Human Capital, Governance and the Transfer of Technology

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Nadeem Ul Haque

Abstract

The failure of economic and social development in the developing countries resides in the inconsistent policies, failure to take up and fulfil responsibility, inefficiency and encouraged waste by the leaders. This paper suggests that transfer of technology in this declining environment would facilitate and encourage economic development. It examines what technology is and also considers the recent dominant trends in technological development. Since transfer implies an act that has to be conducted by some agent, the next issue is of who should effect the said transfer? The answer to this question involves a consideration of the role of government in either directly helping in the transfer or in inducing such a transfer. A by-product of this issue is how the multinational and the indigenous private sector could interact to achieve a transfer of technology. If looked at from this standpoint, how does this issue differ from that of the related issue of foreign direct investment which is going to be an issue of critical importance in the coming years. Given the importance of attracting foreign direct investment, the next consideration should be the economic, political and social factors that could help attract foreign direct investment into the country. Finally, it is argued that, in essence, transfer of technology may be no more than a strong social and policy emphasis on the development of human capital. The paper closes with a discussion of the appropriate policy for the development of human capital.

As the fervour of nationalism in the newly independent colonies died down without yielding the promised rapid economic and social development, there was a scampering for alternative explanations. The tendency was to place the blame squarely on the external environment as the young nations and their leaders continued to exploit the legacy of colonialism to evade their own responsibilities and failures. Thus, through the sixties and seventies, transfer of technology, import substitution, self-reliance, the North-South dialogue and various other such areas that concentrated on blaming the lack of progress on factors other than domestic policy failures were in vogue. Such thinking ignored the fact that developing economies allowed all manner of institution to decline, encouraged waste, inefficiency and rent seeking, maintained inconsistent economic policies, incurred exorbitant defence expenditures, and virtually allowed their human capital to decline, especially if quality considerations are borne in mind. Somehow, in this environment of social, political and economic decline, transfer of technology would allow the forces of economic development to be unleashed.

Experience, however, proved otherwise and by the end of the seventies, observers had begun to record that "what seemed at first to be technological obstacles to development frequently turn out on closer examination to have been policy failures" (Weiss 1979). An important element of this paper is to attempt a determination of what policy can and cannot accomplish in this area.

Since this subject was in vogue, considerable technological as well as political changes have taken place in the light of which perhaps the issue ought to be re-examined. For example while the growth of electronics,

1. The paper was prepared for a conference organized by the Goethe Institute in Karachi on the subject of "Transfer of Technology". The author is grateful to the conference participants for their comments. Qayyim Said provided excellent research assistance as well as stimulating discussion during the course of writing this paper.

telecommunication and computers has revolutionized our notion of technology, and demise of communism as an extant political system has changed our attitudes to the functioning of the economy and the role of the government in the economy. It is with these factors in mind that this paper has been written.

The Definition of Technology

The earlier debate tended to have a linear notion of technology and economic systems. Economists such as Rostow had established a linear model of economic development where to achieve the status of a developed nation, countries would have to go through various stages (Rostow 1960). Each stage represents a move to a higher level of technology such as moving form an agrarian society to one based on light industry and then to an economy based on heavy industry. To move from one stage to another technology had to be transferred from those at a higher stage to those at a lower stage. In this world view, the dependence of those at a lower stage on those at a higher stage is cause for concern and the birth of areas such as the transfer of technology. Moreover, the definition of technology was in a sense hardware-dependant and humans were given the mere role of installing and running machines.

In this view, the rapid adoption of known technology could reduce the gap between rich and poor nations rapidly by means of a faster transfer of technology. Surprisingly, over the years, despite repeated efforts so to make this theory work, the gap was not only closed, it actually increased. Contrary to expectation, the pace of innovation in the industrial centers remained quite rapid, perhaps more rapid than the transfer of technology. This led some to surmise that perhaps higher levels of technology were based on increasing returns to scale (Romer 1986). This observation meant that the earlier hardware-dependant definition of technology or the interpretation techniques of production as man-machine relationships in some deterministic sense could no longer be regarded as appropriate. In more technical terms, the notion of the production function or the production frontier was now changed.

