MODERN TECHNOLOGIES AND SOCIAL PROGRESS IN LESS DEVELOPED COUNTRIES

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Abstract

All available projections of population, per capita income, and demand for food on the one hand, and production and marketable surplus of food on the other, tend to present a large and growing gap insofar as the less developed countries are concerned. It may be a problem of the aid and trade, however it is for sure rather question of sustained improvements in food production, processing and marketing that are lacked in most developing countries. Fortunately, a considerable part of the modern technology is either area neutral or can be made area neutral with certain adaptations. However, most technologies as the whole have originally been evolved relatively certain localities and/or regions. Some parts of these modern technologies discriminate small-scale farmers, especially their mechanization components (machinery inputs) and present barriers against modernization. In such cases, sustainability in rural development consists in conserving rather traditional technologies (hand and animal ones) with some modifications in quality and productivity. It is rather question of better varieties and more productive domestic animal races. New crops and animal protein sources (wild animal farming or ranching) as well as modern on-farm processing methods are also of high value. However, importance of higher profit margin is always underlined as a very important criterion of the success assessment. The process depends on technological and institutional innovations that often are not only complementary but mutually supportive. No doubt that there are social consequences (sometimes very important) that generate further changes in technologies, especially energetic inputs very often replacing traditional energy sources by mechanical ones. All the evidence is not in the social disruption which the changing technologies provoke but their modernization creates substantial rural unemployment and increased rural inequality. This must be taken into account when formulating technology strategies on all levels whereby the sustainability context must be respected.

Key words: per capita income – area neutral technology – small-scale farmers - technology strategy - rural unemployment - rural inequality

INTRODUCTION

World Food Summit: Five Years After

The World meeting named World Food Summit: Five Years After (FAO 2002) focused on progress achieved from the *World Food Summit* (1996, Rome). The Summit (as well as the one in 1996) once again affirmed the political involvement of the World Community to fulfilling obligations that had been formulated by the "Rome Declaration on the World Food Security" and "World Food Summit Plan of Action", both documents being approved by the Summit in 1996. Frequently declared general principles and assumptions for reducing hunger in the World were specified by a more specific way and especially "*immediate responsibility of national governments for the Food Security of their population*" was underlined. The Summit raised some facts and formulated couple of important conclusions:

1. More than 800 million people all over the world from which about 300 million are children, suffer from every day's hunger (*chronic shortage of food*), diseases and invalidity caused by malnutrition. Estimations speak of 24 000 people that are daily dyeing due to the mentioned problems;
2. There are several African countries that face a very probable famine that could blow up in a couple of months;
3. Hunger and poverty are linked to one another. The hunger makes man more prone to diseases and brings reduction of capabilities of people to live and work and to provide their families with food;
4. The progress made in reducing number of starving people is not satisfying. A real need exists to implement an actually effective "Programme Against Hunger" which should become a "*Mobilizing Factor*" of respective global, national as well as local authorities – a tool for struggle against hunger and malnutrition.
5. Six years after (the World Food Summit 1996) the dying poor inhabitants of our Earth is still ongoing for reasons of hunger, famine and malnutrition. The given promises have not been met and the political willingness as well as available funds do not correspond with the

declared solidarity.

6. The hunger has a crushing impact on the economy of the affected countries, it generates (by rough estimations) losses on the level of one percent of the overall economic growth which is influenced by a reduced labour productivity and nutrition diseases;

7. The state and private support to agriculture have decreased within the group of LDC countries (low developed countries). During the decade of 90's (1990 – 2000) this decrease reached 50 percent, e.g. in the sector that provides livelihood for 70 percent of the world poor population;

8. The number of malnourished has been decreasing yearly by six million instead of the needed 22 million (in order to reach the aim given in 1996). If this trend survives the goal to reduce the number of starving by one half by 2015 would be reached about 45 years later, i.e. in 2060.

9. The global market is still far from equitable one. For instance, the OECD countries yearly redistribute into their agrarian sector more than 300 billion $ US, which means that they directly provide support for each farmer amounting to 12.00 $ US per one ton of his production. On the other hand they provide for the LDC group a development assistance amounting to 8 billion $ US yearly, e.g. only 6 $ US for one peasant in those countries.

10. Access to markets in developed countries is limited by number of restrictions that on average go up to 60 percent of the price of agricultural commodities, which cannot be compared with industrial products (4 percent).

The Summit stated that there are substantial variations in food security among different projections for the future are especially due to the regional peculiarities, but these variations do not negate the main conclusion that the food gap is likely very serious and progressively wider in the first ten years of this century. It is because of the food demand growth in the food-deficit regions (especially Sub-Saharan Area) is higher than the production. The disproportion estimates are around 1.5 percent.

