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Agricultural Mechanisation for Transformation

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***Abstract*—**This paper concludes that, for economic development, and to ensure survival, Kenya and similar countries must industrialize their economy and mechanize their agriculture using modern large scale methods.

***Keywords*—**Agriculture, mechanazation, transformation, industrialization.

I. Introduction

WHAT really is the meaning of the word "development"? Our leaders in politics, religion, academics and other spheres of life are all professed proponents of development. To contextualise our presentation, let us examine this word. We are all agreed that development takes place through economic activity. The object of economic activity is to satisfy human needs. The basic human needs include food, shelter, health, education and clothing. More human needs arise as society progresses, i.e. as economic activity is expanded and intensified. These needs are either satisfied, or not, depending on the state of the economy.

Historically, distinct social classes have arisen as a result of economic activity. In this progression, humankind has been progressively liberated from complete dependence on nature to harnessing and controlling nature for its benefit.

Economic progress therefore leads to development. Development therefore is a process of liberating human kind from the mercy of nature, i.e. backwardness. Engineering has played a leading role in mechanising systems in human development. The mechanisation and development of agriculture has had crucial engineering inputs at all times.

Kenya Vision 2030 is the country's programme for transformation covering the period 2008 to 2030. Its objective is to help transform Kenya into a newly industrializing, middle-income, exceeding US$10000, country providing a high quality of life to all its citizens by 2030, in a clean and secure environment.

Increased agricultural and production and productivity is crucial for the realization of Vision 2030. Mechanisation of agriculture in order to achieve greater yields is the only way to achieve these objectives. There are contending groups and views on the strategy for agricultural mechanisation.

The first group opposes the widespread adoption of advanced technologies (mostly internal combustion engines and tractors) in agricultural mechanisation as entirely inappropriate in most situations in developing countries. This group argues that mechanically powered -agricultural mechanisation often leads to displacement of labour and hence increased unemployment, and this results in a host of other socio-economic problems, amongst them, rural-urban migration, inequitable distribution of wealth and in many cases an increase in absolute poverty, balance of payments due to the need to import machinery, fuel and sometimes technical assistance to manage them.

The second group comprises of those who view the use of the improved hand tools and animal powered technology as transitional step between the most rudimentary step in technological development (characterised by entire reliance on human muscle power) and the advanced technologies (characterised 'by reliance on tractors and other machinery).

The third group comprises those who regard these intermediate technologies (i.e. improved hand tools and draught animal technology in agriculture) as a 'delaying' tactic and they advocate the use of mechanical technologies as-the most appropriate. This group argues that alternatives to the mechanical technologies do not just exist as a practical matter, or, if they are available, they are inefficient and they cannot be compared to the mechanical technologies in terms of economics and productivity.

The fourth group advocates a compromise between groups two and third above. This group views the improved hand tools and draught animal technology as more of an 18th century technology and the modem tractor and combine harvester as too advanced for developing countries. This group has been busy designing an 'intermediate', 'appropriate', 'mini', 'micro' tractor for use by farmers in developing countries.

II. Agricultural Mechanisation

The needs for increased agricultural production and productivity have been reiterated many times by our leaders. The mechanisation of our agriculture in order to achieve greater yields is the stated objective of most politicians and indigenous as well as foreign experts involved in agriculture and rural development activities. There are many 'development' NGOs which are engaged in various 'intermediate technology' level development of implements and machinery which they regard as the appropriate tools in mechanising our agriculture. On the other hand, we have suppliers of tractors, combine harvesters and other 'hi-tech' machinery who view their machinery as being essential to the successful mechanisation of agriculture.

The two opposing positions have supporters who have been engaged in an often bitter confrontation. There are other intermediate positions. Prof G.C. Mrema [1] has summarized four positions taken by researchers/ development planners on

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agricultural mechanisation.

