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**APPROPRIATE TECHNOLOGY FOR SMALL INDUSTRY;
A REVIEW OF ISSUES**

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APPROPRIATE TECHNOLOGY FOR SMALL INDUSTRY; A REVIEW OF ISSUES

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I. Introduction

Technology has become an increasingly important dimension of economic growth. The extremely rapid developments in this area during the last few decades have been unprecedented in their speed and their impact on production structures and organization, with consequent drastic effects on economic growth and income distribution within individual countries as well as internationally.

A corollary of this is that the role of technology in the development of small-scale industry has become an increasingly important issue. A significant connection exists between scale of industry and technology. Without technologies capable of making small industry technically efficient and competitive, there would be little hope of translating into practical projects the widespread interest in the promotion of small-scale industry as a strategy for extensive income and employment generation in developing countries.

The objective of this paper is to look into the technological dimensions of small scale industrial development in detail. For this purpose we employ the concept of appropriate technology (AT) as our main tool of analysis for several reasons. Firstly, now that the technological dimension of development is becoming more pronounced, it can be seen that AT has become an increasingly important contributor to solving critical economic, social and environmental problems. AT as a concept is particularly valuable because it is not a narrow notion about technology per se. The concept and the movement that has developed to carry its ideas forward constitute a broad politico-economic critique and a proposal for fundamental changes in the mainstream technological and economic international system.

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Secondly, AT issues have been integrated more closely with general issues of small enterprise development in recent years. This link has come about through the mounting concern of AT practitioners and theorists with sustainable replication through commercially viable production, and with the wider socio-economic, technological and political context in which AT projects and programmes are to be implemented. This has generated a substantive body of evidence about the impact of macro- and mesopolicies on the choice of technology (and hence scale of production). This is of direct relevance to those involved in small enterprise development, particularly in view of the recent emphasis placed by them on the importance of a facilitating policy environment.

Thus, not only did AT constitute a fresh approach to solving global problems of poverty when it emerged as a worldwide movement in the early 1970s, but its basic underlying ideas became even more relevant in the 80s and will continue to be so in the 90s. It will be shown in this paper that in the present era of structural adjustment, the policy approaches put forward recently can make a constructive contribution towards uplifting the vulnerable sections of the population who have suffered its ill-effects.

AT emerged and developed under particular socio-economic and technological conditions. Its role is therefore analyzed in this paper (Section II) in the broad context of international socio-economic and technological change. Section III contains a more in-depth treatment of specific issues seen as vital in determining the present scope of AT as an instrument for small-scale enterprise development and its prospects in years to come. These include political economy aspects and the most recent changes in production technology in the West, which are already leading to moves away from large-scale production and which are likely to have significant effects on the international division of labour. A few concluding remarks follow in Section IV.

II. Appropriate Technology in a Historical Context

The issue of what role appropriate technology can play in technological development can be understood fully only when it is analyzed within a frame of reference that incorporates the major factors underlying the mainstream changes in technological patterns. During the last few centuries these mainstream changes have primarily emanated from the West. They have not only managed to transform local production systems, but they have also had a profound impact on developments in the Third World. Hence we begin by briefly discussing some important technological developments in the industrialized countries. The discussion is limited to historical changes roughly up to the 1970s since these form a necessary background for understanding the emergence of AT as a concept and a movement. More recent changes in the direction of technological development and consequent economic developments that have occurred since that time, especially since the oil price shocks and the international recession of the early 1970s, will be treated in section III of the article.

II.1 The context: Patterns of technological change

Over the last few decades in the West, small-scale, craft-based manual production has virtually disappeared and has been replaced by mechanized - and, of late, automated - production processes. Cheap fossil fuels have made it economical to organize production in increasingly larger units, reaping economies of scale. Organization on a large scale has enabled the splitting up of production operations into many subprocesses. In the old days, one worker would be responsible for the making of a complete product. His level of skill was dependent upon the adeptness with which he was able to carry out all the subprocesses involved. However, by the early 1970s such a worker had been replaced by one whose value derived from the speed and accuracy with which he was able to manage one small, specialized task but who knew little about the processes preceding his work and those further down the line.

The far-reaching rationalization of production processes through specialization, particularly in the period 1945-75, increased manifold the value of output per worker, which in turn enabled incomes to rise and profits to be accumulated further. In this way the production system acquired some important self-propelling features geared to economic growth, with

technological modernization (financed through accumulated profits) going hand in hand with rising final demand. Indeed, the transformation in production processes is equalled by recent developments in output. The volume, range and sophistication of products and services have expanded in a phenomenal way.

Of course, this is not to say that there have not been important differences in the speed of growth, or significant regional variations. In particular, in the period 1950-73 (often referred to as the Golden Age), growth in terms of output volume was much more rapid than before or later.¹ Yet it is possible to distinguish certain technological characteristics of this growth process that transcend temporal and spatial variations. This is important since it is believed that in principle technological progress could be made in different directions; the actual path followed is dependent not only on the possibilities and constraints posed by engineering, but also on the cultural and ideological values of the society that produces the technology (Jéquier, 1976; Kranzberg, 1981).

From this perspective, the principal direction in which Western technological change has proceeded can be best described in conventional economic terminology: it aims primarily at increasing material well-being, in the sense of maximizing volume of production and consumption, with minimum effort and therefore at minimum cost. This overriding concern with material forms of expansion and growth has given the system certain distinctive features. For one, land, capital and labour are viewed as production factors which should be combined in an economically optimal way so as to maximize economic productivity. A characteristic example is the agricultural sector in EEC countries, where farmers try to maximize quantitative yields per hectare by raising land productivity in various artificial ways. Costs are minimized by organizing production in large-scale farms where economies of scale may be realized.