The earlier linearity of the development process as well as techniques of production were also in some sense challenged by the development of the human capital theory (Schultz 1981; Becker 1964; Romer 1989). Studies that attempted to identify sources of growth attributed a strong role to technological innovation and/or managerial efficiency (Dennison 1962). Related work showed that education was an important factor that affected the growth of developing economies (Romer 1989).

Before beginning to define technology let us look at current trends in the area of product development and production. Surveying the literature in the area of technology and production, one can identify four trends or patterns that are important for staying competitive in production of goods. These are:

Rapid Innovation Resulting in Technology and Processes that are more Widely Applicable

Technology innovation spurred on by competition and rapid expenditures on research and development by competitive firms has actually occurred at an increasing rate. The change which was concentrated in microelectronics and telecommunications has actually revolutionized many production and information processes as well as work relations. The new technologies have a broad range of applications in many areas and sectors. Aided by computer integrated machinery, the earlier distinction of light and heavy industry to signify technological sophistication is no longer valid. Increased automation has redefined the labor-machine relationship in a production process. We are in an era of automated or robot-controlled assembly plants, and of services such as banking and insurance being virtually automated because of automated data processing and communications.

Shorter Life Cycles, Greater Emphasis on Quality, and More Flexibility in Response to Consumer Needs

Electronics based, and computer-integrated processes have considerably improved productivity. This technology allows product designs to be improved, changed and implemented more flexibly and rapidly than earlier technologies. Manufacturers are, therefore, able to respond more flexibly and rapidly to changing market conditions and to consumer desires. The result is increased product diversity and more intense competition in the design, distribution, servicing and production of goods. This intense competition has resulted in a rush for improvement of a product and has, therefore shortened the life-span of new technologies and products.

Increased Automation, smaller Role for Unskilled Labour

Increased automation and an emphasis on product design, development and marketing means that there is no advantage to developing countries of being a low cost producer based on cheap labor. The policy-chiche -- "encourage labor intensity" -- that most developing country economists use has less meaning now than ever before. Comparative advantage needs to be redefined in the light of the new production processes and the global competitive environment.

A Strong Emphasis on Quality Management

In this new global environment of fast moving innovations and technologies, the key ingredient is management. New materials and new techniques that allow more efficient and cost effective use of resources are being devised rapidly and only a firm that can adapt quickly to the changing environment can survive (for further ideas on innovative ideas on management see Toffler 1991)[2].

In the light of these characteristics of technology, a more modern definition of technology which shall be used for the purpose of this paper is that technology is the knowledge inputs into high value added, marketed outputs. Such a definition stresses knowledge, organizational modes, and methods, more than hardware. The focus of technology is therefore moved away from physical objects. In fact, looked at in this manner technology is that which is embodied in people and their institutions, and the management capability of those institutions. The acquisition of technological capability is, therefore, more a matter of building, and professional and aggressive marketing capacity are likely to be vital.

Such a view of technology perhaps place the onus of technology transfer on domestic policy more than on international or external impediments. Policy for technology transfer may therefore be defined as the development of institutions that affect how the economy acquires technology from overseas, diffuses and uses such technology rapidly, with a continuous effort at improving and developing the acquired technology.

Who Should Transfer?

In the earlier debate considerable emphasis was placed on policy for the inducement of the transfer of technology. Overvalued exchange rates were maintained (or a dual exchange rate with an overvalued rate for technology import), to encourage the import of technology. Tariff barriers were devised to allow import

2. Quality of products and flexibility of production processes have been improved by the new techniques of management such as just in time inventory, zero defects and total quality control.

substitution to take place. Later, these barriers were maintained to protect domestic infant industry so that technology transfer became strongly rooted. Tax holidays and other fiscal incentives, as well as credit subsidies were devised. Large government sponsored projects were undertaken after considerable deliberations and international negotiations for this purpose.