Adequate Solution of the Situation

Matching the global demand and supply situation may not seem unduly difficult in view of the rapid and sustained improvements in food production, processing, and marketing that have occurred, thanks to progressive development in technologies in the developed countries and some enclaves of the developing world (ALEXANDRATOS, 1996). However, it is important to ensure that food provision imbalances existing at the regional and local levels are effectively erased by extending productive capacities, increasing purchasing power and distributing facilities to all people who need food. On the other hand, the projected need is too great and the purchasing power of the people needing it is too inadequate to be met by aid or by trade (SOFA, 1996).

The long-term solution of the food problem must, therefore, be sought in improving the productive capacity of the farms in the food-deficient regions. But the real problem resides in the fact that the bulk of these primary food producers are small-scale farms, averaging less than 10 hectares (FAO UN, 1998). Majority of the modern technologies that are readily available in the developed countries is prima facie either unsuitable for or beyond the reach of such farms. All present forms of modernization of production in developing countries (for instance, creation of bigger and thus economically more viable units) generate rural unemployment and seem to be unsustainable. Apart from political and social considerations, the perceived benefits do not appear to be worth the perceived costs.

Position of the Productive Technology

Fortunately, a considerable part of the modern technology is either area neutral or can be made area neutral with certain (cheap) adaptations (SEN, 1978). Besides, modern technology needs not ultimately to be the most sophisticated one with much mechanical power. Concept of "appropriate technology" is used to describe such technologies proper for the given natural, social and economic situations. In the context with area neutral parts of the technology, inter allia photosynthesis, biological and genetic processes, some cultural practices and by-product utilization can be named.

If purposive research and development effort is concentrated on these technological segments, many of them can be applied to small-scale farms to a much greater extent then they are today. Prima facie, biological and chemical technological parts of technological processes are more applicable to small farms than are their mechanical components (or sometimes even animal drawn implements). But it is to mention that thanks to the (really) sustainable development based upon the modern purpose-oriented research, miniaturization of the farm mechanization (Japanese model) manages to balance the tendencies for heavy duty machinery use. It enables the small-scale farms to access the mechanical power (HAVRLAND, 2001).

Some technologies that are not area neutral (provided with large-scale machinery) in itself may be made available to small farms through custom work or rental or hire purchase. It makes accessible for small-scale farmers especially the machinery component of the technology increasing its efficiency by renting a relatively large peace of equipment for a limited period of time. Schemes for promoting the above custom work

and rental or hire purchase are well known but they have not yet been given the attention they deserve in most developing countries. However, forms of inter-economic use of agricultural machines (IUM) merit a special interest for many regions as well proved in developed countries and designed as area neutral. Machine Joint-Use Society (MJUS) and Machine Equipment Co-operative (MEC) are forms of purpose-oriented inter-farm cooperation with a certain market component (HAVRLAND, KAPILA, 2004).
A few countries have experimented with a chain of state operated and state funded machine-tractor stations but it has almost failed. The main shortcoming of this has been the bureaucratic and reduced private interest projected in the lack of enterprise and flexibility. In other countries, efforts by private enterprise (private contractorship) have been either prohibited or haphazard and isolated.

Labour and Capital Intensive Appropriate Technologies
It is rather common to contrast labour intensive and capital intensive technologic methods when small farms are considered. Even medium-size and large farms in developing countries are constrained by this splitting up because the labour there is still competing equipment use on large fields.

In fact, both labour and capital methods may play a very useful complementary role in bridging the space between rather primitive technological stages and their sophisticated forms. But the labour intensive technologies are not replaceable under conditions of the basic scarcity in some regions- land that the small-scale farmer faces. Intensive labour application on a scarce land unit helps to increase yields. Also in other cases the labour intensive or purely hand-tool methods are not only adequate but the only possible. It is because they are adequate (appropriate) to the local conditions.
However, it is to mention that the labour alone does not by itself improve the productivity or wage of labour – it occurs only when intensive use of capital accompanies intensive use of labour in such a way that yields of per unit of both land and labour increase in order that every increase in production is accompanied by a growth of per capita income too.
The sustainability of the above need resides in consequent steps phased so that the rural economic balance is maintained and some funds are allocated for the rural infrastructure building whereby increased production helps reduce the food deficit and increased income helps modernize the village. Then, meeting the food requirements and maintaining a certain modernization process by improving the productivity of the small-scale farms can become a continuous process.
Nonetheless, the capital intensive technologies are rather large-scale ones proper for larger-size farms. They are usually constrained (under conditions of developing economies) by inadequate servicing and spare parts supply and accompanied by the increase of the rural unemployment when improperly deployed. The same is true for small-scale capital intensive technologies (small mechanization model) that are more applicable and more sustained for small-scale farms in land-deficient regions except for the rural unemployment that manifests (in this case) as a smaller problem.

