Choice of Technology and Pattern of Development in Less Developed Countries

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The Less Developed Countries (LDCs), even after having achieved political sovereignty, are still economically dependent on More Developed Countries (MDCs). The nature of such a development can be conceived from the following. Out of total world resources allocated to Research and Development (R & D), about 98 percent are devoted to develop technologies primarily to be used in MDCs. The remaining, only two percent, of these resources are used to develop technologies directly relevant to the needs of the LDCs. The LDCs have to import technologies from MDCs to accelerate their social and economic development. The imported technology, being highly expensive, has not only drained the financial resources of the LDCs, but also failed to produce the expected results in terms of employment for surplus labour in the rural and informal urban sectors of these countries.

The LDCs plan to industrialize themselves using the imported technology. The main objective of industrialization strategy of LDCs is to create jobs for surplus labour working in rural sector at subsistence wages and hence raise the standard of living of bottom 40 percent of the population. Unfortunately, because of labour-saving nature of imported technology, the industrial sector (hereafter, referred to as the Foreign Technology sector or the F-

sector) has failed to absorb the surplus labour of the rural sector.

The development planners and experts in Development Economics have started recognizing the role of technology in the development of LDCs. As a matter of fact, the transfer of technology from MDCs to LDCs is one of the burning issues in contemporary Development Economics.[1]

About 'appropriate/inappropriate' technology Stewart (1977) concludes, "... individual techniques are designed for a particular economic/technical environment, and are efficient, indeed viable, often only in the context of that environment. If they are transferred to a completely different environment—from advanced country to underdeveloped country—then the original environment has to be reproduced" (p.83).

One of the effects of the reproduction of original environment in LDCs is the dualistic pattern of development in the form of concentration of resources in the F-sector and neglect of rest of the economy.[2]

Keeping in view the above discussion, the objective of this article is to discuss the impact of imported technology and its selection mechanism on the development pattern of LDCs. To this end, the article is divided into two sections, which are organized in the following manner. In the first section impact of imported technology on the development of LDCs has been traced. Second and the last section shows how the methods of selection of technology themselves are part of the system of MDCs' technology and they lead to dualistic pattern of development in LDCs.

Section - I

This section shows how the transfer of technology from MDCs to LDCs requires the reproduction of original environments and this reproduction leads to dualistic pattern of development in LDCs.

Technology may be defined as the skills, knowledge and procedures for making, using and doing useful things. According to Stewart (1977), technology is a matrix consisting of a set of techniques each of which is associated with a vector of characteristics. These characteristics include the nature and specification of the product, the input use, the scale of production, associated managerial techniques, investment requirements, infrastructure requirements, etc. Technology used and developed in MDCs reflects the economic, institutional and technical environments of these countries. If the same technology is transferred to different economic and institutional environments it will lead to inefficiencies. Any efforts to reproduce the original economic and institutional environments to make the technology work efficiently lead to distortions and inequities.

Besides institutional and economic, there are physical difference like climate --temperature, humidity and seasons-- between MDCs and LDCs. These physical differences alone make MDCs' technology inappropriate for LDCs.[3] However, in this article only the role of economic, institutional and technical differences will be discussed in connection with transfer of technology.

The environments which condition the characteristics of technology can be classified as: (1) institutional factors or organization of production; (2) economic factors particularly income levels; and (3) technical factors.

These factors have been discussed below in an attempt to show that technology developed for and by MDCs when transferred to LDCs lead to dualistic pattern of development in these countries.

