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ADOPTION OF IMPORTED TECHNOLOGY  
IN  
DEVELOPING COUNTRIES.

The Experience of Tanzania <sup>1/</sup>

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<sup>1/</sup> The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

In our dual objectives of achieving both maximum industrial growth and human participation in economic development, we have made greater strides towards realizing the former. At this stage of industrial development it is appropriate to ask ourselves one crucial question. How did we get where we are and which way are we going? It is becoming increasingly obvious that more emphasis is being laid on realizing commercial profitability objectives in appraising our development projects. The choice of proper technology, though closely linked to profitability as an economic variable, has received secondary importance.

The new industrial ventures that have been undertaken by NDC in the Textile and Leather sector and Heavy Industries like the Fertilizer plant, OTEA, Farm and Agricultural Implements Unit, and Steel Rolling Mills are relatively capital-intensive. The purpose of this paper is not only to advocate the use of labour-intensive techniques where it is appropriate, but also to put proposals on adoption of foreign imported technology to local conditions. For practical reasons the terms 'labour-intensive' and 'capital-intensive' are relative, and there is no clear-cut border that distinctively separates the two. It also follows that a Technology that may seem labour-saving in Tanzania may appropriately be classified as Labour Intensive in Developed countries. This is why, as we shall see later, it is necessary to rely on our local research and development facilities to evolve an indigenous technology. There are a good number of reasons why we are utilizing the present techniques of production. On the forefront has been our connection with multinational corporations as financial partners, technical consultants and machinery sellers. They evolve production techniques that have been tested and found commercially profitable in the economic and social conditions in heavily industrialized countries. The Research and Development of these corporations devise the technology that will maximize the use of capital which is cheaper in relation to labour, taking into account such factors as labour unrest into consideration.

There has been a naive correlation between industrialization and development in the less developed nations of the world. Development in these terms is defined as being the attainment of new products, new processes and higher standards of living. The mere growth of economy as shown by the growth of population and wealth, cannot be designated as a development economic growth as characterized by growth of output, and investible surplus cannot be the sole determinant of employment of new technology. The proper criterion for choice of technology should take such factors into consideration as promotion of new and advanced forms of organization, and that technical efficiency should adjust its operations to a changing environment in the shape of wider markets, new tastes and new sources of supply.

To this extent a new technology should satisfy the following conditions:

- a) introduction of a new good or of new quality of a good
- b) the opening of a new market
- c) the conquest of a new source of supply of raw materials or half-manufactured goods
- d) the carrying out of the new organization of industry.

The emphasis in Tanzania now is to adopt a technology that will promote cheap exports as we move from import substitution to export promotion.

Industrial development in this sense has become synonymous with development. In the same degree, the most advanced technology has also begun to be regarded as the background of a sound industrial policy. This can explain, partly, why our economists, consultants and politicians have put so much emphasis on importation of the most modern technology which is capital intensive. There has been a need to demonstrate to the masses what has been achieved in terms of development as symbolized by a chain of "modern factories".

Some international companies can argue with some justification that the fiscal policies of the emergent nations encourage the use of capital intensive methods. The taxation systems alter the relative costs of labour and capital. With easy access to foreign exchange to import expensive capital equipment, and absence of import duty on capital goods it becomes unsound not to employ capital intensive technology. Some of the hidden costs of labour are the training costs, labour unrest, absenteeism and lack of industrial attitudes. These have discouraged foreign industrialists to employ labour intensive technology. But it is very doubtful that the minimum wage legislations have been instrumental in increasing labour costs. What can be said with certainty is that with such generous investment allowances, and depreciation allowances it would be unwise for an entrepreneur not to utilize the abundant capital resources whose low cost will maximize both profitability and return on investment.

Much has been said about the feasibility of increasing human participation in our industrial development by adopting a technology that will employ a lot of labour relative to capital. Suffice it to say that the social costs of unemployment and political implications that follow are great. It is labour that is the abundant factor in developing countries, although for it to be employed it should be trainable and easily adjustable to industrial conditions. Unfortunately, the proponents of this approach tend to estimate the degree to which labour can be substituted for capital. There are practical limitations in the production processes. It is the end product that determines what method of production would be employed. As products are becoming more sophisticated so are the processes. With these limitations a 100% labour intensive technique is becoming increasingly obsolete. Here, there is a dilemma in the choice. There is a need for our economists in their project appraisals to avoid both obsolete and experimental technology. Expensive imported machinery compounds our development problems by trying to solve the problems of the new technology which has not been tested commercially and proved profitable. A technology that