Importance of Capital Investments into Technologies
Increased production is generally possible by intensive use of labour alone, however the result is always a short spurt but not a sustained progress in the agricultural development. It can be concluded that the agriculture needs progressively intensive use of capital as a base for its further expansion. Intensive use of manpower accompanied with a positive production response is possible in regions of lack of acreage and fertile land. Progressive modernization of the agriculture that is essential for a sustained production depends on both labour and capital in the millions of small farms in the food-deficit and labour-surplus regions of the developing world.

Deeper analysis of the above relationships shows that intensive use of labour will be helpful for the adoption of many biological and chemical innovations or is about to make them available to small-scale farms. But intensive use of capital will be needed to get the best results of this effort by, especially, provision of the degree of mechanization required for optimum efficiency of labour and for progressive improvements in its remuneration.
Estimates by FAO in its study *World agriculture: towards 2010* (WAT2010)[2] suggest that there are reasonable prospects for maintaining an *overall balance between food supply and effective demand*, although the elimination of chronic undernutrition remains a formidable additional challenge. The investments needed to achieve this, and *more equitable food distribution*, have not been gauged so far. Few systematic records exist of past investments, nor exist good models of the *causal relationship* between investment in agriculture and food supply.
Some broadly indicative figures on current investment can be derived from FAO data and other sources. These imply that *net investments in on-farm improvements* in the developing world may have been US$26 billion per year in the recent past (*US$77 billion gross*) and in the post-production sector US$15 billion per year (*US$34 billion gross*).
In addition to these largely private investments, *public expenditure on research and extension in developing countries* may be estimated at about US$10 billion per year and on rural infrastructure at, very tentatively, US$20 billion per year. International assistance to agriculture in developing countries rose from around US$12 billion per year in the early 1980's to nearly

US$16 billion in 1988. It has since declined to under US$10 billion annually by 1994 (FAO, 1997).

The efficiency of investments is as much an issue as their volume Countries and donors are making efforts to match public funding more closely with beneficiary needs, through decentralization and participatory approaches in the planning and *implementation of development programmes and the privatization* in part or in whole of formerly public agricultural services where returns can be privately appropriated.

As to future investment, provisional estimates suggest that to increase food production in developing countries in line with effective demand until 2010, *gross investment of some*:

- US$86 billion will be required annually in primary agricultural production (including irrigation) provided especially by small-scale farms,
- US$43 billion for related post-production facilities (again in the form of small-scale production) and
- *US$37 billion for public support services and infrastructure.*

Taking into account all relevant factors and their *different effects on the level of investment*, e.g.: *real price changes for capital items, technological progress* and *disinvestments in the past.*

It may be assumed that the resulting incremental gross investment on small-farms figure in terms of *primary production, post-production*, and *public support services and infrastructure* of US$31 billion annually, constitutes a conservative but realistic estimate.

Modernization and Supportive Innovations – Barriers and Expectations

Modernization and supportive innovations implementation are a real must for the future if a sustained development is to be met. But these processes are not as fast as it is required. The problem resides in various technological, economic and social barriers that usually must be faced. They are more impacting farms more it gets smaller. If the optimum use of a given area neutral technology is dependent on specific conditions or other technologic processes that are not so, it may pose problems for small-scale farmers. Then, the only solution consists in providing services on private (custom) or public (collective) basis (HASSING, 1998).

Unsatisfactory a real barrier may be seen in the profit margin which is not large enough or a perceived risk is too great. The consequence is that the farmers can not adopt a desirable innovation. Marketing services, price or income supports, supervised credit may reduce this barrier. Non-formal education, extension services closely supported by research and feedback arrangements, and geographical and social mobility reduce the above barriers. It will, therefore, be useful to orient research and education to well defined target groups or areas, to identify special needs for new technology or product promotion (RIEDIJK, 1986).

Technological and institutional innovations often are not only complementary but mutually supportive. Thus, parallel introduction of technological and institutional innovations in a strategic manner may in fact act the one supporting the other.

The mechanization innovations can create rural unemployment if not dealt with as a practical policy. I.e., if machines are introduced suddenly, on a large-scale and without adequate safeguards for the transitional period the amount of labor may become surplus. The rural policy approach consists in phasing development steps when the direct loss of unemployment becomes more than offset by an indirect gain in unemployment. Furthermore, many machines help make the labour less irksome and more productive instead of making it redundant.