Organization of Production (Institutional Factors)

Mostly in the local-technology sector or the L-sector indigenous organization is suitable for small scale enterprises. But for larger enterprises the use of MDCs' technology generally requires the use of MDCs' organization. In other words, the use of MDCs' technology requires MDCs' organizational talent in LDCs. As a result, there is a 'shortage' of local entrepreneurial talent in LDCs. It turns out that imported technology (MDCs' technology) and imported organizational skills tend to reinforce themselves. It is conceivable that foreign managers, having training in their own techniques, would always select MDCs' technology in case of expansion. As a result, import of more MDCs' technology will take place. This will take the shape of vicious circle in the following way. MDCs' technology when used in LDCs required the reproduction of original environments in terms of managerial skills. To make the imported technology work efficiently, import of managerial skills takes place. This results in concentration of resources in the tiny F-sector and neglect of the remaining economy[4]. As is well know, the imported technology and complementary organizational expertise are far more expensive relative to local technology and local management. A very small proportion of the labour force is absorbed in the F- sector and because of higher salaries in the F-sector, the distribution of income gets more unequal. A minority of the population raises its standard of living at the expense of majority. This leads to dualistic pattern of development.

Income Levels (Economic Factors)

Income level differentials between MDCs and LDCs are of crucial importance as far as transfer of technology is concerned.

Technological development is a function of both demand and supply factors. With the increase in level of income, demand for more sophisticated products increases. To supply such products more sophisticated technology is used. This technology is generally capital intensive. This is being practised in MDCs. Engel's law states that when income increases the society not only consume more in quantity but also in quality.[5]

The role of supply factors can be seen in the following way. The technological development depends on the resource availability. A society is expected to spend more on R & D to develop new technology if it has more resources. But tracing the relationship between per capita income, per capita saving and per capita investment, Stewart (1977) has developed the following identity:

$$\alpha = \beta \gamma \quad \text{——————} \quad (1)$$

Where α is investment per person of labour force, β is average propensity to save and is output per person of labour force.

Because of high income levels in MDCs, Eq. (1) can be realized without major distortion. Whereas, transfer of MDCs technology to LDCs requires transfer of Eq.(1) too. The LDCs being low income countries have very low per capita savings over the labour force. Therefore β is very small for LDCs. Since Eq.(1) is an identity it must hold and to make this hold, major distortions take place. To reach

the required investment per person in the F-sector, resources are shifted from the L-sector to the F-sector. Eq. (1) indicates if MDCs' technology requires α to be twenty times the level of saving per person in the economy as a whole (both F-and L-sectors) and if all the savings are used in the F-sector only twenty percent of the labour force can be absorbed in that sector.

This analysis indicates that MDCs' technology requires investment per capita more than available in the LDCs because of their low income levels. To make the imported technology work, the LDCs have to concentrate their resources in the F-sector and neglect rest of the economy.

Because of more sophisticated techniques used in the F-sector, the productivity of labour and hence wages are higher in this sector. The labour force working in the F-sector consume high quality products, enjoy better health, hygiene and nutrition standards. The distribution of real income becomes more unequal in favour of the F-sector employees.[6]

The above analysis also indicates that because of income level differentials between MDCs and LDCs, the MDCs' technology when used in LDCs leads to dualistic patter of development favouring the F-sector at the expense of the rest of the economy.

In addition, the imported technology also affects the life style of the labour force working in the F-sector. The pattern of demand of the F-sector employees is comparable to their counterparts in the MDCs. Furthermore, the goods produced in the F-sector are consumed only by the elites of the society. That means, one of the preconditions for the demand for the F-sector products is the unequal distribution of income. If income

is equally distributed, the levels of income in LDCs will be too low to permit the demand for F-sector products.[7]

Skill Requirements (Technical Factors)

The technology developed in MDCs requires higher levels of skills and training. The LDCs have to either duplicate these skills to adopt MDCs' technology or import these skills alongwith technology. It is relatively very expensive for LDCs to provide education and training needed in the F-sector. Only minority can afford such an education and training. Majority of the labour force works in the L-sector and does not need such an education and training. The locally trained and foreign personnel working in the F-sector get very high salaries such that gap between the salaries of F-sector and L-sector employees become larger than that in MDCs.

The above analysis indicates that MDCs' technology requires specific training and education and only minority of the population in LDCs can afford it and eventually work in the F-sector and enjoy relatively high standard of living. Hence, the skills requirement of MDCs' technology also leads to dualistic patter of development.