The constant need to experience tangible growth is reflected on several levels. 'Progress' or 'achievement' is measured in terms of a statistic indicating the level of material output attained and how fast it has increased recently. Stagnation in economic growth is considered undesirable, an uncomfortable situation for a country to find itself in. Similarly, capital investment embodies progress since it leads to more production, a better product or a new product, and is therefore desirable. Whether the new equipment will enable those who work with it to find satisfaction in their work and use it as a means of self-expression is not a major issue. Work is

seen primarily as a chore and a duty, not as something to be enjoyed. Therefore the idea is to minimize the time spent on it by increasing labour productivity through capital-intensive methods of production. These trends are reinforced by the increased cost of labour as a result of the need to maintain high standards of living. Corporations try to substitute mechanized production processes for labour in order to maximize output and profits.

Another important aspect of Western technology is its preoccupation with satisfaction of demand in the short term, longer-term considerations being subservient to this. An important consequence of such a view is that it leads, for example, to an undervaluation of costs of non-renewable resources, and to the use of potentially harmful agents whose effects become apparent only in the longer run. The lack of concern over this also means that production systems that are by their very nature unsustainable in the long run are nevertheless being used and continue to be developed. Since products and services turned out by such technologies are underpriced in comparison to their true cost, they fetch a ready market, thus increasing the pressure on R&D departments to develop them further.

It should be noted that despite some significant changes in the direction of technological development since the mid-1970s that have resulted in moves away from large scales of production, the concern for short-term profit maximization in a narrow sense has remained an important element of production philosophy in the 1980s.

II.2 The gestation of AT: The 1950s and 60s

The emergence and development of the AT movement should be seen in the context of the continuous expansion of the mass production and consumption ethic. The further this system developed, the more obvious it became that it suffered from a number of vital shortcomings. In the West these anomalies began to manifest themselves primarily in the environmental and social spheres of life. They gained momentum in the early 1970s, with the reduction in oil supplies suddenly exposing the limits to growth posed by depletion of non-renewable resources. Reservations also began to grow on the output side. Increasing levels of pollution began to rebound and an awareness began to emerge that continuation of growth in the same direction might not be associated with progress in the true sense of the word. The Club of Rome reports and Rachel Carson's Silent Spring (about the devastating effects of

DDT) were written during this period. On the social front, the deterioration of the social fabric began to cause concern. The degradation in the quality of working life and the feelings of alienation experienced by people living in urban agglomerations became more and more visible in rising aggressiveness, crime and drug problems. It was in these years that Schumacher wrote:

'If that which has been shaped by technology, and continues to be so shaped, looks sick, it might be wise to have a look at technology itself. If technology is felt to be becoming more and more inhuman, we might do well to consider whether it is possible to have something better - a technology with a human face' (1973: 155).

Similar developments were going on in the Third World, but there the issue took on more of a politico-economic dimension. In view of the importance of these developments for understanding the context in which AT emerged as a movement, they are treated here in some depth.

In the early part of this century Gandhi agitated in India (then a colony) against the use mass-produced cloth imported from Britain, and in favour of self-sufficiency by local communities. He saw the swadeshi way of life, based on the local production of basic needs, as the only viable and sustainable road to an independent form of development (Gandhi, 1919).

However, the mainstream economic road chosen by the majority of developing countries was not in this direction. The 1950s and 60s saw the emergence of development strategies with a heavy emphasis on growth through Western-style physical capital accumulation. There was a widespread belief during this period that growth would take off once a certain minimum critical mass had been achieved (Rostow, 1960) and that the benefits of this growth would then trickle down to enable the economic uplifting of the entire population. Therefore, aspects of distribution were not viewed as a major independent goal of development policy. The positive experiences of post-War Europe with the Marshall aid plan, and of the Soviet Union which had achieved notable results with a similar model, fed the belief that the problems of underdevelopment and poverty in Third World countries could be overcome by exporting the same approach, including transfer of Western technology.

However, as the Golden Years of the 1950s and 60s gave way to the 70s, it became increasingly clear that the growth experience of the developing countries would not live up to expectations. In a recent review of post-War development experience, H. Singer lists two factors as being most responsible for this (Singer, 1989).² Firstly, while at the beginning of the 1950s the terms of trade for primary commodities were highly favourable they

deteriorated sharply during the remainder of the decade and through the 60s. Balance of payments constraints thus began to make themselves felt as an important impediment to the financing of the development effort, and domestic savings could not compensate for them.

Secondly, the limitations of the import-substitution industrialization strategy as the main avenue of development began to manifest themselves. Contrary to expectations, the newly-set-up industrial activities did not generate the momentum required to pull the rest of the economy along. Instead, they remained in a rather artificial enclave-like situation without organic linkages to the rest of the economy. This applied particularly to companies set up by multinationals, which failed to generate to any appreciable degree the favourable local spin-offs that had been envisaged, such as technology transfer to local companies, generation of foreign exchange, and development of local input-supply industries through backward linkages. Infant-industry policies were extended into policies of continuous protection which laid the basis for a highly inefficient modern industrial system, leading at the same time to the elimination of indigenous local production systems and entrepreneurial talent.³

The one-sided emphasis on industrialization as the engine of growth also meant that the agricultural sector, the traditional economic base of the majority of the population, came to be neglected. Low internal terms of trade for agricultural products combined with overvalued exchange rates to work to its disadvantage. Furthermore, at this time technological development in the West began to focus on the production of substitutes for primary commodities. The cane-sugar market faced competition from corn-based sweeteners, tea and coffee had to contend with competition from soft drinks produced in the West, and artificial flavourings began to replace many traditional products. Products made from palm oil, copra and other traditional commodities, which enjoyed comparative advantages in the exporting countries on account of their climatic characteristics, were replaced by locally produced vegetable oils such as soybean oil and corn oil which were made possible through technological change.