is competitive and commercially profitable in West Germany may not prove to be so in Tanzania with its peculiar environment, social and economic conditions. It demands analysis to adopt the acceptable and productive technology. While some projects may be attractive to machine sellers, it may be a risk to an underdeveloped country. We should try not to be the first to adopt the new technology nor the last to cast the old one aside. For it is equally true that an underdeveloped country that uses an old standard process is taking no risk in technical performance but may be risking its entire investment if the process or equipment has been rendered obsolete by new developments which have made the old process uncompetitive. The hazards of both obsolete and experimental processes are particularly likely to occur in an industry in which the technology is changing rapidly. The main areas of risk are chemical and fertilizer plants. The Three Year Investment Plan for NDC which ends in 1975 will include quite a number of new projects and industrial ventures. Some of these are the Morogoro leather complex, garment industry, bicycles, washing agents, cast iron foundry, structural steel, pharmaceutical and civic explosives. The question that should be asked is, will the new technologies employed maximize both output and employment?

The implications of the proper choice of technology are many. Undue emphasis has been placed on foreign exchange benefits, commercial profitability, and national economic profitability in feasibility studies. It all depends on what the priorities of the particular country are, in consideration with present and future needs - time preference. Unemployment has been on the increase, while industrial output has been expanding. These dual aspects of industrialization should be reconciled. It follows logically that the employment of imported expensive machinery has an adverse effect on the foreign exchange position; as dividends, interests and maintenance fees are sent out of the country. The employment of a lot of capital and relatively little skilled labour has contributed to multidistribution of income. Increased human participation would above all things bring more people into the monetary sector. The geographical distribution of industries in Tanzania and other East African countries has concentrated on the capital cities where external

economies of scale are many. The process is self-sustaining. The problem becomes increasingly serious as complex capital intensive technology cannot be spread to the rural areas to speed rural industrialization.

### SMALL SCALE INDUSTRIES

Small scale industries that can be spread to the rural centres are for all technical purposes labour intensive. As the productive process becomes more complex the part played by labour becomes more meaningless. Capital intensive technology becomes highly specialized in every process and therefore promoting a high degree of division of labour. Human labour becomes an appendage of the machine. Man becomes a cog in the machine. This deprives a worker of job satisfaction and sense of achievement and adversely affects productivity. It reduces human motivation for work. In simpler technologies a worker understands the whole process and the part that he plays in it is directly related to the end product. Reduction in the degree of capital intensity and simplification of modes of production would lead to job enlargement and restore to the worker the sense of workmanship he has lost. Maintaining a complex equipment is expensive in terms of technical services required. Shortages of spare parts become critical. The market potentials of developed countries cannot absorb the output of the modern capital intensive technical processes in absence of export opportunities. Capital intensive technology has promoted marked examples of underutilization of capacity. This is costly to developing countries. It is imperative for research departments in developing nations to modify imported technology to suit the economic and social needs. This is a short-term solution. The long-term solution will lie in devising "indigenous technology" that is neither too labour intensive nor too mechanized - "intermediate technology".

### IS INTERMEDIATE TECHNOLOGY FEASIBLE IN DEVELOPING COUNTRIES?

Other things being equal, in most developing countries, it is the labour intensive rather than capital intensive industries that would appear likely to possess the greater relative competitive advantage, even when the

productivity of labour is somewhat lower than in advanced countries. But it is also equally true that labour saving technology is not of great value to an economy which is over populated. The search here should be for technologies which increase the yield per acre or which enable large numbers of persons to be employed in secondary industries for a small expenditure of capital. If the "stepping stone theory" is true, it is realistic for countries like Tanzania to move from simple industrial operations to larger and more involved operations as skills, capital and experience are acquired. There is a need for an industrial "evolution" from simple to complex processes. This is because our underdeveloped infrastructure includes poor transportation, marketing and lack or absence of technical and executive skills. The foregoing factors are prerequisites for an advanced technological revolution. If an "intermediate technology" will be found by our economists and planners, it would benefit the small scale industry sector. NDC and Mincom has started to put a lot of emphasis on small scale industries. The UNDP of India have come to advise Tanzania as to how best we can harness our resources for small scale projects. Part of their research should include the "evolving" of intermediate technology for rural industrialisation. An intermediate technology - neither too mechanized nor too primitive, is consistent with both goals of employment and output maximization. In fact, such a production technique is less demanding in terms of things we lack like capital, management and technical skills.

