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TECHNOLOGY AND SOCIETY IN STRATIFIED DEVELOPING COUNTRIES

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The model of Technology-Society interactions presented in the previous lecture is only valid for homogeneous and isolated societies. It is too simplistic for most developing countries, as may be shown by considering the case of India.

Indian society is not homogeneous; it is economically and socially stratified. This stratification is manifested in a number of ways, but one manifestation is the pattern of distribution of expenditure (Table 1). It can be seen that the annual consumption of the richest 5% of the population is slightly greater than the poorest 30%, and the richest 10% of the population accounts for 24% of the expenditure in contrast to the poorest 60% who are responsible for 37%. Such a skewed distribution is the result of income inequalities (Table 2).

The richest 5% (about 30 millions) includes the owners of large assets (capital, land, factories, etc.), political leaders, top bureaucrats, technocrats, executives and professionals. The next richest 5% includes the relatively prosperous Indians with household incomes greater than about Rs.800 per month - rich farmers, bureaucrats, scientists, engineers, white-collar workers, and the other so-called "middle classes". At the other end of the spectrum are the 50% of the population (about 300 millions) below the poverty line with household incomes of less than about Rs.300 per month - the poor farmers, landless labourers, tribals, harijans, etc.

Thus, in the first approximation, the stratification of Indian society - and that of most other developing countries - can be represented as a dual society - a society of the elite (the richest 10%) and a society of the masses (particularly the poorest 50%) which may not be isolated from the former, but is separated from it by a wide chasm of incomes and consumption patterns.

More significantly, there is a tremendous difference in the attitudes and life-styles of these two societies. The poorest 50% struggle for elementary minimum needs in respect to water, food, shelter, clothing, health, education, transport, etc. In contrast, the elite of India - and that of most other developing countries - practice a philosophy best described thus: "all that is rural is bad, all that is urban is better and all that is western is best". Thus, the elite seek a life-style similar to that in the developed countries - above all, in the goods and services they try to acquire. This means that there is a strong influence of the developed countries upon the elites of developing countries.

Hence, most developing countries neither have homogeneous nor isolated societies, and the over-simplified model of science- technology-society interactions (Figure 1 of Lecture 1) must be elaborated to deal with stratified societies in strong interaction with the developed countries.

One possible elaboration is shown in Figure 1. It involves a replacement of the one circle representing society in Figure 1 of Lecture 1 with the three circles at the top of Figure 1 (circles 1.1, 1.2 and 1.3) representing the three societies relevant to the present discussion, viz., the society in developed countries referred to here as "western" society,
the society of the elite and the society of the masses below the poverty line.

Whereas there is a tremendous overlap between the wants in developed countries and those of the elite in developing countries (cf. circles 2.1 and 2.2), it is a characteristic of a dual society that there is virtually no overlap between the wants of the elite and the masses in developing countries (cf. circles 2.2 and 2.3). In contrast to the masses below the poverty line whose wants correspond to the basic minimum needs of water, food, shelter, clothing, health, education, employment, etc., elite wants tend to be modelled on the pattern of the developed countries. It is important, however, not to restrict the concept of elite wants only to goods and services for personal and group consumption. The elite equates itself with the nation - its needs are considered to be national needs, and its geo-political interests are looked upon as the country's interests.

In dual societies, it is the politically powerful elite - the richest 10% of the population - which controls the bulk of the decision-making. Thus, it is the elite which operates the filtering process that selects out some wants for onward transmission as demands upon industry, agriculture and the services (if the technologies for satisfying these demands already exist) or upon the technology-generating institutions (if new technologies are to be developed). By the same filtering process, other wants are completely shelved or drastically under- emphasized.

In most developing countries, this elitist filtering process results in

(a) the wants of the elite being wholly transmitted as demands requiring satisfaction, and

(b) the wants of the masses below the poverty line being largely ignored even though they are an expression of urgent minimum needs.