1. The first group is those who oppose the widespread adoption of advanced technologies (mostly internal combustion engines and tractors) in agricultural mechanisation as entirely inappropriate in most situations in developing countries. This group argues that mechanically powered -agricultural mechanisation often leads to displacement of labour and hence increased unemployment, and this results in a host of other socio-economic problems, amongst them, rural-urban migration, inequitable distribution of wealth and in many cases an increase in absolute poverty, balance of payments due to the need to import machinery, fuel and sometimes technical assistance to manage them. They further argue that adoption of mechanical technologies does not necessarily lead to increased yields and land productivity and equal or even higher increments could be achieved by use of biochemical inputs alone. This group often advocates the use of improved hand tools and/ or draught animal technologies coupled with biochemical inputs (fertilizers etc.). Essentially, they see the hand tools and animal powered technologies as an alternative to mechanical technologies in the agriculture of developing countries especially the smallholder sector.
2. The second group comprises of those who view the use of the improved hand tools and animal powered technology as transitional step between the most rudimentary step in technological development (characterised by entire reliance on human muscle power) and the advanced technologies (characterised 'by reliance on tractors' and other machinery). This group argues that the course of technological development is evolutionary and it is each country's prerogative to aspire to a higher technological plateau. It is argued, modernity is a legitimate goal, but care should be taken to ensure that technological, cultural, economic and social development all work in tandem to ensure a well-balanced society. This group opposes any rapid mechanisation policies, in particular those which aim at wide scale adoption of mechanical technologies among small and medium scale farmers. In many cases this group has attempted, at times convincingly and at other times unconvincingly, to show that these improved hand tools and draught animal power are just as 'good' and economical as the mechanical technologies.
3. The third group comprises those who regard these intermediate technologies (i.e. improved hand tools and draught animal technology in agriculture) as a 'delaying' tactic and they advocate the use of mechanical technologies as-the most appropriate. This group argues that alternatives to the mechanical technologies do not just exist as a practical matter, or, if they are available, they are inefficient and they cannot be compared to the mechanical technologies in terms of economics and productivity. They further argue that, where these mechanical technologies have failed in developing countries, this has in most cases been a consequence of poor planning, management and supervision. They view the agricultural production process as a thermodynamic process (advocating a minimum level of energy per hectare) and argue that food and crop production has to be achieved in the most efficient way, maximising the productivity of land and labour, and it is only by doing this that a surplus can be realised which can then be marketed at a lower price. There are those who oppose agricultural mechanisation for fear of creating unemployment and compare them to the Luddites in England of 19th Century, who smashed textile machinery because they feared it, would create unemployment. This group argues that as long as agriculture in developing countries is perceived as a 'gigantic programme' of relieving unemployment, then these countries will continuously face hunger and massive starvation. On the question of energy problems required for running these tractors, it is argued that the. fossil fuels spent in running them even in the most advanced countries is less than 5 of the total commercial energy used, and in any case the other biochemical inputs which do not seem to be questioned in so far as energy is concerned, are even much more energy intensive than the fuel required to run the machinery and implements.
4. The fourth group advocates a compromise between groups 2 and 3 above. This group views the improved hand tools and draught animal technology as more of an 18th century technology and the modem tractor and combine harvester as more of. a 21st century technology for most of the developing countries. This group argues that more appropriate form of mechanical technologies can be developed for the farming systems in the third world. Thus, over the past 70 or so years, this group has been busy designing an 'intermediate', 'appropriate', 'mini', 'micro' tractor for use by farmers in developing countries. The idea here has been to develop a technology which can be afforded by the small scale farmer and which is also multi-purpose. Development of such technologies has been particularly done on the Asian subcontinent (Philippines, Thailand, etc.) as well as some of the more advanced countries in Europe and, in Africa, e.g. 'Tinkabi' and 'Kabanyolo' tractors.

A. Agricultural Mechanisation as a Strategy

Agricultural mechanisation cannot be viewed in isolation. It is a strategic programme in the overall economic development plans of the country. Specifically, it must be discussed as a part of the industrialization efforts of the nation [4].

In analyzing our agricultural mechanisation and industrialization objectives and strategies, we must also take into account the historical situation in which we find ourselves. Our technologically backward economy was fashioned deliberately by the British colonialists. Our economy supplied Britain with raw materials and it in turn supplied us with durable and semi durable consumables like bicycles, ploughs, spades, etc.

The few engineering workshops we had were mainly

engaged in repairs of imported goods; simple engineering items like springs, steel wires, iron chains and machine tools were imported - mainly from Britain. The above scenario has not changed much, except for the emergence of 'Jua Kali' sector which mainly recycles scrapped imported machine parts into hand-made consumer semi-durables. The 'JuaKali' sector uses highly labour intensive methods, reminiscent of 18th century Europe. The basic question which we must address is simply: What is the best option for agricultural mechanisation?