It is easy to build and to put into operation and produce quickly. Such a process will very much facilitate "industrial decentralization" to achieve a more reasonable distribution of industries in all the regions of Tanzania. It is easy to raise capital from local resources, like TIB and TRDB in financing cheap and simple production processes. Tanzania cannot afford to set up a few large complex plants because of the inherent financial risk. The magnitude of loss through failure of one big project would be reduced through diversification which can easily be promoted by cheap "intermediate technology". It is imperative for planners and politicians alike to include in the proposed National Industrial Consultancy Centre a



division to study the "technology" currently being imported. It should meet the needs and priorities of Tanzania. Two aspects are important. How technology should best be acquired, absorbed and adopted to local conditions is of great consequence to the future economic growth of this country. Secondary as the industrial base is expanded, the path from unsophisticated Technology to more complex and varied should be well charted. A few factors are important about technological development in Tanzania.

As Tanzania moves from import substitution to Export Promotion, our products should be competitive on an international basis. This would require a cheap and efficient technology which may turn out to be capital intensive. The flow of technology should be adequate to meet the basic needs of industrialization - to cover major technological and production gaps in the Tanzania's industrial programme as expressed in NDC's Three Year Investment and Development Plan.

Technology must be correlated with the locally available inputs and with present and projected demand. The inputs to be considered are indigenous potential skills and raw materials. While aiming at generating maximum employment, easy absorption of imported know-how should be considered.

The Government should play regulatory role in importation of technology. This is because indiscriminate and unrestricted importation of foreign technology with reference to costs and needs can create economic pressures, distortions, which tend to be aggravated over time. There is the negative foreign exchange effect of importing heavy capital goods. Complete technological dependence may hamper indigenous research and development of technical assistance facilities. This is a prerequisite creation of a strong technological base. The growth of domestic technology and consulting engineering services is vital to developing countries. It will make it easy to adopt and develop acquired technology.

Technology that is feasible in Tanzania is that which will maximize both employment and productivity in the long run. Labour intensive technology will expand employment, incomes to labour and hence consumption. This has two effects: it reduces the inevitable surplus and capital formation. There is here also an inherent danger of an inflationary spiral. Will labour intensive methods produce enough output to match the extra demand generated by additional labour incomes?

In the case of labour intensive technology, costs are mainly in the form of variable costs and total costs will tend to rise as output rises. The opposite is the case with capital intensive methods. Fixed costs form a substantial portion of costs which will tend to rise less rapidly than output. Average tends to fall as output rises. It is therefore logical to conclude that the size of the market will determine the type of technology to be employed. Can the local market in Tanzania absorb the large output needed to sustain capital intensive technology?

Since a project evaluator is concerned specifically with one project, he may be misled into thinking that employment maximization means maximization of employment in that project. Clearly, however, he has to be concerned with the opportunity for overall employment increase, and this does not depend only on how labour intensive a project he chooses in. It may be better to invest in a capital intensive project that will promote complimentary industries and increase the "employment multiplier" both in magnitude and over a longer period of time.

#### CONCLUSIONS ON IMPORTATION OF TECHNOLOGY

Labour intensive factories are especially helpful when they draw on resources with little alternative use, e.g. under employed labour and waste materials. While primitive techniques may offer obvious opportunities for improvement, at the same time the shortages of capital would suggest that improvement falls short of an adoption of the extremely capital intensive techniques of the West.

