate to their needs and environment.

THIRD WORLD TECHNOLOGY

There is a surplus of labour in third world countries, so mechanisation is hardly needed to replace labour as is the case in Europe and North America. Mechanisation of the western model will only aggravate the existing shortage of work places, increase the economic gap between the haves and the have nots, and further increase the need for scarce foreign currency.

Appropriate third world technology must be labour intensive, create employment, be easy enough to use for unskilled labour with a minimum of resources, and supplement or complement the local environment without damaging it (7).

Third world countries are tropical and therefore enjoy a high level of solar isolation. There is therefore little need for space heating, for lighting and there is a greater potential for biomass production using irrigation farming and double cropping. There is a potential for using organic oils, ethanol production and alternative energy sources.

Technically, third world people are generally unsophisticated and lacking in background exposure to technology. Any technology policy should therefore include a significant education and training component, particularly aimed at schools and the creation of awareness of technological options. Economically, third world countries are poor, so there should be maximum use of local inputs. Socially, third world people are highly socialised with a strong division between mans work and womens work. Women often do the work using hand tools that aggravate low productivity, while machines are the province of men who will not however do womens' work, so social acceptability is an important factor for consideration. And plant and equipment to suit a community is likely to be small scale.

The late Dr E F Schumacher wrote his book "Small is beautiful", after a visit to India when he became interested in the provision of low cost work places to help poor people to help themselves. He coined the term 'Intermediate Technology' referring to a technology between the hoe and the tractor plough. This term is now not popular as it has two disadvantages. Firstly, it suggests that the objective, the tractor plough for example, is superior to both the hoe and the intermediate technology which may not be true. Everyone can not have a tractor plough and there are very good improved ox ploughs. Secondly, it implies a temporary stepping stone to the real thing which creates problems of credability and social acceptance. More recently therefore, the term "Appropriate Technology" has come into use and is generally recognised by workers in this field as a small scale and may be low cost, easy to use equipment suitable for this kind of application, which has merit in its own right.

As all good engineering should be "appropriate" this term has lead to confusion and is criticised. A more recent term heard in Zimbabwe is "Rural Development Technology". However, the need for appropriate technology is not confined to only rural areas, so today, there is no appropriate term that is generally acceptable to fully describe the situation.

"Technology" therefore appears to be not just a term defining a collection of methods, techniques and equipment, but it implies of philosophy of life and development. Conventional engineers or any other professionals may therefore find difficulty working in this field. It requires a holistic multi-disciplinary approach. This may not be so far removed from the situation with micro-processors, where there is a need for both the hardware and the software for a viable programme.

LINKAGES

The comparison of appropriate technology (AT) with microprocessor leads to the study of linkages (8). Technology may be linked forward in a community to production and development, or backwards to the need for imputs and resources. It may be linked horizontally to other needs so requiring a package approach. So to introduce fertiliser for agriculture, may require the development of savings clubs to provide the finance, and the provision of roads and a truck to transport it. There may then be a need for vertical linkages to other organizations in other countries to provide the expertise. If however the farming is being undertaken by a woman her first priority this month may be washing soap or clean water, which may or may not be a problem for an engineer, but if an engineer is identified in one of the linkages, he, or she must be adequately briefed in order to provide an appropriate solution in their part of the system.

AGRICULTURE AND INDUSTRIALIZATION

The majority of third world people live in rural areas, but given the opportunity many will migrate to urban industrial areas. Where either "urban pull" as with town attractions for young people or "rural push" as caused by drought in rural areas, are excessive, the result is a proliferation of shanty towns with all their related problems.

The situation is aggravated by a high rate of population increase, increasing land pressures, rising aspirations, and poor land with a low production potential, that can no longer support its people at the level they expect. Industrialisation is needed to complement agriculture. The third world population now constitutes the greatest potential production force and the greatest potential consumer market in the world, a situation parallel to the industrial revolution of Europe.

