IMPACT OF TRANSFER OF TECHNOLOGY ON INDUSTRIAL PRODUCTION AND TECHNICAL EDUCATION

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1. INTRODUCTION

Underdeveloped Economies (UE) are characterised by the fact that the majority of the population - in the case of Tanzania about 90% - are concerned with simple production in the agricultural sector under subsistence economic conditions. The respective social and technical forces of production (PF) do not allow for a surplus product sufficient for indigenous economic development.

Tanzania's policy of villagisation is therefore a first step towards stimulating development of social productive forces. In 1974 the agricultural sector contributed 37% to the GDP of Tanzania. Villagers succeeded to produce with simple means of production in addition to their own subsistence a surplus product for the benefit of the society as a whole.

However, increased subsistence production does not expand the purchasing power of the population. Purchasing power is the necessary prerequisite for development of an internal market of wage-goods manufactured by the indigenous industrial sector.

This problem in mind, we have to ask: How is the modern monetary sector interrelated to the development of agricultural production?

The monetary sector consists of industrial production and services. In both fields less than 8% of the Tanzanian populations are employed. These are the only group with regular incomes, either wages or salaries. These employees provide at present the major purchasing power within the economy.

Industrial production, including building construction, mining and manufacture, contributed in 1974 17% to the GDP of Tanzania. What is their impact on agricultural production?

Building construction e.g., like the Kilimanjaro Airport or urban road constructions can hardly be seen as improvements of agricultural infrastructure.

Existing mines do mainly operate for direct export of raw materials..

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Resources like iron and coal are discovered but not yet exploited.

90% of the Industrial enterprises are interlinked to agriculture; they are "processing" the respective primary goods. However, many of the products like sisal, cotton, leather, etc. are exported as "semi-finished" rather than "finished" goods. The "value-added" in mining as well as in processing industries within the economy is relatively limited.

Only 10% of the manufacturing enterprises are dealing with PRODUCER GOODS. Within this categorv "assembly work" of imported components like trucks or fertilizer is dominating. There are workshops for repair work and manufacture of spares. But there are hardly any engineering industries; indigenous industrial research and technical development are therefore an exception.

Whereas agricultural and industrial production are the "productive" sectors contributing with 54% to the GDP of Tanzania, the service sector is only indirectly productive; services like education, health, public administration, etc. are necessary to the society; but they are deducted from the revenue which is accumulated by the productive sectors. It is therefore a serious problem for the economy to cater for the service sector which is expanding faster than the productive sectors.

The major problems for the development of an UE are therefore the following:

- There is little mechanisation of agricultural production, hence, low productivity of labour;
- The realisation of the surplus value happens via external markets due to lack of purchasing power (jobs, income);
- Export preference for raw materials and semi-finished goods in contrast to finished goods allows only little "value-added";
- "Unequal exchange" on the world market leads to an unfortunate balance of foreign exchange earnings.
- The expanding service sector consumes an increasing amount of the GDP,
- Furthermore, if finance, production and distribution are under control of international capital, the surplus value appropriated in UE is not necessarily retained there.

Hence, such a structure of production, trade and exploitation determines the limitations for indigenous capital accumulation and economic development; this is particularly so because there is no indigenous producer goods department.

However, the scarce foreign exchange earnings are insufficient for the transformation of simple production into complex production; the development of technical forces of production requires import of foreign capital both in terms of loans and producer goods.

Transfer of Technology is the fashionable catch-word which tends to associate progress and development. But it is rarely considered in all its dimensions: import of productive capital, know-how, manpower - as well as certain forms of business administration and industrial work organisation to underdeveloped economies. It is an experience that transfer of technology can lead only to limited development of productive forces, mainly in such fields which are of interest for foreign capital due to profitability in general or the availability of certain raw materials in particular. Transfer of technology is very often a function of imperialism penetrating capitalist relations of production into UE and strengthening dependence in more sophisticated ways.

The struggle of an UE is therefore based on the following major contradiction:

The speed of accumulation in advanced economies reinforces and deepens the existing "international division of labour", developed economies manufacture producer goods and transfer their technology to UE which in return are forced to continue providing raw materials and certain consumer goods.

These phenomena indicate that the state in underdeveloped economies has a significant function as far as strategy of development, control of surplus appropriation and investment are concerned.