In short, the strategy led to the emergence of a dualistic type of development in which trickle-down did not occur in a major way. Instead, income inequalities widened in many countries. The widening income disparities would have been initially regarded as a necessary temporary evil that would be overcome once the economy reached the take-off stage, but as

the economic boom of the Golden Years faded out in the 1970s it became increasingly obvious that the development effort lacked internal dynamism. The cracks began to show at the time of the breakdown of the Bretton Woods system in 1971 and widened with the first oil price hike in 1973/4. Oil-importing developing countries were severely affected by rising import bills and by the international recession that followed. Although, as Singer points out, the GDP growth performance of the developing world as a whole (excluding oil exporters) in the period 1971-80 remained at 5.2%, this figure masks the fact that much of this growth was in a sense artificial since it was financed by recycled OPEC surpluses. Secondly, it masks important differences between countries: in sub-Saharan Africa, growth fell to 3.3% and was negative in per capita terms (Singer, 1989).

II.3 AT in the 1970s: The early stages

Whereas the full impact of these developments would become clear only in the 1980s, awareness rose in the 70s that the nature of growth in the developing countries, rather than its speed, left much to be desired. The take-off stage failed to arrive and expanding output in aggregate terms went hand in hand with rising levels of unemployment and poverty. At the international level, the lack of internal dynamism showed itself in increasing dependence on the West, particularly in technological matters.

This led to a major shift in development-policy thinking in the direction of distribution issues, employment generation, poverty alleviation and collective self-reliance through a New International Economic Order. Ideas advocated by the International Labour Organization, such as development through local resource mobilization, basic needs planning, integrated rural development, decentralization of planning and adoption of income and employment generation programmes for the poor, gained prominence at this time. Thus the concern shifted from growth per se to the question of how those bypassed by the growth process could get access to its fruits. A direct focus on the target groups in question was seen to be the main solution.

Employment promotion through stimulation of labour-intensive small and micro-enterprises began to form an important element in the strategies outlined above. A multitude of institutions designed to promote the cause of the small scale sector were established and substantial assistance programmes were mounted in this period. The main philosophy underlying the approach to

assistance at this time was that the sector was in many ways disadvantaged as compared to the large-scale industries, for example in access to technology, credit, raw materials, foreign exchange and markets. These constraints could be overcome by making such services institutionally available to small entrepreneurs and potential entrepreneurs through assistance programmes aimed specifically at them, for example in the fields of credit, technology development and dissemination, marketing support, raw material supply, and so on.

Most of these supply-side interventions were designed by government officers and policy-makers used to dealing with the large-scale industrial sector. The majority of these programmes were scaled-down versions of large-scale industrial development programmes and did not take the specific characteristics and requirements of the small scale sector into account. As a result, nearly all such programmes failed miserably (UNIDO et al., 1988).

The concern with income and employment creation through stimulation of productive activities for the poor had an important technological dimension. Bhalla observed in respect of the basic needs strategy, '... be it the distribution of income and purchasing power, the composition of output, access to resources, inputs and outputs, all these variables have important implications for the choice and development of technologies in developing countries' (1979: 29). All major components of such a strategy - incomes for the poorest through access to suitable products, services and inputs; decentralized production of these goods and services; and national and collective self-reliance - were favourable to the development of technological alternatives that could bring about a redistribution of income and creation of employment for the poor. Such technologies had to be small in scale and yet more efficient than traditional ones, relatively cheap, easy to operate and repair locally, suitable for use with local resources, and compatible with the local socio-cultural environment.⁴

Summing up the above, we can say that earlier approaches to appropriate technology had been largely confined to incidental initiatives; but the climate became more favourable to the development of AT in the 1970s and the decade witnessed the emergence and development of AT institutions worldwide. Many of the OECD countries provided modest funding for local organizations which were to develop and disseminate AT.⁵

However, as the widespread development and implementation of AT projects got under way, a number of problems associated with the

dissemination and successful functioning of appropriate technologies started to make themselves felt. This led around this time to vigorous debate about the economic efficiency of AT.⁶ Some economists (for example, Eckaus, Kaldor and Emmanuel) were of the view that efficient technologies with appropriate characteristics could not exist in view of the inflexible nature of the mainstream technological developments (Stewart, 1989). This debate was to continue in the following decade, when dissenting views were given new fuel by the opposition to neoliberal structural adjustment ideas.

In the area of practical implementation, it was soon found that mere development and publication of knowledge about appropriate technologies, no matter how suitable they might be in terms of their capacity to generate employment for the poor, tended to remain an isolated activity as long as it did not lead to the development of a local innovation system geared towards the development, adoption and maintenance of such technologies. Such an innovation system would have to include, apart from local R&D capability, various complementary services such as an institutional infrastructure to supply qualified manpower, a credit system to finance innovations, a transport and distribution network, an information system on market opportunities for finished and half-finished goods (subcontracting), and a reward system that would motivate entrepreneurs to innovate (Jéquier, 1976: 44). Jéquier points out that the development of this 'software' is crucial to the success of AT. Also, the poorer the state of this software, the more critical becomes the reliability of the hardware. This is particularly important in view of the target groups of the AT movement: the poorer the user, the less is his/her staying power and thus the lower the degree of acceptable risk. In addition to the services that should support a local innovation system, an appropriate economic environment for small firms is vital for their sustained and successful application of new and improved technologies. In this connection, de Wilde and Schreurs draw attention to the need for appropriate marketing channels (1990).