India offers a very interesting example of how every effort was made for a long time to nurture a domestic industry and induce a large element of a transfer of technology. For forty years they relentlessly pursued a policy where they encouraged import substitution in the heavy and engineering goods industry to develop an industrial base in the country. Various forms of tariff protection, overvalued exchange rate, and various other incentives were used. However, the Indian industry remained technologically backward, uninnovative, and absolutely devoid of quality consciousness. It provides a classic case of how official protection was used as a means for industry to remain uncompetitive at the expense of the consumer. Today, India is busy dismantling the forty year old system, and attempting to wean industry away from protective subsidies and to expose it to external competition.

Role of Government in Technology Transfer

In devising any policy strategy for the government, the management capability of the government, i.e., the nature and the efficiency of the political-bureaucratic structure, and must be clearly kept in mind (see Dahlman 1989 who also notes the need for government efficiency as a factor in the transfer of technology). Well-intentioned and well-designed policies could lead to a waste of resources with little or no effect if those who are charged with implementation are not of the right calibre (see Haque and Montiel 1992 for general and theoretical discussion of the role of government in developing countries).

Even if one does not bring in an explicit evaluation of the quality of government into this discussion, of the role of government in transferring technology, an over-active role of leadership for the government would not be defensible. Certainly, no grounds exist for the creation of any cell for the transfer of technology or the devising of an appropriate technology for us. In either case, the presumption is that the government has both better information as well as better ability to analyze and process that information. Most efforts at planning and delineating development policy, have served to create large bureaucracies and greater rent seeking opportunities but certainly also have belied this presumption.

Bearing in mind the current management capacity of the government, perhaps the best recommendation would be one that implied the minimum possible direct involvement of the government in attempting to induce a transfer of technology. Thus the government should neither directly import technology nor attempt to affect any relative price in the economy directly or indirectly for the purpose of technology transfer. Fiscal and credit initiatives should also be avoided since they will only affect relative prices and hence lead to inefficiencies, the opposite of what we wish to achieve. However, as we shall see below, there remains an important task for the government to perform -- that of maintaining an overall policy stance that improves the country's credibility and economic image internationally. In that sense, the government can be an important catalytic agent without taking on any direct involvement.

Transfer of Technology and Foreign Direct Investment: Private Sector, Multinationals and Brand Names

If one eliminates any direct role for government in affecting transfer of technology, then it is really up to the private sector to import or develop that it finds profitable. In order to make the right decision, the private

sector must have the right signals from the market. Hence, the need for the government to leave relative prices unchanged from market determined levels.

Multinationals, or large foreign firms are investing very large proportions of their resources for the development of new products, technologies and processes. In recent times, brand names have come to be identified with important and desirable characteristics such as quality and reliability. In some products, the technology is tied into the acquisition of the right to the brand name.[3] Such products, technologies and processes may be proprietary in nature. For the import of such proprietary technology, joint ventures may be required. If the country profile in international market is attractive enough, multinationals will look favourably on such joint-venture deals with the domestic private sector.

When looked at from this standpoint, transfer of technology is tied in with the desire to attract foreign direct investment. Basically, economic policies should be adopted that allow the domestic private sector to the discipline of market forces both at home and abroad. As country creditworthiness and hence country credibility is established, foreign direct investment will look kindly on the country.[4]

Policies for Attracting Technology and Foreign Direct Investment[5]

Government policy should be directed towards providing adequate support to the private sector which takes the lead in investment and technology transfer decisions. Such a policy should comprise of the following elements:

Sound Financial Policies

The backdrop to successful private sector initiatives is provided by the adoption of macroeconomic policies that are consistent and that avoid internal and external imbalances. These would include the adoption of policies that avoid large fiscal and current account deficits and hence prevent excessive growth in the money supply. The intent of these policies is to avoid cycles of inflation and currency depreciation that result from imprudent financial policies. Investors can, therefore, take long term decisions in a suitable, inflation-free environment.

Political Stability and Continuity of Policy

Sound financial policies must be accompanied by political stability. Political upheavals, changes in regimes, threats of nationalizations, imminent and predictable devaluations, impending spells of inflation, and other such factors have been known to spur capital flight out of the country (Khan and Haque 1989). Factors that encourage flight out of the country certainly are not going to help to encourage foreign direct investment or the transfer of technology into the country.