The international financial and economic dependencies determine the framework for the degree of national self-reliance; the social relations of production within the UE concerned determine the ideology of the ruling classes and the policy of the state.

Tanzania e.g., has opted for the progressive strategy of a "self-centered economy" which particularly requires the development of an own department for production of capital-equipment.[1]

Theoretically it is quite obvious that indigenous manufacture of producer goods will multiply appropriation of surplus value, local accumulation of capital and self-reliance in manpower education - therefore, overall socio economic development.

But what are the conditions for the practical implementation of such a strategy?

There will be a transitional period with the following compromise: Export oriented industries have to be expanded in order to support the establishment of basic engineering industries. But both require a clear long-term government policy regarding choice and transfer of technology and the respective implementation by all institutions which are directly or indirectly involved in the development of social and technical productive forces.

The focus of this paper will therefore be:

How do dependence from foreign capital, choice of technology and the respective industrial organisation affect the socio-economic development of underdeveloped economies in view of the strategy of a self-centered economy in general - and for an indigenous engineering industry in particular?

2. THE FACTORY SYSTEM

Major phenomenon of industrialisation is the Factory System (FS). The FS centralises the labour force, organises manufacture as a social, technical and economic process. The FS disintegrates the social formation based on "subsistence production" and introduces an industrial culture of "complex production based on wage labour".

The FS reflects the two major principles of industrial production which are:

- division of labour and
- mechanisation of work.

As early as 1776 Adam Smith advanced three arguments for the economical superiority of the FS:

"The great increase of the quantity of work which, in consequence of the division of labour, the same number of people are capable of performing, is owing to the three different circumstances,

- first, to the saving of time which is commonly lost in passing from one species of work to another,
- secondly, to the increase of dexterity in every particular workman,
- and lastly, to the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many".[2]

2.1 Automation of Manufacture (Man-Machine System)

Since Smith's day, capitalism has developed both the principle of "specialisation of work" and the principle of "mechanisation of work" as major rationales for increasing productivity.

In a capitalist economy technological advance is a major function of private accumulation and therefore is a legitimate factor which determines the respective socio-economic development. Techniques are means of exploitation and reflect the corresponding relations of production.

History of science and technology under capitalism shows increasing organic and technical composition of capital hence intensification of productivity and exploitation of labour. This significant tendency is reflected in the process of "Automation".

We will use the concept "automation" synonymously for several issues, such as rationalisation, mechanisation, computerisation, etc.. Basically all these measures lead to increasing productivity of labour because they involve the substitution of human operations and control functions by machines.

Therefore, the social administration of the essential principle of exploitation is to be continuously adapted to the changing technological environment; changes of technology particularly affect requirements regarding quality and quantity of social labour, determined by the kind and level of technology. Technology requires certain skills for its operation and technical control as well as for work organisation and social control.

We shall try to provide a sample of alternative techniques which may reflect different historical stages of technical development in the now industrialised societies. These alternative techniques may be options available to UE planning for "appropriate industrial development"[3]:

a. Hand Tools (HT). Nearly all products manufactured by sophisticated machines can be produced also by hand, using hand tools. Obviously this requires "craftsmen" with the appropriate general training and experience. The simpler the tools the more the worker has to have the skill of an artist.
   This level of technology restricts the number of products which can be made in a given time hence it requires many skilled people in order to satisfy a high-demand.

b. General Purpose Machines (GPM). For jobbing or batch production, different products and operations have to be considered, for which general purpose machines are the most appropriate from the engineering point of view. These machines are mainly used in engineering industries, in central workshops, in an atmosphere of low volume of output, and instability of part or product design.

Hand tools and general purpose machines are both most appropriate for the development of engineering skills, particularly as many skilled workers are needed in order to manufacture many products in a short period.

However, an enterprise applying cost-benefit analysis in order to decide the choice of techniques will find that the time needed, and training and labour costs of these skilled operators, are "uneconomical". This will lead to the decision to sub-divide the work, to intensify the division of labour, which will allow the employment of less skilled and less costly labour - or eventually to substitute workers by employment of special purpose equipment.

c. Special Purpose Equipment (SPE). The more an enterprise specialises in a limited range of goods in fairly high numbers, the more manufacture may be arranged in "Line layout"; high production rates justify the special design of equipment and plant, including special fixtures and better integration of machine design according to the particular requirements for those products.