CHANGE

The industrial revolution of Europe created great change and for some people great hardship. The introduction of technology inevitably has a social cost. Third world low income people both need technology and resist it where they see no immediate sustainable short run advantage to change. Peasants and low income people have no reserves to carry them through a bad season or a period of investment and reorganization. They therefore play safe, and are accused of being conservative. Meanwhile they see a suggested change as being of less value than the need to avoid community conflicts and new socio-economic pressures (9). It is therefore essential that people are actively involved as major participants in any programme. They must come to see the programme as theirs. The role of the specialists who advise them must be that of a catalyst from outside the system.

EDUCATION TRAINING AND EXPERIENCE

Young people learn much from their childhood environment. If that environment is essentially a traditional rural one lacking in technology, the child moves to school with a disadvantage. If the school is isolated and lacks modern teaching equipment, the child drops out, or starts tertiary training with a greater disadvantage. If the lecturers have not received inservice training, the new graduate is little more equipped for life than the adults. The cycle is repeated, and technical advisors propose solutions which, much to their surprise, do not work. So there is a build up of frustration, apathy, inactivity and increasing poverty.

In the first five months of this year, 172 presidents of major Japanese companies stepped down mainly, it is reported, because they were unable to cope with rapid technological change. Who is responsible for technical training and education at primary, secondary and tertiary level today? Is it adequate? Are engineers assisting in the planning of new curricula for schools?

INSTITUTIONS

Any society will need a specific technology to support it, but what kind of society is needed? If it is socialist, is it to be based on China, Korea or Tanzania, because their agricultures and industries are different.

The objective may be development, but does this mean national economic growth as measured by an indicator such as gross national product (GNP) or is it the development of people through raised standards of living which GNP can not readily measure? GNP does not take into account the activities of the informal sector which in the third world countries may be very significant, and includes all those activities practised by men and women, usually without any formal organisation but carried on for financial gain, directly or indirectly. Much of this is practised by women at home. What is the policy towards the local activity of multi-national corporations? They may do much good and provide much needed resources and expertise, but at the cost of suppressing small scale labour intensive industry. Perhaps there is a place and a need for both, but there should be a recognised policy to stabilise development.

Building regulations, the procedure for obtaining an electric power supply, import export paper work, and various other legislation and regulatory instruments could become obsolete under a new government. They may be distinctly counter productive and prohibit development where unsophisti-cated people are concerned.

Technology is not neutral. It does not benefit everyone equally. Change will therefore often be resisted by someone. A change for the good must therefore be well prepared, and an effective lobby in the right quarter may be desirable if not essential. Technology has a political face.

PROMOTING APPROPRIATE DEVELOPMENT TECHNOLOGY (ADT)

Appropriate technology may include a wheelbarrow to carry wood, a computer to study the role of wood, and a photovoltaic electric supply to a hospital in order to avoid the use of non existant wood. Selling ADT may involve many intangibles which can not be costed in money, only in the increase or decrease in human suffering, inconvenience, well being or frustration, which may be impossible to measure in units that are conventionally acceptable to economists, politicians and policy makers, especially those from outside the third world countries.

The cost per tonne of sugar to produce may be less at a large mill than at several smaller mills based on isolated small irrigation schemes. A feasibility study however should allow for the saving in transport at the small mill supplying local peasants some of whom may benefit from employment in the mill, stock feed by-products or a general multiplier effect that might contribute to the provision of a better road, post office and a new secondary school and so on (10).

A major difference between low and high performance technology is the rapid fall-off in the benefits derived from high technology when its operational parameters are not favourable (11). This is just another way of saying that high technology is generally designed for a sophisticated society with a specific set of circumstances. Under different circumstances the technology may fail. The low technology may be preferable if it utilises local resources including lower levels of management and skill. If however the local market is small and erratic, low profit generation may make reinvestment in research and development (R&D) impossible, and the plant is doomed.

Appropriate or development technology must always be good engineering. This was not always the case, and in the early days of "intermediate technology" the over enthusiasm of some non professionals using cheap, trashy, poorly designed items earned the movement considerable criticism.

ZIMBABWE EXPERIENCE

Background

Zimbabwe has well developed commercial orientated manufacturing, agricultural and mining sectors with relevant supporting infrastructures. Much of the manufacturing industry is concentrated in the cities of harare and Bulawayo. Commercial agriculture is often considered rather as a magic box from which to extract food, foreign currency and higher taxes when the seasons are good. There is some state farming which supplements commercial farming output and may supplement production from the new and largely untried settlement schemes. There is also a growing informal sector about which little is known.