Section - II

The concern of this section is to show that the selection mechanism of imported technology itself leads to dualistic pattern of development in LDCs.

It can be argued that the choice out of available techniques depends on the goals of the decision-makers on the one hand and the characteristics of the techniques on the other hand subject to the constraints being faced by the decision-

makers. This choice is made in three different ways in the presence of F-sector.

First, because of 'linkages' between techniques and goods consumed, the technology used in the F-sector usually requires the specific kinds of inputs. These inputs are generally produced by MDCs' technology. Furthermore, because of unequal distribution of income in LDCs, demand pattern of elites is same as that of MDCs' general public. It has been mentioned above that high income groups demand more sophisticated (capital-intensive) goods. The links between different consumer products, e.g., air conditioners and circuit breakers, affects the selection mechanism. Besides, the demand for these goods is also created through advertisements. It must be noted that the demand for a particular technique is derived from the demand for a particular good.[8]

On the other hand, the level of income in the L-sector remains very low because of lower productivity in this sector. The standard of living of the population associated with the L-sector remains far below than that of the F-sector employees.

This analysis suggests because of differences in the demand pattern of employees in F- and L- sectors, the selection mechanism regarding techniques is affected. The selection mechanism also creates gap, which is expected to widen over time.

Second, choice of technology depends on the relative factor prices. It is argued in the literature that earnings and availability of capital and highly skilled labour used in the F-sector are determined internationally because of international nature of capital and technology markets. For the techniques used in the F-sector, the relative price of capital is lower than that of labour and opposite is true in

the L-sector. This makes an obvious choice of more capital-intensive technology in the F-sector. This means the nature of MDCs' technology itself influences the choice primarily in its favour. As a result of this choice there is more open unemployment in the F-sector which causes increase in income distribution inequalities.[9]

The third and the last argument for the selection of MDCs' technology is in terms of control of resources by different types of decision-makers. It is an established fact that the nature of the F-sector is fundamentally different from the L-sector. As has been argued above, because of linkages, between F-sector products and techniques, the choice of more capital-intensive techniques is preferred. This implies that more resources are devoted to investment in the F-sector. Because of high prices of the F-sector products and high profits in this sector, more resources are accumulated over time in this sector than in the L-sector. Furthermore, the terms of trade are also in favour of the F-sector products because of different market structures associated with two sectors. It may be noted that the F-sector is fundamentally oligopolistic, whereas L-sector is relatively competitive. High salaries and income of the consumers of the F-sector products make the demand for these products increase very rapidly.

The above discussion indicates that a gap takes place between the resource control of the F- and L-sector and the gap is expected to widen over time.

The additional arguments can be made to show that gap of resource control between two types of sectors is further widened. The international finance lending agencies, domestic government and local banks all favour the F-sector enterprises over those of the L-sector. The key point in this argument is that the policy makers do not have vested interest in the prosperity of F-sector, they will always

favour the F-sector in the belief that use of MDCs' technology will affect industrialization and hence development of their economies.

The above arguments also lead to the same conclusion i.e. the selection mechanism of MDCs' technology itself favour the use of capital-intensive technology relevant to the tiny F-sector and paves the way for dualistic patter of development in LDCs.

Recommendations

Before completing this article, the following recommendations can be made. The LDCs should not rely on imported technology. They should patronize indigenous technologies to encourage local talent and meet the local needs. The Indian experience is relevant and can be useful for many LDCs, especially, like Pakistan.

End Notes

1. See Stewart (1976), p. 125
2. For more on this issue see Nelson (1974), p. 67
3. For more on this see Dahlman and Westphal (1983), p.7
4. For more on this see Hawrylyshyn (1978), p. 79
5. For more on Engel's Law see Rutherford (1992), p.178
6. For more on this point see Baer (1976), p. 123
7. Ibid, p.124
8. To assess that the demand for a particular technique is derived from the demand for a particular product, see Bason (1978), p. 74
9. See Srinivasan (1982), p.89

References

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