B. Agriculture in the Economy

The objective of agriculture is to produce food and other raw materials using the most efficient and cost-effective methods. Agricultural mechanisation is, therefore, a strategy for achieving this objective [4].

C. Agriculture and Employment

It is often argued that as agriculture employs the vast majority of our labour force, it is therefore our most significant economic sector. Implicit in this statement is that this state of the affairs has to be maintained, at least for the foreseeable future. What is the validity of this argument?

As stated above, the primary objective of agriculture is to provide food and other raw materials. This process must obviously be carried out in the' most efficient and cost-effective manner. Employment is created in this sector because we require human labour intervention in the production process. Mechanisation leads to more labour and process efficiency, resulting in better energy utilization and lower production costs. In an industrializing economy, labour requirements are reduced in various industries as production systems are progressively mechanised. The workers displaced in such industries are absorbed in other industries where they are required. In fact, the lowest unemployment rates are in the most industrialized countries which have the highest levels of agricultural mechanisation [2].

Mechanising our agriculture will displace some labour from the sector. This is actually desirable in a modem industrialising economy. In such an economy, labour is required in many other areas.

III. The Way Forward

The basic approach to economic development that we should take should be that of a nation based on modem industry. That is: We should industrialise.

This includes industrializing our agriculture. This is the only way that we can expand the production of food and capital equipment to satisfy the basic needs of our people. Industries using modem large scale methods have to be supplemented by small industries which may be particularly suited for better utilization of local resources, and for achievement of local self-sufficiency in respect of certain types of essential consumer goods like food, cloth and agricultural implements. For the small scale industries to survive and thrive, they have to be supplied with a number of factors including: Cheap raw materials; cheap, efficient and reliable power; technical advice; organized marketing of produce; and where necessary, safeguards against intensive competition from imports.

The basic strategies for industrialization should involve: Emphasis on heavy industries; establishment and nurturing of well supported and funded research institutes; setting up of the infrastructure for power and transport; and selective disengagement of the economy from the world economy.

Economic development is a process in which the standard of living of the people is progressively raised through domestic wealth creation. Modern scientifically-led economic development has led to industrialization, in which the people themselves have undergone tremendous change.

Semi-subsistent peasants, the so called small-scale farmers have been transformed into industrial workers in developed countries. This process has liberated many people from backwardness and superstition. The process of development, i.e., industrializing, will change the quality of our people. As people are liberated from their adverse economic conditions, and transformed into industrial workers, their attitudes change. In short, they will undergo a cultural change. Practices such as moranism will, inevitably, die.

The perverse position that, in modem times, that we must permanently run an economy in which a significant sector is engaged in agricultural production using rudimentary hand tools, animal powered technologies and manual machines such as oil presses should be opposed.

Agriculture, really, like all production processes, is a thermodynamic process. There must be a minimum energy input into the system to achieve meaningful production. Food and crop production has to be achieved in the most efficient way, maximising the productivity of land and labour, and it is only by doing this that a surplus can be realized which can be marketed at a lower price. Further, if the economy does not produce enough surpluses, then there is nothing to re- invest in the acquisition of new and better technology.

Well-paid, highly educated experts from international organizations and NGOs, and local consultants on their payroll who have graduated from using slide rules to electronic calculators and finally to electronic computers should not sermonize to us about the merits of using hand tools and animal power. These people enjoy the fruits of industrialised societies, which have only been made possible by modem industry. They enjoy modern medical care with all its scanners etc., they drive air-conditioned cars which glide over potholes. They enjoy cultural events (cocktail parties, plays, etc.) made possible by industrialization. They communicate through faxes and email. They use mobile telephones and watch satellite television, and 'they have the most modern household appliances to make life easier. Why would these people, then, be opposed to others enjoying the fruits of industrialization? Their unstated aim, surely, is to keep us backward.

The above indicates to us that for us to industrialize and mechanise our agriculture, we need to have meaningful investment in science and technology research and consultancy. This should include the nurturing of a patriotic community of researchers and consultants in agriculture,

engineering and other related areas of S & T. The funding of research should be carried out primarily by our government. As Dr. C. Odegi Awuondo remarked in 1996, most foreign research funders actually know what results they want. They just want their positions reinforced by local researchers.

Our researchers must be paid meaningful salaries; they cannot be expected to do any useful work if they are constantly hustling to keep alive. Worse still, the low pay entices them into the hands of foreign agencies; they become consultants for these agencies locally or they leave the country altogether to affect the same.