Special purpose equipment is both the result of the division of labour and at the same time leads to further specialisation of operations. For the respective workers "on-the-job- training" of some weeks, days or hours will suffice.

d. Open Loop Automation (OLA). A high rate of output of discreta items or bulk may justify "open loop automation". Open loop refers to the model of the electronic control circuit. It is 'open' in so far as the worker is still involved, in order to perform control functions. Open loop automation may be characterized as "progressive mechanisation". E.g. the turret lathe is equipped with a set of tools needed for several different operations. These tools are adjusted at the start of production, according to the standard dimensions of the product. The machine will operate automatically. However, changes in the system, such as tool wear, will not lead to automatic readjustment. This means that while the variety of functions of the worker is reduced, he still has to perform quality control, re-adjustment of tools and maintenance.

This leads to a new phenomenon: Automation of the actual machine operation provides a lot of idle time to the operator. Therefore a

department with several machines of this type may employ relatively fewer workers, because one operator may run two or more machines in parallel: we have the "multi-machine operator", who specialises particularly in setting up machines, supplying materials, controlling quality and re-adjusting tools.

e. Closed Loop Automation (CLA). Machines at this level of technology are called "automats". Closed loop refers to the fact that operations as well as control functions are performed automatically.

Automatic control means that actual output data such as temperature, pressure, chemical composition or dimensions, which so far had to be fed back by an operator, are now automatically compared to the standard programme. Deviations from the standard leads to automatic introduction of corrective actions.
These automats certainly increase productivity, secure standardised product quality and require fewer and fewer skills for operation and control, since these functions are reduced to a minimum. On the other hand, a new phenomenon arises: Automats are highly sophisticated machines, the mechanised manufacturing process is of increasing complexity, which necessitates continuous upgrading of the quality of maintenance work.

f. Computer Controlled Production (CCP). Automation is limited technically by the imagination of engineers. The ultimate development would be a completely integrated automatic sequence, beginning with the input of raw materials, and ending with the final product, with no human labour involved other than that required to design and build the original equipment, to feed the computer, and to maintain the system once installed. There are more and more examples for such integrated automatic production lines for items like electronic components or even for motor car production. But more often we find computer controlled chemical processes such as refineries.

2.2 Organisation of Manufacture (Division of labour). We now want to show how the principle of "Division of Labour" (DL) can be organised in the field of material production.
DL leads to specialisation of tasks; where manufacturing of a product consists of several succeeding operations each involving a particular skill,

these operations must be also co-ordinated to ensure a smooth process of production. There are four major options for work co-ordination in material production:

a. Universal Craftwork. Where only one or few products are made on a small scale, one worker with "general training" in all skills required will complete all the operations for the whole product.

In Europe craftsmanship is a traditional qualification, particularly regarding the pattern of formal training and the ideology of the particular trade. It is derived from the work organisation of pre-industrial production. Craftwork in industrial societies is concerned mainly with the manufacture of producer goods, of which the key-trade is tool-making.

Craftwork requires a high level of skill in working with hand tools, as well as in operating various multi-purpose machines. It requires abilities of analysing; technical planning and engineering drawings; calculation of time, material requirements and production costs; operation and control of the manufacturing processes. The skilled craftsman must be fairly flexible as to different kinds of products. Craftsman usually performs complete projects with little supervision. These requirements can be met only by a basic training in training workshops plus practical experience in the actual process of manufacture.

From history we learn that skilled workers with general training are more likely than other groups to be actively involved in workers movements like trade unions and political parties. This seems to suggest that general education, formal training, and project-type of self-reliant work, contribute to the development of political commitment, a major prerequisite for confident political participation in the struggle for the economic and social development of the working classes.

However, there is another historical experience that because craftsmen are in a relatively privileged economic situation compared to other strata, they may use their political involvement and trade union activity only in order to follow their own craft interest, rather than the wider class interest. This tendency is usually analysed in terms of a "labour aristocracy".

b. Repetitive Partwork. Where large quantities are produced an enterprise will try to set up "production lines" according to the sequence of operat-

ions. Improvement of productivity of labour is achieved through "specialisation by individuals". Several workers will be trained each according to a particular operation. In contrast to "general training", specialised "on-the-job training" will do in order to increase dexterity in the one particular operation.

The main result of the FS is the promotion of production lines and the division of work into ever more minutely specialised tasks down to affew grasps only. The workers do repetitive partwork, only little skills and training are required.