3. Prominent examples of such products are McDonald Hamburgers.
4. For an analysis of how country specific risk inspired either by incorrect policies or domestic socio-political factors, can inspire capital outflows, or capital flight, see Khan and Haque (1989).
5. (Haque 1992; Haque and Montiel 1992).

Open Economy for Encouraging Competitiveness

The example of India is quite instructive on how tariff protection served only to inhibit technological advancement and the development of domestic competitiveness. Evidence from many countries has shown that for economic growth it is important to maintain a competitive stance for domestic industry. The latter is best achieved under the threat of external competitiveness (Bhagwati and Kreuger 1978). The reform programs of many East European countries and the republics of the former Soviet Union have been based on the early adoption of this principle of openness.

Efficient Regulatory and Legal Framework

Much of economic activity in the private sector has to rely on contractual arrangements in order to allow the comparative advantages to be fully exploited. Recent research has shown that to a large extent reputation and other self policing mechanisms allow such contracts to be enforceable without government intervention. Official intervention, more often than not, serves to protect a defaulter of a contract.[6] A principal role for the government is that of providing an effective and efficient legal and regulatory framework to allow private sector activity to flourish. Thus efficient institutions should be created that protect innovations by means of copyrights and patents, allow adequate financial inter mediation, and provide information and monitoring of all economic activity. This should be backed by an independent and efficient judiciary that is capable of speedy enforcement of the law and contracts.

Giving Priority to the Development of Infrastructure

As argued above, an important element of technology in these days is the development and delivery of innovative products and designs with speed. The new enterprises have to be flexibly managed and capable of quick reactions. Efficient communication networks and the availability of quality human capital are, therefore likely to be quite important to such an enterprise. Easy access to international information networks and communication could be important to such enterprises. Extensive telephone systems which allow access internationally enabling efficient fax contacts very difficult would help the competitive stance of developing economies.[7]

There is no reason to assume that the government and its departments should have the sole responsibility to take on the task of the development of infrastructure (see Haque and Monteil 1992 for a discussion of the role of government in infrastructure). In the past, areas such as telephones, power-generation, and road construction were regarded as either decreasing cost industries or projects with long gestation lags. Such projects were considered possible only if the government initiated, developed and maintained them. In recent times we have seen many countries inviting the private sector to take on these tasks that were traditionally in the government domain.[8] Policy is this area must seek to encourage and monitor private sector participation.

6. A prime example is the inability of government to prosecute the operators of the finance companies and cooperatives that defrauded depositors in Pakistan in 1977, 1987, and 1990.
7. We see here an example of how maintained large macroeconomic imbalances affect the economic efficiency of the private sector. The use of a prohibitive excise duty on domestic telephones alters the relative prices of domestic phone calls drastically and even the costs facing domestic producers.
8. Mexico and Argentina have, for example, sold their entire telephone operation by an international bid.

Encourage Labour Mobility

The government is the largest employer in most developing countries. While there are strong barriers to entry into the government, government employees are also blessed with security of tenure. Within the government, a rigid hierarchical structure is observed where promotion depends not on performance but on time in grade. The result is a distortion of the incentive system in the system. Those within the government have no desire to improve their productivity or to upgrade their skills, while those on the outside wish for the easy employment of the government. If the current barriers to entry to the government are removed and promotions are geared to some notion of productivity, labor mobility and a strong system of incentives will increase the efficiency of both the public and private sectors.

Increased Efficiency of the Public Sector

The public sector underpins all other sectors of the economy and has the capability of affecting all economic activity. As such, all efforts should be made to improve the productivity and efficiency of the public sector. The management of the public sector should be as efficient as that of any enterprise. In fact given the potential of various forms of the free rider problem, given the lack of a residual income earner in the public sector, there is a great need to have mechanisms in place for the monitoring of the productivity and usage of resources in the public sector. What is surprising is that this issue receives as little attention as it does in most development literature.

Liberal Social Environment

Last but not least is the maintenance of a domestic social atmosphere that is in harmony with the rest of the world, to allow foreign talent to make home in the concerned developing country and hence transfer technology.