The realization was also growing that developing countries should try to strengthen their own indigenous technological capability and reduce their dependence on transfers of foreign technology (Weiss and Jéquier, 1984).⁷ Dahlman and Westphal pointed out in this connection that technology transfer could not entirely replace indigenous technological effort (1981). Local effort to master the acquired technology was essential to make optimal use of it, adapt it to continuously changing circumstances and set into motion

subsequent indigenous technological innovation. Without technological mastery, there could be no take-off by a dynamic process of local innovation.⁸ This realization led to a gradual change in emphasis within the AT movement, away from the pure transfer idea to a wider, more organic approach geared towards building up the facilitating infrastructure and stimulating indigenous technological capability (Katz, 1980). More attention was also given to sensitizing and awareness-raising of relevant policy-making bodies.

In retrospect, the initial approach also lacked the benefit of well-developed economic and financial tools of analysis. The economists and technologists promoting these small-scale activities had been educated in the era when physical production had been seen as the key to development. Their analysis was limited to technical and financial aspects: whether it was possible to produce the required products on a small scale and the costs and benefits at a certain point in time. There was as yet no awareness that market prices could change drastically due to the development of different demand patterns, thereby seriously influencing the predicted financial viability of a firm. Nor was the macro-environment in which the firm was functioning taken into account. The cost of capital was assumed to be equal for both the small scale subsector and the industrial sector as a whole. Subsequent research has shown that, due to biased macropolicies, the small scale sector actually pays 30% to 60% more for capital than does the large scale sector (Haggblade et al, 1990) The effect of macropolicies on the commercial and economic feasibility of small-scale enterprises is discussed further in the next subsection.

II.4 AT in the 1980s: Towards maturity

In the 1980s, national governments and donor agencies started to realize the potential offered by further development of AT as well as research into the factors inhibiting the widespread use of such technologies. While several AT organizations stayed at the level of local hardware development and dissemination, others adopted a more multi-disciplinary approach, looking at both hard and soft technologies and the macroeconomic environment in which the technology was to function. Several factors can be pinpointed to explain the increasing concern with the context in which AT had to operate. In order to highlight these, it is necessary to return briefly to the economic developments then taking place on the international scene.

At the beginning of the 1980s the worldwide economic climate worsened so much that the development prospects of the majority of Third World countries were affected drastically. The second oil crisis of 1978-80 set the stage for a strong international recession. There was a severe slump in commodity prices, and protectionist tendencies came up in the Western countries to safeguard their own vulnerable production and employment against imports from the developing world. This coincided with rising real interest rates and a strong appreciation of the U.S. dollar. On top of this, commercial bank lending, which had been the major source of deficit financing in the preceding decade, was first reduced and later came virtually to a standstill (Singer, 1989: 98).

All these factors combined to put the balance of payments of developing countries under severe strain, especially those of the sub-Saharan countries and others that had become increasingly reliant on debt financing. The external financing of the previous period had not led to the structural transformations required for self-sustaining growth. The full impact of these imbalanced development patterns of the 1970s was felt in this period in the form of mounting debt problems.

This climate was favourable to the advent of the neoliberal ideas that were to underpin IMF and World Bank policies from then on. The issue of debt repayment, rather than development, played a dominant role in the shaping of these policies. Their basic premise was that the economies of the developing countries needed structural adjustments to prevent an international financial crisis. The main cause of the accumulated debts was seen as lying mainly in the internal policies pursued by the governments concerned rather than in international financial, technological and power imbalances. Therefore, the affected developing economies needed an all-out market orientation to put them back on the road to efficiency and international competitiveness. This entailed, among other things, drastic reductions in government spending, including cutbacks in domestic price subsidies, floating of interest rates in harmony with supply and demand, abolition of regulations governing the functioning of the private sector, realignment of exchange rates and abolition of quantitative import restrictions. Approximately two-thirds of the countries in Latin America and Africa are at present implementing such structural adjustment measures.

These policy prescriptions were clearly not in accord with the sort of development strategies pursued until then, including the approach taken to

the promotion of appropriate technology. After all, the basis of these strategies lay in supporting those being discriminated against by the same market mechanism that the neoliberal approach sought to advance. The appropriate way of achieving this was by delivering assistance directly to the beneficiaries in question and thus circumventing the market mechanism.

However, the differences were perhaps not as clear-cut as might seem here. It has already been mentioned that there was a tendency within the AT movement to place more emphasis on influencing the policy environment in which AT was to be adopted and used. This trend also came up outside the AT movement and began to pervade thinking about development policy, affecting the implementation of programmes aimed at small and micro-business development, and views about income and employment generation in general. As will be shown below, these tendencies are now leading to a shift of approaches in a direction not totally opposed to the World Bank-IMF philosophy, although, of course, some major differences remain.

The importance of the policy environment

Several major research efforts in the field of small enterprise development undertaken in this period focused on the wider context of programme implementation, motivated by the often disappointing results obtained in this area. Failure in reaching the target group, inefficient programme implementation by local organizations and support of unviable activities had become recurrent problems. The Michigan State University study of the effect of policies on small enterprise development (Haggblade et al, 1990), the PISCES and ARIES investigations (Mann et al, 1989), studies by Appropriate Technology International (Stewart, 1987) and the joint analysis by UNIDO, UNDP, ILO and the Netherlands Government (UNIDO et al, 1988) brought out the disappointing results of government-led small enterprise support programmes and the promising efforts made by many NGOs in this area.