Specialisation and automation in mass production create for the majority of industrial workers jobs consisting of repetitive partwork. We find three major groups of these so-called "left-overs of mechanisation":

- assembly work at the conveyor belt (e.g. radio assembly)
- operation of special purpose machines (e.g. drilling)
- quality control at the conveyor belt (e.g. bottle checking)

All these forms of partwork characterise a pre-automatic stage of manufacture. These operations, are for technological or economic reasons not mechanised. The operations which the worker performs are completely determined by the design and layout of the process or the machine. The worker is an element in the assembly line, he has to repeat operations according to the paces set by the given control programme. His movements and work speed are determined by the plant; the work place is fixed and he cannot leave his position without interrupting the whole production process. He is a left-over of mechanisation which makes him even more an integral part of the plant.

The skills and knowledge required for this sort of work are of low standard and are gained on the job within a short period, There is no planning or decision-making involved, no autonomy, not even to modify motions. The result is physical and psychological stress; operations and movements are habitualised; to keep pace with the plant requirements requires continued concentration.

There is neither communication nor co-operation with colleagues. All social relations are determined completely by the design of the plant and by the programme controlling the plant.

This work situation is obviously characterised by complete alienation, which gives the workers neither job satisfaction, since there is a

complete absence of autonomy and responsibility, nor economic security, since further mechanisation will lead to unemployment.
The majority of industrial workers perform this kind of repetitive partwork. In contrast to craftsmen, they lack proper education, training and experience, which are clearly necessary pre-requisites for the development of a progressive political commitment. The absence of these attributes is a barrier, both objectively and subjectively, to the development of the strength to struggle for the improvement of their socio-economic situation. Objectively, these workers are easily replaced by other unskilled workers; subjectively they lack the confidence to fight, except against their fellow workers in the competition for jobs. This of course contradicts the principle of solidarity amongst workers.

c. Partwork Rotation. It seems that division of work becomes counterproductive after a certain degree of specialisation, particularly because workers reject this type of work. Proof of this is revealed in the experience of mass-production: High rates of absenteeism, sick leave, labour turnover, poor quality of work and conflicts on the shop floor.

The experience of these consequences of repetitive partwork lead the management of some enterprises to superficial "solutions" - to the application of the principle of "job-rotation". In order to reduce the results of repetitive work, workers are shifted after a while to other operations. This procedure is supposed to improve "job motivation", and the range of skills and experience accumulated by the individual worker.

d. Team Co-operation. Whereas some capitalist enterprises have experienced the profitability of partwork rotation there is hardly any co-operative teamwork because this model obviously touches the question of ownership and workers' control. Team co-operation considers all workers involved in a certain production process or a section of the production line as equally important in their functions. Several managerial responsibilities are delegated to the group. As soon as the workers have sufficient general education and technical training for different tasks, allocation of work can be done within the group according to qualifications and needs. The team is self-reliant in, and responsible for planning and organisation of work, as well as in operation, control and maintenance of tools and equipment. Setting and control of work targets and quality standards as

well as job rotation can be easily organised by the group in accordance to the overall enterprise targets. Incentives may be based on the performance of the whole group.

This type of work organisation obviously does not require a supervisor in the form of an outside technical and social controller - the group can elect a co-ordinator for a particular period.

This kind of work co-ordination can be practised by the crew of a production unit, by a team doing maintenance and repair work. But this model also applies to processes of technical design and development where workers, technicians, engineers and others are supposed to co-operate.

Such a system of work organisation in some enterprises has proved to be beneficial to the workers' needs and also economical for the enterprise as a whole. It indicates a certain degree of social self-reliance within a given arrangement of technology.

However, self-reliance in production cannot be realised without abolition of certain technologies, like the assembly line. Only under a system of workers' control on a co-operative basis will we find full control of the means of production in the sense that the workers determine the design of the equipment and the organisation of production.

Team co-operation as a model of workers' control points at the possibility of changing capitalist work relations which are still dominating in Tanzania - in spite of the Arusha Declaration.

Given these typologies of "techniques" (2.1) and "work co-ordination" (2.2) the following questions occur:

- If there are alternative technologies, what is their impact on socio-economic development?
- If there are certain neo-colonial and financial dependencies, do UE have a choice on technology?
- If there are alternatives, and if UE's have a certain independence of choice, what is the political strategy according to which technology is chosen?