History has taught us that different countries have not followed exactly the same path to industrialization. England started with steam power, followed respectively by the internal combustion engine, electrification, nuclear power. South East Asian nations achieved industrialization by "jumping" to, micro-electronics, the most modem industries at the time they were industrializing.

We must, therefore, prepare ourselves for a big jump forward. The 'successful' mechanisation of our agriculture will also depend on defining minimum land sizes for different agro-ecological zones. Rampant subdivision of land has led to minuscule land holdings in some areas with the best agricultural soils such as Kakamega and Kisii. The use of land for speculative purposes also adds to production costs. Careful policies should be adopted to discourage such speculation.

The crucial question in industrialization and agricultural mechanisation is: Where do we get the capital from? We know for sure that the World Bank, IMF, etc. will not provide any meaningful funding for these purposes. This is simply because the countries which established these organizations have no interest in our industrialization.

We must look elsewhere. The first place is our own selves. Almost every self-respecting cooperative society has (or intends to) invest in beautiful modem office complexes in Nairobi and other urban areas.

At a time when we are importing sugar, would it not have been wiser for Ukulima Cooperative Society to invest in a sugar factory? And the businessmen importing sugar, could they not have invested in sugar factories? We read, very regularly, in the local press of huge sums of money stolen from the public kitty. How many agro-industries could we have built from, the billions?

Just how much money is spent on internal security, i.e., regular police, special branch, CID, military intelligence, APs, GSU, Ngoroko squad, the list is long! How do they help our development efforts? We can greatly reduce expenditure on external and internal security and be much safer.

A genuinely popular pro-people government will be secure with a much smaller internal security apparatus. A small and professional military backed by a reserve of trained civilians can be very effective in responding to external aggression. Civilians between the ages of 18 and 50 would be required to undergo some form of periodic military training. Personnel released from the security system can be gainfully deployed in our industrialization efforts. They are usually quite well trained. The money saved from reduced security expenditure can be used in building-factories and other infrastructure.

There are other areas from which domestic capital can be generated. These include the cessation of parliamentary by-elections. Since 1992, we have had too many of them! The cost is great. We should have used the money to build factories.

The other source of capital is from abroad. Firstly, our citizens who, we are told, have huge sums of money in foreign bank accounts, should be required to repatriate these funds.

Secondly, we can very carefully negotiate with foreign companies and governments for joint ventures. The foreign investment in our economy should be mutually beneficial to the parties concerned. We should not be in the business of inviting foreigners to our country to repatriate abroad all the wealth created.

IV. Conclusion

Industrialization and agricultural mechanisation will only be possible through enlightened political leadership. The government must reconcile apparently opposing sides in: production and consumption; agriculture and industry; heavy and light industry; and large scale and small scale agriculture [3], [5], [6].

The government should involve our local experts in clearly defining our industrialization and agricultural mechanisation objectives. Correctly defined strategic programmes should be implemented by competent professionals who are deft at tactical management.

The people should be involved at every stage of the processes described above. Without the enthusiastic support of the people, the programmes cannot succeed. Just after the inception of the processes, the people should begin to see some tangible fruits. This will motivate them to work harder.

The people should enjoy maximum human and social rights for their enthusiastic involvement in economic development activities. They should be free to debate issues, associate, elect leaders of their choice, etc. Equally important, they should have affordable access to food, shelter, housing, education, and medical care. Fee payment at points of use for education and medical care, as prescribed by SAPs, should be done away with. The payers use money they have earned from the economy, not from Mars. We can therefore, find ways of humanely collecting the money from the economy before a service is required.

Where necessary, the private sector should be motivated and nurtured to provide a useful input in our agricultural mechanisation efforts. However, the government bears the ultimate responsibility for economic development. Our government should not abrogate its responsibility for economic management to foreign agencies and mystical economic forces emanating from America and its industrialized allies.

We must have foresight. We should plan for ourselves, our grandchildren, and our great grandchildren. Some of our leaders act as like a medieval army of occupation, who would loot and mismanage a country and return triumphantly back home with their ill-gotten proceeds. Do these people ever

think of their grandchildren? What country will these children inherit at this rate?

For economic development, and to ensure our very survival, we must industrialize our economy and mechanise our agriculture using modern large scale methods. There is no other way.

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