The studies more or less unanimously reached the conclusion that the limited success of these supply-side interventions could be attributed to a large extent to the hostile policy environment which discriminates in various ways against small-scale rural production. By hostile is meant, in particular, the kind of regulations that go with an import-substitution industrialization strategy, such as import restrictions that work in favour of large-scale units, credit rationing that rules out access by small

entrepreneurs, unfair competition from inefficient parastatal units receiving government subsidies, and so on. The role of government agencies and parastatals as implementing institutions of supply-side policies was also questioned on the grounds that they have inherent tendencies in their decision-making processes that tend to lead to inefficiency and reinforce discrimination against the small scale sector.

As one of the strategies for small enterprise development, AT was likewise confronted with these issues. Its experiences with dissemination and diffusion of technologies continued to be mixed; this was obviously related to the kind of adverse economic and political circumstances under which the technologies had to be implemented. At the same time, its perspective was threatened by the overriding concerns of macroeconomic structural adjustment and stabilization, which shifted attention away from interventions at the micro level.

The above-mentioned studies had a number of consequences for the direction of AT as a strategy for small scale industrial development. NGOs, beginning with those in the USA and those in developing countries sponsored by USA-based donors, started to focus on the sustainable dissemination of AT. Small enterprise promotion being the natural channel for the dissemination of productive appropriate technologies, a link was forged between AT and the NGOs' experiences in the field of small enterprise development. Project assessment and design started to focus on the commercial viability of household, micro- and small enterprises and the need for and consequent development of an institutional infrastructure to support the dynamic development of ATs once they had been transferred, modified and/or adapted. Experiments with new financial mechanisms, such as small-scale equity participation by donor agencies and lease/purchase schemes for very small technologies, were initiated to take into account the different risk-levels of a poor entrepreneur as compared to his counterpart in large-scale industry.

In addition, attention was focused on more meaningful monitoring and evaluation efforts. Monitoring was set up in a way that not only facilitated reports by the donor agencies on the progress of the implementation of the project, but also enabled local staff to use it as a management tool in the implementation of projects. The general trend in project assessment and design was to replace the traditional cost-benefit analysis with enterprise cash flow analysis, which could then be used as a monitoring, evaluation and learning tool.

Adjustment with a human face: A new role for AT

As the implementation of structural adjustment (or rather attempts at it) got under way in a number of countries, its adverse effects on growth, distributive equity and poverty began to show through. The expression, 'The operation was successful, but the patient died,' began to acquire a new meaning. The UNICEF study Adjustment with a Human Face concluded that, in spite of improvements in current account balance in 56% of the IMF-assisted countries in the 1980s, in almost 60% of those countries growth and real investment deteriorated or did not improve during the first programme year. Evidence about changes in income distribution was at best mixed, and the number of people living under the poverty line increased in many of the Fund-assisted countries. A widespread and sharp deterioration in child health, nutrition and standards of education was noticed.

The study was very critical of the one-sidedness of the adjustment policies, which had been concentrating overmuch on short-term deflationary stabilization without laying a sound basis for the restoration of growth in the longer term, and had been neglecting the human dimension. The writers argued for a more expansionary form of structural adjustment in which 'additional support for small-scale activities, especially in the informal sector, is a vital element ... to protect the incomes of the vulnerable during the adjustment process' (Cornia et al., 1987: 208).

In the same vein, the World Employment Programme of the International Labour Organization gathered evidence about the mixed blessings of structural adjustment. In a series of studies on employment and income in Asia (which as a continent was still much better-off than Africa and Latin America), it was pointed out that the brunt of the structural adjustment burden had been borne particularly by those who were outside the organized labour market (ILO-ARTEP, 1987). Detailed studies of the impact of the 1977 liberalization policies and the 1982 adjustment programme on small and rural industries in Sri Lanka had to conclude that most of those industries were too small to take advantage of the new opportunities created through improved access to imported technology, raw materials, credit and overseas markets. Instead, many were affected negatively through increased competition from larger domestic industries that did manage to reap such benefits, and from sudden imports of consumer products (Osmani, 1987; Islam and Romijn, 1988).

It has been pointed out already that AT found itself at a crossroads for reasons related to its micro-level approach and the constraining policy environment. These difficulties, combined with the growing anxiety about the impact of structural adjustment on the poor, presented a major challenge to the movement to come up with new approaches for a 'technology with a human face'. Appropriate Technology International, a Washington-based NGO active in the development and dissemination of AT, joined hands with Queen Elizabeth House, Oxford University, in the coordination of a worldwide research programme aimed at gaining a deeper insight into the relationships between macro- and mesopolicies, choice of technology and the development of small enterprise.

While the main objective of studying these relationships sprang from the growing concern over the limited effectiveness of, and problems associated with, widespread outreach of micro-interventions in the AT field, structural adjustment provided an added dimension. The focus on linkages between macro- and mesopolicies and their impact at the micro level made it possible to consider how far the World Bank-IMF policy packages would be consistent with policy findings from the research, and in what way the former might be changed to become more favourable to the adoption of AT. In this respect, it is to the credit of the AT movement that it has assumed a leading role in voicing the mounting criticisms of structural adjustment, and in putting them on the academically sound footing required to convince those committed to the continued administration of the World Bank-IMF medicine.

The structured market approach

Stewart's most recent synthetic paper on this body of research runs along the following lines: It is by now clear that a number of economically efficient and socially desirable appropriate technologies exist which economize on scarce capital, use abundant labour and affect income distribution favourably. Yet there is ample evidence that these are not being chosen.⁹ This is because decisions pertaining to investment at the micro level are affected by macro- and mesopolicies that are in many ways hostile to the adoption of AT, and thus to small-scale forms of production.