Technology and Income Distribution

It is sometimes surprising that along with the technologic changes towards more sophistical technological levels the rural incomes grow but they are becoming more skewed with time. It means that a substantial number of people within the rural population have not benefited from these incomes at all. The figures are alarming in view of the ILO market-basket poverty line based on the nutritional standard that points out a real contradiction of the rural economic growth. Usual explanation is that it is result of the unemployment generated by the machinery use.

However, the problem resides in the income distribution system and is not caused by the technological level itself. Furthermore, it cannot be argument against modernization and economic growth. But it is a reminder that growth by itself, given the social structure prevailing in many developing countries, has left far many people behind as economic dropouts. It is for sure that the technology required for economic growth is displacing job holders to an unacceptable degree. The following conclusion is resulting that the policy makers must regularize modernization through the new technology by more careful way in the future then they ever did in the past, if they have any concern at all for the poor depending on a wage or self-employees with minimal resources to survive.

Whether the modern technology displaces workers seems to depend somewhat on which constellation of factors is found and how it is changing over time. I.e. which crop is grown (some are more amenable to the machine process than others), diversity of the farming process followed, kind and amount of machinery (heavy duty) and in which practices it is used, whether double cropping is practiced, pattern of land tenure and presence of tenants, occasional labour, resident farm labour and so on.

Reason for Modernization and Its Social Effects

The reason for modernization (higher level technology introduction) seems to accompany the use of high yielding crops and animals that would recuperate higher investment costs. On the other hand, in the case of higher technologic level, qualified labour must be dealt with in a personal manner lest it can damage or disrupt the harvest. The chain of events is likely to be cumulative and one operation (ploughing or seeding, for instance) is mechanized and the mechanical power source becomes available at the farm, it will be relatively inexpensive to mechanize other field operations. In this instance, the first mechanization round is positive and produces even increased labour use, the second-round effects (mechanization of cultivation operations and harvest) will probably be adverse.

Not only the effect of substantial rural unemployment but also increased rural inequality is created by the modernization of the agriculture. However, the net effect of mechanization to date in developing countries is not to create unemployment and underemployment and it is not to say that technological changes cannot be utilized in a more imaginative, socially beneficial manner in the future. It seems, even, that each step toward modernization in rural areas and especially in the field, brings about unwanted social costs in the form of reduced incomes of a part of the rural population caused by the unemployment. The way out from such a social deadlock can be found in "appropriate technology" as already mentioned.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the above facts and analysis results the following conclusions can be drawn and conclusions suggested:

1. The World Food Summit "Five Years After" (FAO 2002) formulated general strategy for fighting hunger and poverty in the World that have been specified as (especially) "*immediate responsibility of national governments for the Food Security of their population.*

2. The long-term solution of the food problem must be sought in improving the productive capacity of the farms in the food-deficient regions. However, majority of the modern technologies that are readily available in the developed countries is prima facie either unsuitable for or beyond the reach of farms in the developing countries due to their size and financial incapacity of land-users .

3. Some technologies that are not area neutral (provided with large-scale machinery) in itself may be made available to small farms through custom work or rental or hire purchase. But their biological and chemical technological parts of technological processes are rather applicable to small farms than are their mechanical components (or sometimes even animal drawn implements)

4. The sustainability of the modernization process resides in consequent steps phased so that the rural economic balance is maintained and some funds are allocated for the rural infrastructure building whereby increased production helps reduce the food deficit and increased income helps modernize the village

5. Progressive modernization of the agriculture that is essential for a sustained production and food security depends on both labour and capital in the millions of small farms in the food-deficit and labour-surplus regions of the developing world. But in many areas lack of manpower (for especially seasonal picks) hamper to increase the food production and capital investments are necessary to secure it.

6. Modern technologies (especially machines) must not be introduced suddenly, on a large-scale and without adequate safeguards for the transitional period, so that the amount of labour were not to become surplus. By such a way creation of rural unemployment by mechanization innovations can be avoided. This is the must of the practical rural policy.

7. The profit margin is the most sensitive parameter of the modernization process which can turn in a real barrier if not large enough or a perceived risk is too great. Marketing services, price or income supports, supervised credit have to be reasonably utilized which could reduce this barrier.

8. Technologic changes towards more sophistical technological levels may generate the effect of the rural incomes grow but they are becoming more skewed with time. The problem resides rather in the income distribution system and is not caused by the technological level itself. Distribution system has to be checked and its weaknesses identified in order to do proper changes.

9. Not only the effect of substantial rural unemployment but also increased rural inequality is created by the modernization of the agriculture. Searching the way out from such a social deadlock the rescue can be found in "appropriate technology".

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