A discussion of the pattern of demands transmitted to the productive apparatus of society, and therefore the bundle of goods and services that is produced, would lead to questions of political economy which are outside the scope of this presentation. Suffice it to state here that the masses below the poverty line are virtually outside the market economy because of their lack of purchasing power. Industry, therefore, finds its market almost solely among the elite. And, in the choice between expanding the market by increasing the purchasing power of the masses, and keeping the market restricted but increasing the return on each sale, the decision-makers have generally pursued the latter option. Perhaps, this is because the former option requires a drastic re-distribution of assets, particularly land, i.e., a solution which is unpalatable to the richer land-holding sections of the elite.

What, however, is relevant here is the operation of the filter which results in a particular pattern of demands being imposed upon the technology-generating institutions. This filter operates mainly through the funds allocated to research and development, and the data (Table 3) shows that little emphasis is placed upon the urgent basic needs of those below the poverty line.

The motivational processes leading to this result are quite complicated.

(1) The neglect of the needs of the masses may not be deliberate. In fact, the decision-makers responsible for dividing the national research and development budget between the different Science and Technology agencies may well be under the impression that their allocations correspond to the needs of the people. Perhaps the discrepancy is between the elite's perception of the people's needs and the actual needs of the people. For example, the elite are aware of the desperate need of the rural masses for energy, but construes this as a demand for electricity from nuclear reactors, whereas those below the poverty line require energy mainly for cooking, and electric cooking may not be the answer.

(2) The scientific elite is preoccupied by considerations of machismo with respect to the industrialized countries and wants to prove itself in the so-called advanced technologies. The associated dream is to be considered "modern" and "play in the same league" as the developed countries. But, no elite will be considered macho if it is impotent in the face of poverty.

(3) The decision-makers on research and development are often victims of the myth of spin-offs, according to which the best way of satisfying need X is, not to "zero in" on X, but to concentrate on need Y in the belief that the work on Y will lead to spin-offs which will be useful in tackling X.

(4) There is also the simple and naked fact that the sharing of the national research and development cake is associated with empire-building tendencies -- each science and technology agency seeks to increase its budget irrespective of whether or not that increase will lead to a better correspondence between the people's needs and the thrust of Science and Technology.

(5) Geo-political interests and considerations of "defense" are very significant in the thinking process of Science and technology decision-makers.

(6) Many decision-making scientists also have a firm belief that the technologies for tackling the problems of poverty are all available, and therefore there is no need for research and development to be directed towards these problems. This naive view is the natural result of total unfamiliarity with these problems and their magnitude. What may be in their minds are the solutions adopted in the industrialized countries, but these may not be solutions at all because they are incompatible with the constraints of capital, population, resources, etc.

(7) Finally, these decision-makers usually believe that the real challenge lies in the future when only futuristic technologies will satisfy the projected needs. Hence, in considering the immediate needs of the poverty-stricken masses and their future requirements, the scales are tilted overwhelmingly in favour of the future when what is required is a balanced emphasis on the short- and long-term needs.

Coming back to the demands of the elite, these can be satisfied straight-away by the productive apparatus when new technologies are not required. In the case of India, there is a severe restriction on the imports of finished goods, and therefore the demands have to met through the Indian productive apparatus, mainly industry. But, Indian industry is of two categories:

(1) indigenous industry (circle 5.3) which is based on the indigenous technology (circle 4-2) developed by national educational, scientific and technological institutions (circle 3-2),

(2)foreign-collaborating industry (circle 5-2) which enters into collaboration agreements with industry in the developed countries, referred to here as "western" industry (circle 5-1) in order to import the technology, which for convenience is termed "western" technology (circle 4-1), generated in their institutions of education, Science and Technology (circle 3-1).

In assessing the relative significance of these two categories of industry, several points should be mentioned.

Indian industry, particularly the large-scale variety, has shown an overwhelming preference for importing technology rather than sponsoring its generation - thus, there have been about 6000 foreign collaboration agreements for technology imports between 1948 and 1979. Many of these imports have been repetitive in the sense that several enterprises make the same product under different collaboration agreements.