Zimbabwe is divided into five Natural Regions based on rainfall, soils, ecology and related factors.

Natural Region 1. An area of high annual rainfall, including winter and summer precipitation along the eastern border that creates good conditions for grass and dairy farming, fruit production and forestry.

Natural Region 2. The commercial farming area of the highveld watershed, based on maize, tobacco, small grain, co ton and intensive stock production.

Natural Region 3, 4 and 5. These ring the Natural Region 2. They are progressively drier, warmer, and lower in altitude. Agricultural production becomes increasingly more extensive unless modified by irrigation.

Much of the sophisticated commercial activity is associated with Natural Region 2. This area with its infrastructure advanced communications systems and national electricity grid requires top class engineers and technicians for maintenance and development.

However, there are an estimated 800 000 low income rural families who are mostly in Natural Regions (NR) 3 to 5, where agricultural potential is generally low, where there is generally a lack of resources and infrastructure, and where there is a severe population imbalance. There is generally a high proportion of children and old dependents. Male absenteeism is caused by employment elsewhere, especially in NR2, and responsibility for farming, income generation, maintenance of the home and child bearing is left to the women.

The author has been operating an ADT extension project in the area north of Nyanga, in the north east corner of Zimbabwe for two years. The area is approximately 4 000 km^2, has an estimated population of 9 500 people, and includes all five natural regions.

The first needs identified in this area were for home soap making, candles, sewing instruction for clothes, (especially uniforms for new schools) clubs, cooking facilities and food. Interest then changed to income generation and small scale industries, the manufacture of sand cement building blocks, water supplies, leather tanning, baking.

Interest has been shown locally in items such as a bicycle, ambulance, vaccine cooler, beer and cool drink cooling, building methods, water pumps, solar energy, biogas, sanitation, transport, wheel chairs, house furniture, equipment for new clinics and schools, small workshops and rural electrification possibilities.

Progress is slow but steady, in a rather erratic way depending upon the weather, seasonal tasks such as planting or harvesting, family commitments, visits by VIP's, availability of inputs, and the perserverance of advisors.

Hardware, tools, equipment, building materials and other inputs are generally in short supply locally, and transport is exploited to the full.

Harare, 300 to 500 km away, is the largest market and business centre. This represents a major constraint because people tend not to visit due to expenses, lack of contacts fear of mugging (often grossly exaggerated) and a general lack of knowledge as to how to facilitate requirements.

There are carpenters, tinsmiths, blacksmiths, builders but they appear unable or unwilling to work from drawings. A pattern must be supplied and this is then copied with little difficulty.

There is a general lack of knowledge or interest in, building regulations, quality control, patent rights, timeliness, continuity of supply or budgeting and planning. There is however great satisfaction shown when a project is successful, and the assistance offered is much appreciated. Correspondence, record and book keeping are often weak. Names are frequently altered both of people and places. A training centre may be known by three names by different people in the area. Meetings are called and cancelled at an hours notice. The agenda is often clearer after the meeting.

DISCUSSION AND CONCLUSIONS

The histories of mankind and his technology were closely entwined until today, when there now exists two groups, the so called developed worlds of the west and the east, and the third world.

The low income people of this third world require a technology that is both technically sound and socially acceptable if the people are to achieve an acceptable standard of living or equity.

Many items of appropriate technology are known, others must be located or modified, while some problems need solutions using modern materials and design practice.

Who is to plan and direct this work? Who can or should advise governments, create awareness, or brief policy makers and proposal writers? Who knows about steam engines, producer gas, liquid piston pumps, hand tool workshops, rural electrification, windmills, or small scale sugar mills and lens polishing equipment for low cost spectacles?

There are many as yet unanswered questions suggesting the need for further study. It is hoped that the deliberations of this seminar will contribute positively towards the development and applications of appropriate technology, to improve the well being of at least a few of those estimated 800 million third world people living in extreme poverty.

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