There are various categories of such policies. Firstly there are those that affect prices and availability of resources to the firm; these include taxation and investment promotion measures, subsidized credit for selected

enterprises, overvalued exchange rates in combination with low tariffs on capital goods, tariff structures, administrative mechanisms for allocation of foreign exchange, and labour market policies that create dualism in the labour market and make labour costs in the formal sector artificially high. Then there are the policies that affect the objectives of decision-making bodies, such as overfeeding of parastatals with aid funds which has contributed to a shifting of priorities from efficiency towards maximum loan disbursement. Other important policy areas are those concerned with research into and development of technology and its dissemination, policies towards markets and products, rural linkages, composition of units and institutions. Stewart argues that it may not be possible to make all these policy elements AT-friendly, but some scope does exist since all the changes would not involve disruption of vested interests to the same extent (Stewart, 1990).

The issue of rural linkages deserves special mention because it draws attention to the need for balanced growth as an important precondition for sustained domestic development. Ranis cautions that the concern with the restoration of international competitiveness of countries in the context of structural adjustment, and a series of good harvests over the past ten years, are shifting the development focus back to industry. Referring to the East Asian success stories, he points out that such an approach would underrate the key role of the rural economy in bringing about both domestic growth and export-oriented performance. And what is required for the success of rural development is not merely a focus on agriculture but rather the integral mobilization of the rural economy in which agricultural development and growth of rural non-agricultural activities reinforce each other mutually (Ranis, 1990).¹⁰

In a comparative analysis of the Philippines and Taiwan, Ranis and Stewart pinpoint a number of important factors that determine the magnitude of these linkages and thus the adoption of small-scale forms of production using AT. In respect of linkages from agriculture to rural non-farm activities, the labour intensity of agricultural growth is seen to be vital. In Taiwan the government actively pursued a strategy of rural development through productivity increase in agriculture, coupled with a land reform which enabled equal distribution of the productivity gains. The landholdings are cultivated intensively because of their relatively small size. This pattern of agricultural growth gave rise to strong regional development in which small local non-farm activities using AT, such as local small-scale

processing plants and small machine-workshops, played a major role. Conversely, a situation characterized by a highly skewed distribution of land and rural incomes paired with a neglect of rural development and decentralization (as in the Philippines), has been conducive to the adoption of large-scale capital-intensive technologies in processing. Likewise, the sophisticated agricultural machinery required by the multinationals involved in pineapple production could not be supplied locally. In conclusion, policies favouring land reform and equality in the distribution of rural incomes, combined with suitable incentives such as local infrastructure and favourable prices, are important to the success of small-scale appropriate technologies (Ranis and Stewart, 1987).

It can be concluded that a number of the policy changes advocated in Stewart et al. (1990) in principle go along with the liberalization ideas of the structural adjustment approach. However, they do have reservations over the approach, the main one being over its predominant concern with demand restraint policies and its belief that a non-interventionist market solution would deliver the goods by itself. After all, the context within which these policies are being executed is one of extreme disequilibrium. What is needed, argues Stewart, is a 'structured market' in which the market is given institutional support on various fronts to correct these imbalances and give small producers a fair chance (Stewart, 1990).

The structured market approach still needs to be worked out in detail. In particular, attention needs to be paid to building in mechanisms for ensuring that the benefits go to the truly poor. In this connection Saith calls attention to the need to consider the dynamic nature of rural linkages and their distributive consequences. Quoting the example of the impact of infrastructural development (electrification) on artificial jewellery production in Indian villages, he shows that what starts as a local linkage benefiting the poor, easily changes into capitalist accumulation from which only a few benefit, leading to differentiation within the countryside itself. Initially people from department stores buy local designs in the villages. As soon as sales improve, the production process is motorized and moves to a small town, often with bank financing. Frequently the firm is bought out by someone from outside (Saith, 1990: 345).

And then there is a whole spectrum of sizes between large and small: bringing up the example of the impact of the phenomenal growth in agricultural productivity due to the Green Revolution, Saith points out that

this has been known to make viable the introduction of small-scale mechanized processing methods while at the same time replacing local traditional methods of production, with distributive consequences which may disfavour the poorest (Saith, 1990: 345).

Saith is also less optimistic about the prospects of rural industrialization generally, largely because demand will tend to shift away from goods produced by rural industries as development proceeds. Referring to Asia, he shows that the problem of labour absorption has not been solved even in economies with successful rural growth. He concludes that there remains a great need for devising appropriate entitlement systems that can give the poorest direct access to the benefits of development, for example through appropriate forms of ownership or direct employment creation programmes (Saith, 1990).

Observations such as the above need to be included in the monitoring and evaluation of AT and small enterprise programmes, including changes in macropolicies as advocated by Stewart, Saith, Liedholm and others. Only through thorough research and analysis, not only at the level of the enterprise but also at the regional and national level, shall we be able to add detail and improve upon concepts such as structured markets.

III. The Prospects of AT: Some Underlying Issues

The above picture of the history of the AT concept and approach shows that a number of problems have been encountered in the area of practical implementation. An important reason for this is that the issue of the appropriateness of AT sometimes appears to overshadow the question of whether something that is appropriate also has scope in practice. Perhaps this is due to the view that what is desirable should in principle also be practically feasible. Yet the principal problems associated with the promotion, adoption and use of AT can be traced precisely to the fact that appropriateness does not always imply technical, financial, economic or political feasibility.

A few underlying issues touching on the practical feasibility of AT will be analyzed in more detail in this section in view of their importance for a correct assessment of its present and future potential. We shall begin with a discussion of some important factors that determine technological change and choice generally, and the way they affect AT. In this context, 'appropriateness' will also be looked at in more detail. The discussion will be rounded off with some remarks on the prospects of AT in the context of important recent developments on the technological front, including trends in industrial organization away from mass production and in favour of vertical specialization.