Further, the expiry of one agreement only leads to another agreement, rather than to self-reliance in the technology. Hence, technology imports have been used in most cases as substitutes for indigenous research and development, rather than as spring-boards for technological self-reliance.

(This is in total contrast to Japan, which also has relied heavily on foreign collaboration, but for every dollar incurred on technology import, Japan has spent about four dollars on research and development on the same products/processes, and thereby advanced beyond the foreign competitors.)

In addition, there are a number of fringe benefits to be derived from foreign collaborations, for example, investments with almost no technological risks, trips to, and shopping in, the glamorous cities of industrialized countries, opportunities for the exercise of political-cum-bureaucratic power arising from foreign exchange and licensing regulations, and even commissions for the conclusion of agreements (at rates the order of which have become public through the Lockheed scandals).

Above all, the agreements provide the entree into the local economy of brand-name luxury products and geo-political weapons so much aspired for by the elite. It must be noted here that the industrialized countries have long ago satisfied the minimum needs of their populations, and since then their technologies have turned increasingly to luxury consumption and military applications.

The net result is that only industry which cannot afford the financial costs of foreign collaboration is forced to depend upon national technology-generating institutions for its technology, and this indigenous industry in India is mostly small-scale industry.

In most developing countries, therefore, foreign- collaborating industry plays a much more dominant role than the indigenous version. Further, the linkage of the demands of the elite is very much stronger with foreign-collaborating industry (cf. continuous lines from circles 2-2 to 5-2 or 2-2 to 3-1 to 4- 1 to 5-1 to 5-2) than with indigenous industry (cf. dashed lines from circles 2-2 to 5-3 or 2-2 to 3-2 to 4-2 to 5-3).

The filtering operation that blocks the transmission of most of the wants of the masses below the poverty line (circle 2-3), i.e., the basic minimum needs of the poverty-stricken population, is indicated in Figure 1 in two ways. Firstly, the neglect of these basic needs by the technology-generating institutions is emphasized by the absence of a linkage between circle 2-3 and either circle 3-1 or 3-2. Secondly, the reluctance of the productive apparatus to respond to the needs of the poor is stressed by the lack of lines joining circle 2-3 and either 5-2 or 5-3. Of course, these linkages are rarely zero -- for instance, when the rural poor suffer from communicable epidemic diseases, the elite is also vulnerable, and such needs are obviously responded to effectively.

In the absence of either modern industry or institutions to respond to the needs of the masses below the poverty line, these masses have no choice except to fall back on traditional industries based on the reservoir of empirical knowledge accumulated over the centuries, i.e., on traditional technologies (cf. the linkage 2-3 to 4-3 to 5-4 and 5-4 to 2-3).

There is a very strong linkage 3-1 ----> 3-2 between the educational, scientific and technological institutions of developed countries, referred as "western" institutions, and those in developing countries, the latter being patterned very closely on, and often being set up by, the former. Superimposed on this process is the fact that developing countries receive education and training for a large proportion of their personnel, and in many countries a large influx of expatriates and "experts", from developed countries.

In the generation of technology, the educational, scientific and technological institutions of developing countries invariably start with imported western technology as a starting-point and as a model, hence the linkage 4-1 ----> 3-2. Thus, they emerge (linkage 3-2 ----> 4-2) after a

process of imitation, adaptation and innovation (the innovation, rarely!) with a technology which is naturalized. Indigenous technology, therefore, is mostly naturalized technology which in turn is a "blurred xerox copy" of "western" technology because of the inevitable copying errors.

Even this process of naturalization constitutes an advance towards technological self-reliance with respect to the developed countries, but it is constantly impeded by the preference of industry for foreign collaboration. The situation is best described by an analogy in which local industry is looked upon as the wayward husband, the national technology-generating system, the plain wife, and "western" technology, the attractive mistress. As often happens in such cases, the husband's attentions centre around the mistress, and in the resulting atmosphere of indifference, the wife -- in pre-liberated societies! -- turns to irrelevant activities (for example, knitting or charitable work). This analogy explains rather well the feelings of redundancy, irrelevancy and demoralization in national educational, scientific and technological institutions.