3. IMPACT OF CHOICE OF TECHNOLOGY ON SKILL REQUIREMENTS

We use the below matrix in order to correlate the two factors "division

of labour" and "automation of manufacture" with each other. This matrix therefore reflects the allocation of such technical tasks to workers (W) and to engineers (E) which are significant to a manufacturing process according to the techniques chosen!

AUTOMATION OF MANUFACTURE / SPECIALISATION OF TASKS	ALTERNATIVE TECHNIQUES (see 2.1) (Increasing degree of automation) a HT	b GPM	c SPM	d OLA	e CLA	f CCP
- Design of tools and machines	W	E	E	E	E	E
- Design of products	W	W	E	E	E	E
- Planning of operations	W	W	E	E	E	E
- Control of time	W	W	E	E	E	E
- Operation of tools and machines	W	W	W	E	E	E
- Control of quality	W	W	W	W	E	E
- Maintenance of tools and machines	W	W	W	W	W	E
- Set-up and repair of machines	W	W	W	W	W	W

This matrix illustrates two significant hypotheses relevant for industrialisation of UE:

3.1 Choice of sophisticated techniques leads to an intensification of the division between mental and manual work, reflected in the tasks of engineers and workers.

Operations remaining with the workers are getting reduced by number (see under dotted lines); they become also more specialised and of repetitive character. Technical advance demands less education and training and requires less responsibility, because all tasks of planning, from decision-making for the entire production process down to work organisation on the shop floor are taken away from the worker.

Automation increases the tasks of planners and engineers (see under dotted lines); they have to anticipate functions of the production process and to programme them into the equipment design and the computer. In consequence this means, social control by supervision is more and more substituted by technical control of work. Evidence for this tendency is the fact that a given number of workers in a highly mechanised factory require fewer

supervisors than in less mechanised production.

3.2 Choice of sophisticated techniques leads to an intensification of the international division between those countries manufacturing producer goods, and those producing primary goods.

Export of productive capital from DE results in surplus extraction from UE; the higher the degree of automation of the techniques chosen, the greater the "technological lock-in" regarding supply of raw materials, tools and spares, which are usually designed and licenced specifically for the equipment concerned.

Choice of sophisticated Techniques also result in underdevelopment of skills which is illustrated by the double line in the matrix: Functions possibly performed in DE are right hand of the double line.

Therefore, the higher the level of technology chosen, the fewer qualified tasks - both of workers and engineers - are required to be performed in the UE concerned. Production is getting more and more predetermined via technology of the supplier company.

Hence, in the last instance, choice of sophisticated technology and its transfer lead to exclusion of major engineering tasks from UE - therefore, maintain and increase underdevelopment of skills, particularly those skills involved in research, design and technical development.
Highly sophisticated technology is also most inappropriate regarding creation of employment. In DE technological advance results in "structural unemployment"; transferred to UE, these techniques neither create jobs, nor increase the working classes and their purchasing power.

Hence, import of sophisticated techniques neither significantly increase the number of productive workers, nor the quality of skill requirements.

4. TRANSFER OF TECHNOLOGY, A FUNCTION OF IMPERIALISM

A survey carried out in the Federal Republic of Germany[4] (FRG) reveals the aspect of neo-colonial dependency. The subject of the survey was the attitude of some 115 enterprises regarding private investment and the respective transfer of certain manufacturing processes and the associated work organisation from the FRG to UE's. Some of the results shall be quoted:

"High production costs - particularly labour costs - in industrial countries motivate several companies to co-operate with developing

countries. Hence, the political request for increasing international co-operation is supplemented by the benefits for private investment".5

26 out of 46 companies explain:

"In spite of the relatively low productivity of labour the product costs in developing countries are still comparatively lower - up to 50%...".6

These statements show that the survey looks particularly into the possibility of transfer of such technologies which are within the FRG:

- "wage-intensive in terms of a great part of labour costs in the net value, and which require
- low qualifications in terms of a high percentage of unskilled or semi-skilled workers".7

Although companies, both with and without experience in UE are aware of the:

"... lack of trained manpower as the greatest disadvantage for a co-operation...".8

they still assess the skills which are available as appropriate for their technology.