III.1 Trends in technological change and choice: Towards capital-intensive production

It was observed earlier that patterns of technological change are not value-free. Apart from pure technical aspects, a number of factors outside the engineering sphere have a definite impact. Reference has already been made to vested interests, norms, values, culture and the like. For example, the Western model of technological progress emerged within a society in which the social and cultural climate was conducive to the commercial application of its underlying creative ideas.

A significant corollary of this is that the socio-cultural underpinnings of a technology have a bearing on its spread and acceptance, which depends on the norms and value system of the society in which it is used. Therefore, it would make sense to say that technologies embodying Western values would 'fit' well into production systems in Western countries

but not in other countries because they would not affirm the value-attributes of that technology.

Yet it has been observed time and again in practice that the appeal of Western large-scale, capital-intensive technology is extremely powerful in such countries. This appears to be so even in developing countries with radically different economic conditions that make the technology totally inappropriate from a purely economic point of view if nothing else. At the same time, locally more suitable forms of production are on the decline or have great difficulty getting off the ground. This tendency is so profound and widespread that once modern Western technologies are brought into a traditional society, they manage to superimpose themselves and compete successfully with local production processes to such an extent that the latter find it difficult to survive or are even destroyed. Observing this, several writers have said that it would seem as if this pattern of technical change, with its increasing technological and economic dependence on the West and the unbalanced, dualistic internal development path with which it can be associated, is the only possible road to progress (Alvares, 1980; Pelto, 1973).

A number of analyses have tried to shed light on the underlying reasons for this phenomenon. Stewart's examination of technological choice provides some useful insights into the economic aspects. As she points out, the choice of technique is not a simple matter of deciding on the labour intensity or capital intensity of a particular production process out of several that are otherwise identical, as the neoclassical approach would have us believe. The level and state of a technology reflect the capital and labour resources of a society at the time when it was developed. Thus, relatively labour-intensive techniques are likely to have been developed at a time when investible resources were less abundant. More modern techniques are likely to be relatively more capital intensive. Also, because they were developed at a later date, they incorporate a more advanced level of scientific knowledge and skill and are consequently technically more efficient. They also embody superior product characteristics and more advanced input (particularly skill) requirements.

Further, argues Stewart, since technological change has been concentrated in the economically advanced countries, developing countries have little choice but to use the technologies produced there. Thus their patterns of technological change, growth and resultant income distribution are essentially derived from the Western pattern (Stewart, 1977).

Technical efficiency and modernity are indeed powerful arguments in favour of the selection of a modern (read: capital-intensive) technique, even in a developing-country environment where the capital scarcity, abundance of unskilled labour and modest living standards of the majority of the population would indicate the suitability of a simpler, more labour-intensive technology producing a locally more appropriate product. But even the decision in favour of or against technical efficiency and modernity is essentially a value choice. The People's Republic of China is a good example of a country which placed a higher priority on distribution and self-reliance, leading to a different technological path. However, the above characterization of technical change does appear to hold in the majority of developing countries. Thus there is a very deep-rooted problem in considering AT as an alternative. What, then, can be its prospects?

III.2 AT and the political economy of technological change and choice

To answer the question of the prospects of AT and its relation to value choices, it is helpful to first analyze the meaning of 'appropriate' in a little more detail. 'AT is a technology which is suited to the environment in which it is used,' writes Stewart (1985: xiii). It could be inferred, therefore, that a vast scope for its use would exist by definition. Yet, she continues, inappropriate technologies are consistently chosen. If appropriate technologies are not chosen, are they truly appropriate? Here the term 'appropriate' starts to spark many questions: appropriate for whom, where and when? And appropriate in what sense? Certainly there are technologies which are appropriate in some ways but inappropriate in others.

At this point there is the danger of assuming that if account were only taken of the relevant socio-cultural, contextual and temporal aspects, it would be possible to unequivocally determine the most appropriate technology on a case-by-case basis. However, this is impossible. Different groups and individuals may have rather divergent views on what constitutes appropriateness in a particular given context, depending on what they consider to be their best interests. Potential users of a technology may hold a different opinion from that of the people working for the NGO trying to promote it, whose ideas in turn could be different from those of the policy-makers, and so on. Divergence of interests is often related to the different

economic environments faced by various groups of decision-makers in an economy, which makes different -and competing - technologies economically appropriate for each of them at the same time. Thus we need to ask a further question: appropriate by whose standards?

It is not surprising, therefore, that the term 'appropriate' has given rise to a lot of debate ever since it came into use. Some writers even preferred to use a different, perhaps less controversial term such as alternative technology (Dickson, 1974) or intermediate technology (Schumacher, 1973). But these have their own drawbacks and they have sometimes merely added to the confusion. For example, the intermediate technology concept has been under criticism for allegedly aiming at the continuation of the technological backwardness of developing countries through the promotion of inferior techniques of production.¹¹ Reviewing the issues, Kaplinsky concludes that AT is inherently a relative concept (Kaplinsky, 1990).

In practice most groups working on AT have preferred to interpret 'appropriate' in terms of a number of specific characteristics,¹² including technical, economic and sometimes also social and environmental attributes. The following list is derived from a review by Kaplinsky of the criteria in use by various agencies (Kaplinsky, 1990)¹³.