Transfer of Technology and Human Capital Development

The definition of technology that is proposed here depends less on machines and more on man. In this view, management and innovation are considered to be the key ingredients for the success of a business enterprise. With this emphasis on the aspect of human ingenuity, an important element in any policy or desire for economic progress in general, or transfer of technology in particular, would be a strong emphasis on human capital development.

What is Human Capital?

At a general level, human capital refers to the improvement of the quality of manpower in the economy. It is the investment in human beings to make them more productive. Consequently, it incorporates all that goes towards making more efficient individuals of the average citizenry. It is, therefore, more than just the attainment of literacy. Elements of health and longevity are also elements of human capital for they affect productivity.

Given the rapidly changing world as signified by the increased pace of innovation, the definition of human capital has to be adapted accordingly. In such an environment, flexibility, adaptability, discipline, and

innovation, both in management and labor, is required. This places greater emphasis on quality of human capital than ever before.[9]

Policies for the Promotion of Human Capital

Emphasize Quality Rather than Quantity

Traditionally, in this area, emphasis has been laid on the spread of literacy. But the dictates of the current global economic competition would imply a broader definition of a policy on human capital accumulation. It would appear from the arguments presented above that quality considerations in education at all levels will be an important element of any education policy. Historically, most developing countries have emphasized quantity. Thus, we have a large number of universities and research institutes and add to these numbers at a very rapid rate. Yet any evaluation of such institutions reveals an almost total absence of quality consciousness. Fewer institutions that emphasize and demand quality education and research would pay higher dividends.

Quality Higher Education

In the scramble for numbers such as widespread literacy, high school attendance and number of graduates, that are dictated by planners, education bureaucracies have allowed quality to be sacrificed. This has perhaps been most marked at the level of institutions of higher learning. The liberal sentiment is also to argue for more resources to be directed towards literacy and primary education. This absolute equalitarian argument has also helped in the deterioration of quality higher education. However, an argument can be made that improvements in the quality of education at the university level perhaps would permeate downwards to improvements in the quality of education at lower levels. After all university graduates are the ones to impart education at lower levels. This argument would reinforce the need to achieve quality in academic institutions without worrying about numbers.

Basic Research

Most large corporations are plowing back large portions of earnings into research. Japan and the Asian tigers too are attempting to develop indigenous research and development potential. However, the policies that are currently being pursued have to be altered. Merely the creation of an organization with an acronym, and an officialdom and a rigid hierarchy, emphasizing age rather than capability, and some trappings of donor funding cannot generate research potential. This method for creating such institutions that we are currently employing, only creates a budgetary line item either today or tomorrow. Research and research potential is the product of individuals capable of quality research. Once again policy should emphasize fewer institutions that are flexibly and academically managed and emphasize quality research.

Conclusion

Unless a broader view of the subject of transfer of technology is taken and translated into the design of public policy, the ultimate goal of all societies -- that of attaining economic progress -- will elude us. Like in many other areas of public policy, there are no short cuts. For the achievement of economic progress based on growing domestic productivity and improving domestic technology, sound economic policies in a stable

9. In the current international environment of intense competition, it is surprising that we continue to emphasize increased education expenditures for the spread of literacy as the most effective policy for the accumulation of human capital. This policy recommendation is made regardless of the capability of the government to deliver on this score. No evaluation is made of the past efforts to increase literacy and the efficacy of the expenditures incurred therein.

political and social framework will have to be adopted. Such a policy would provide a stable inflation-free economic environment as well as a sound and well functioning legal and regulatory framework to allow friction-free, and efficient enforceable economic contracting to take place. External competition will ensure that the domestic private sector remains competitive and efficient. However, an efficient and cost-effective public sector that minimizes the use of the country's resources has to underpin such a reform.

No discussion of economic development or transfer of technology would be complete without emphasizing the role of human capital development. It has been argued in this paper that without a strong emphasis on the quality of education at every level the foundation for the transfer of technology will remain weak. In most developing countries, the drive for quantity has led to a sacrifice of quality. There is an urgent need to reinvigorate the university system and various research establishments in these countries such that a quality product is encouraged. If necessary, we should even merge some of these institutions to concentrate resources for better quality.

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