It is obvious from the survey that private enterprises investing in UE consider neither 'appropriateness of technology' nor the 'need for education and training' from the point of view of the respective UE. This may be proved by some further findings:

Regarding 'methods of training': 14 out of 40 companies intend 'basic training', 8 out of 40 'on-the-job training'; 18 out of 40, however, have no programme at all in mind for future training.[9]

Similarly regarding 'duration of training': 9 out of 40 companies consider more than 6 months; 20 out of 40 plan less than 6 months training; the remaining 11 companies have got no opinion at all about duration of training.[10]

These few quotations clearly reveal that it is a major concern of DE to maintain the given world-wide structure of division of labour, in order to continue extraction of surplus labour from UE without contributing even to basic development skills. Training obviously increases production costs!

5. PRESENT CONDITIONS OF INDUSTRIAL PRODUCTION AND TECHNICAL EDUCATION AND TRAINING IN TANZANIA.

The present situation and some results of an industrial survey made in Tanzania[11] shall be presented by means of the following hypotheses:

(i) Most enterprises consider the non-existence of technical skills and choose those technologies which must maintain this situation. The given

industries do not require and do not develop skills in their production. The majority of workers either operate special-purpose machines or do highly divided partwork - neither of which require general education or systematic technical training.

(ii) In-plant training conducted by the enterprises - if it exists at all - relates only to the given technology of that enterprise. In-plant training does not provide enough skills even for the present requirements; industries prefer poaching of manpower in order to save training costs. The result is a shortage of skills for both present and future industrial development of the whole country - particularly regarding engineering industries.

(iii) Most suitable training fields for all engineering skills are maintenance and central workshops of large enterprises; these areas are the potential for manpower development for a future producer goods department because they foster a great variety of technical skills and managerial abilities.

(iv) Although product design so far is determined mainly by outside requirements, there are signs of indigenous technical developments. The first steps are usually caused by economic pressure in the form of shortage of foreign currency, which creates the need for 'import substitution' of energy, materials and equipment.

(v) Small scale enterprises seem to be appropriate institutions to evaluate local needs, to train manpower, to build and test prototypes and eventually to hand over production of the respective goods to existing large industries.

(vi) However, so far there are nearly no design offices attached to large industries which could introduce new products into the production lines. The respective posts must be created in order to absorb the increasing number of engineers. Design departments are most important in order to communicate technical needs from industries and to co-operate with institutions of technical education regarding applied research.

(vii) Institutions of technical education and training fail to provide adequately qualified manpower because there is total divorce between most educational institutions and industrial production. The theoretical knowledge provided does not relate to present industrial practice; very basic actual technical needs in production remain unsolved.

(viii) Most institutions of technical education and training are not related to each other, and fail to co-operate or even co-ordinate their curricula. Such co-ordination is vital in order to prepare workers, technicians and engineers and managers for successful future co-operation. As long as these institutions are not properly integrated, education and training will support the reproduction of hierarchical work relations.

(ix) The lack of a strategy of industrialisation results in the major problem for all institutions of education and training to predict future technical skill requirements by type and by number. This concerns particularly provision of manpower for such industrial processes which are not yet employed in UE.

(x) The national system of general education and formal training mainly emphasises the training of the bureaucratic strata; therefore, inadequate in-plant training of workers and over-emphasis on academic education of middle and upper management ask for the political support of a national vocational training. Such a scheme has to secure a general training to many workers, which industries at present are not able or willing to provide.

(xi) The present industrial employment ratio and the education output ratio for 1977 have the following frightening tendency:

> Engineers and technicians will be facing an overwhelming majority of semi and unskilled workers; there will be only very few workers trained in the relevant skills, they will be in no position to contribute in any significant way to the development of engineering industries; Even if there are sufficient engineers, there will be no industrial development if training for skilled craftsmen is not expanded on a massive scale...