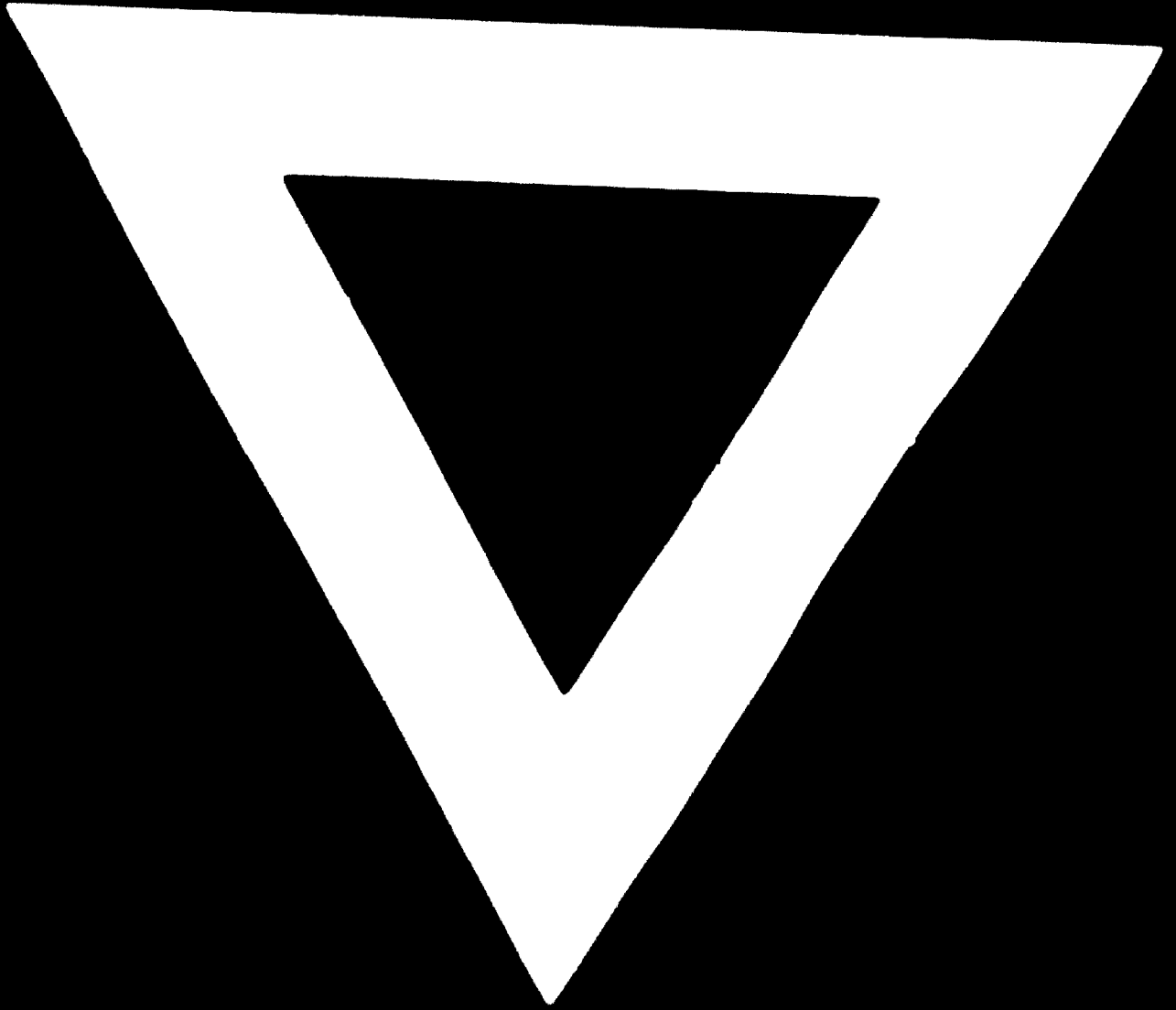
No advanced technology has yet been found which is suited to the factor proportions of the underdeveloped countries. Perhaps such a technology does not exist, but it is important to find out. Meanwhile, the lack of technological advancement adapted to our factor proportions is a serious

obstacle to our development efforts. An obstacle that scarcely existed in the Western world during its industrial revolution. Is repudiation of technological colonialism and dedication to the "national technological independence" possible and desirable? If technological colonialism means widespread preference for distant resources of information, it is likely to grow with industrialization as experience increases in buying information abroad - hiring technicians, foreign specialists, contracts with foreign licensees, consulting engineers and Research Institutes.

How do we achieve optimum capital - labour intensity? The answer should not be whenever physically possible, but whenever "economically possible". When the other costs are considered, the aim is to raise productivity. If incidental benefits, and costs "external" to the transactions of production and distribution are absent, the best technique under competition will be the most profitable. When an alternative technique is considered, what counts should be comparison of their respective output raising capacities with their costs and not the relative use of labour or capital.

Conclusively, project appraisals should consider seriously the costs and implications of importing a particular technology for the present and the future. The peculiar conditions prevailing in the country and declared priorities should determine the right technology. Future research in underdeveloped countries should lay emphasis on finding an "intermediate technology" which is as vital as market research. Process research should devise a technology for the underdeveloped world that will maximize both output and employment over time.





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