The analysis outlined above leads to several important conclusions regarding the shaping of technology in stratified developing societies in strong interaction with industrialized countries.

(1) The dual societies of these countries result in the thrust of their technological efforts being oriented towards the demands of their elites rather than towards the basic needs of their masses.

(2) Since these elite demands are an imitation of those in developed societies, i.e., demands of luxury consumption and geo- political influence, they are best satisfied by western technology.

(3) The elitist-western thrust is aggravated by the conscious attempt of national technology-generating institutions to emulate their counterpart institutions in the industrialized world and to acquire "western" patterns of technological capability even though these patterns are unrelated to basic needs of developing countries.

(4) This distortion is further accentuated by the large-scale attempt of developing countries to get their manpower trained in the west, for the most significant result of such training is an increased alienation from basic needs, particularly of those below the poverty line.

(5) An important aspect of this alienation process is a virtually unexamined and unquestioned acceptance of developed country preferences, guidelines and paradigms into the innovation chain, for example, the implicit faith in "economies of scale" and capital-intensive labour-saving approaches.

(6) If direct imports from industrialized countries are prohibited or restricted or constrained because of balance-of payments problems, local industry is established on the basis of western technology.

(7) In doing so, local industry prefers to import technology through foreign collaboration agreements, rather than to generate its own technology.

(8) Even when it does generate its own technology, this is done by a process of naturalization -- imitation, adaptation and innovation.

(9) If technology imports are not used as a starting point for indigenous technological advances and as a springboard for technological self-reliance, then the bias for importing technology is tantamount to an undervaluing of indigenous technological efforts and an undermining of the national institutions of education, science and technology. The institutions become, at best, an insurance against a cessation, interruption or reduction of technology imports, and at worst, wholly redundant except as welfare measures for the support of scientists and engineers.

(10) Bereft of major technological missions, except where geo-political interests are concerned, there is a widespread demoralization of technologists.

(11) Hence, technological capability is not improved and technological dependence (upon the developed countries) increases. In fact, this dependence is recursive due to technological advances in the industrialized countries.

(12) At the same time, because the needs of the masses are largely bypassed in the thrust of technology, inequalities are aggravated. And, this inequality is recursive due to preferential catering to the demands of the elite.

Hence, the dual societies of developing countries shape technology into a pattern which amplifies inequalities and erodes self-reliance. Such a pattern is inconsistent with development, if development is viewed as a sustainable process directed towards the satisfaction or basic needs, starting from the needs of the neediest, and towards self-reliance.

BIBLIOGRAPHY

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Table 1: Distribution of Expenditure in 1967-68

Percentage Groups		Population (millions)	Per capita Per Year (1979 Rs.)	Total Expenditure (1979 Rs. billion)	
Richest 5%	10%	25	2878	72.80	122.84
Next 5%		25	1978	50.04	
Next 30%		152	1306	198.30	
Next 30%		152	808	122.52	
Next 10%	30%	51	584	29.58	70.08
Next 10%		51	476	24.10	
Next 5%		25	378	9.56	
Poorest 5%		25	270	6.84	
Total 100%		506	1016	513.70	

Table 2: Distribution of Incomes

Percentage Group		Annual Household Income (1979 Rs.)
Richest 1%	10%	100,000
Next 4%		50,000-100,000
Next 5%		10,000- 50,000
Next 10%		5,000- 10,000
Next 30%		3,000- 5,000
POVERTY LINE		
Poorest 50%		3,500

Table 3 : Central Research & Development Expenditure (1976-77)

Agency	Rs.million	%
Department of Atomic Energy	578	18.0
Defence Research & Development Organization	522	16.2
Department of Space	389	12.1
Council of Scientific and Industrial Research	413	12.9
Indian Council of Agricultural Research	369	11.5
Department of Science & Technology	103	3.2
Indian Council of Medical Research	42	1.3
Department of Electronics	42	1.3
Other	756	23.5
TOTAL	3,214	100.0