Fig. 1

SYSTEM OF FORMAL TECHNICAL EDUCATION AND TRAINING IN TANZANIA (1975)

Co/20/10/75

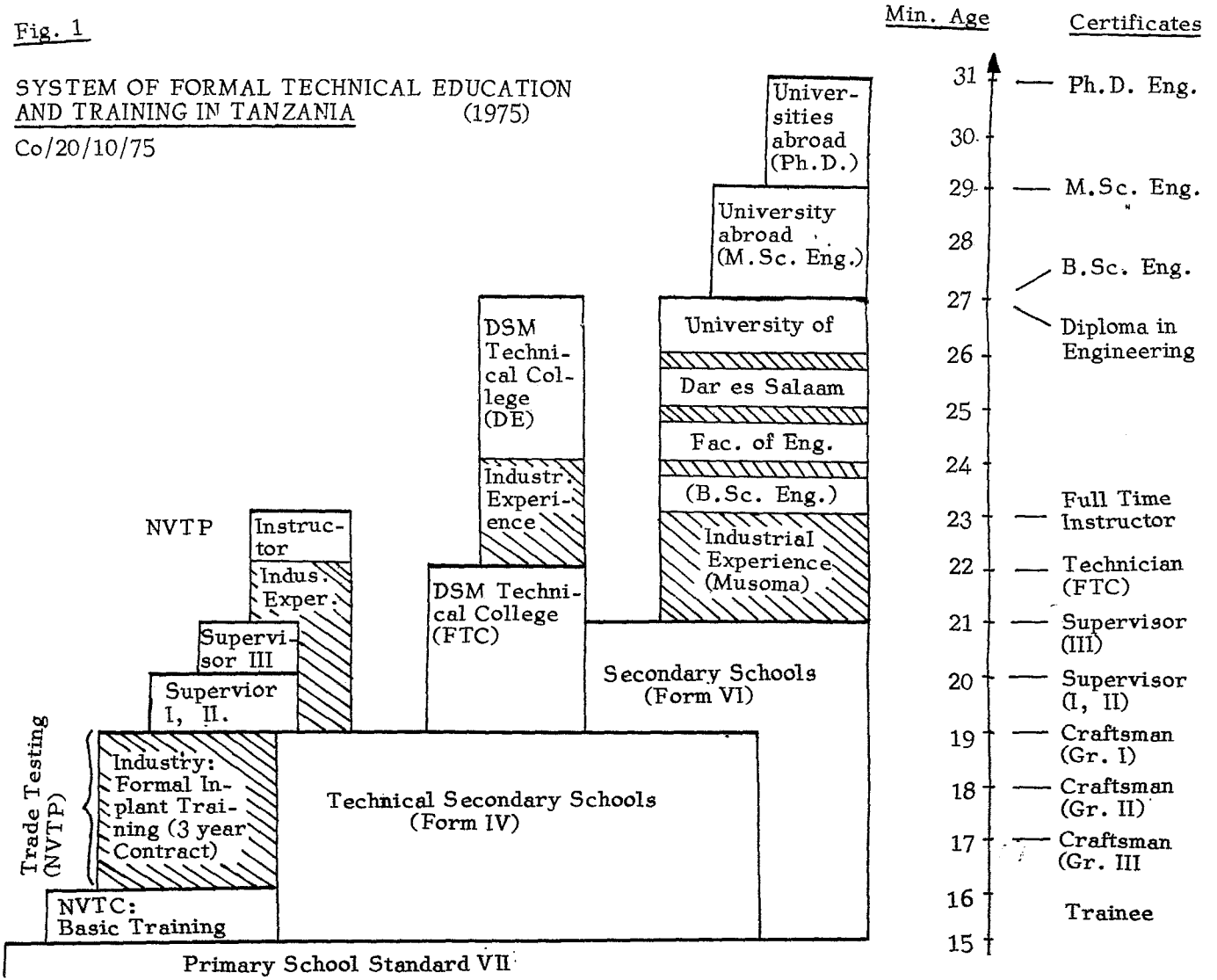

Table: 1

PYRAMID OF TECHNICAL EDUCATION AND INDUSTRIAL EMPLOYMENT				
Employment and Output Ratios Categories, Degrees and Institutions of Technical Education	Necessary Employment Ratio in a self-centered industrial Society	Employment Ratio by 1974 in Tanzania based on 28 major industries (including expatriate)	Output of Formal Technical Education in Tanzania by 1977 (Projections are based in input figures provided by Ministry of National Education DSM Tech. College, National Vocational Training Programme)	
			Ratio	No. of Students
ENGINEERS: (B.Sc. at the Faculty of Engineering, UDSM M.Sc., Ph.D. Eng. from abroad Universities)	1	1	1	600
TECHNICIANS: (FTC, Diploma in Engineering at the Dar es Salaam Tech. College)	5	5	2	1,200
CRAFTSMEN: (Grades II and I only at the National Vocational Training Centre)	25	13	5	3,000

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