AT should be technically efficient, it should not be wasteful. It should be economically efficient, making the best use of resources according to availability, and low-cost and small-scale so that poor people can afford it, leading to a more equitable distribution of incomes and assets. It should be socially and culturally compatible; it should preferably enhance the quality of life, be satisfying in terms of creativity of work, involve the use of machines that are subordinate to rather than dominant over people, be based on communal rather than individual use of goods and services, enhance social participation, and facilitate deconcentration of power. Lastly, it should be environmentally compatible; that is, it should preferably use renewable rather than non-renewable energy sources and raw materials, produce goods that are meant to be durable and can be recycled or reused, cause minimal pollution and wastes, blend into local ecosystems and be based on the rational sustained use of the environment.

Even a cursory examination of this list suggests that the success of AT is indeed a tall order when it is defined in this way. As far as technical efficiency is concerned, there is evidence that some small-scale techniques

can do at least as well as large ones (Stewart, 1989); but, as pointed out above, the magnitude and extent of distortions in resource allocation and factor prices prevailing in many Third World countries work heavily against their adoption. The relationship of these distortions to political economy issues has already been hinted at in connection with the structured market approach.

Thus, such technologies may be relatively profitable if inputs are valued at shadow prices in an economic cost-benefit analysis, but the outcome may be much less favourable if actual market prices are used. This is not to say that cost-benefit analysis is not useful as a tool for determining cost-effectiveness at shadow prices, but it has to be kept in mind that the actual investment decisions made by people in the private sector are made within the framework of actual resource availability and prices.

Many other policy distortions mentioned in the context of the structured market approach could also be added to the list of factors working against the adoption of AT. All these cannot be treated in detail in a paper of this size, but an example may serve to illustrate the thrust of the argument. In his well-known analysis of bread-baking techniques in Kenya, Kaplinsky comes up with an interesting observation (Kaplinsky, 1990). He remarks that the interests of the local capitalists who owned the three big bakeries were obviously served best by a capital-intensive, large-scale form of operation, but not because such a technology would generate a higher profit per unit of output in comparison to smaller-scale, more labour-intensive techniques. In fact Kaplinsky calculated that as far as ordinary bread was concerned, the large-scale technique was comparatively less profitable than the small-scale alternative, even at distorted market prices that favoured the former.

A number of important points can be made in this context. Firstly, as long as the capital-intensive plants made some profit, aspects such as controllability of operations, extractability of profit, market size and status were far more powerful arguments in favour of using such techniques. In other words, the choices were not guided solely by maximum-profit-per-unit-of-output considerations. Secondly, the owners of the large bakeries obviously had more staying power than those operating small ovens in the countryside, which gave them an important competitive edge. Thirdly, their bread, being promoted as a modern and 'civilized' food, commanded (and still commands) quite a lot of brand-loyalty even though its quality was not

superior. Fourthly, although the large bakeries could not make a great deal of profit on bread, they also manufactured a range of pastries, cookies and other similar products on which profit margins were substantially higher and for which substantial demand existed in urban areas. And fifth, their market power in the bread sector was matched by equally firm control of the flour market, which worked to their advantage in maintaining their grip on bread production.

This example shows that choice of technology involves a great deal more than is suggested by a simple economic cost-benefit analysis. Ultimately it shows that if technologies - or products - that can be considered 'inappropriate' from the point of view of the nation as a whole are chosen in a developing country context, it is because the groups or individuals who exercise control over investible resources have priorities and interests which are served well by the application of such technologies. As Kaplinsky and Dickson rightly observe, power relations (defined as the power to determine outcomes in situations of conflict) are a central feature of technological choice (Kaplinsky, 1990; Dickson, 1974). In developing countries such power is exercised by elitist core groups whose aspirations concerning progress and advancement are to a great extent modelled on Western ideas. Their interests are closely linked to, and served by, an international system of capital that derives its power from the pursuance of similar objectives (Dickson, 1974).

Kaplinsky also pursues the political economy argument in respect of the generation of technology. Technological progress will be pursued in the direction that suits the interests of those who have the political and/or economic power to control it. The resources available for R&D and commercial application of new technologies are concentrated in their hands and will be directed towards investment that strengthens existing interests (Kaplinsky, 1990). As we saw above, Stewart pinpointed this as an important reason for the tendency of relatively capital-intensive techniques to be relatively more efficient technically.

In conclusion, therefore, the political economy of technological choice has been rightly identified by the AT movement as a vital area constraining its prospects. The three issues that impede the adoption of AT technologies in developing countries, namely problems of availability, efficiency and considerations affecting choice, are ultimately driven by one and the same factor: the whole complex of values, motives and interests of the individuals

and groups, both in developing countries and in the West, who have the political and economic power to determine the outcome of developmental processes to their own advantage. AT's main characteristics do not serve those interests; on the contrary, they are often opposed to them because AT aims to help those individuals and groups who do not have that political or financial power to express their needs in the market.

At this point the conclusion might be drawn that the prospects of AT are not too good as long as fundamental issues such as political economy do not change. Yet, as has been discussed in Section II.4, it is precisely in this regard that some recent positive developments should be noted, now that awareness is growing about the unfavourable impact of structural adjustment programmes on the poor. This is certainly likely to be instrumental in improving the prospects of AT.

III.3 Recent developments in organization and technology, and their impact on the prospects of AT

There is yet another major aspect of the international economic crisis of the late 1970s and 80s which is likely to affect the prospects of AT. It is now becoming increasingly clear that an important dimension of the recession lay in the breakdown of the mass-production paradigm as the main engine of economic growth in the West. The mass-production system had worked as long as the markets it served could be satisfied with standardized goods. The production of such goods was particularly amenable to mechanization in which economies of scale were obtained as a result of large production runs.

Four structural processes, each in their own right and through interaction with each other, led to the breakdown of the mass-production system. These were:

- (i) The saturation of markets for mass-produced goods.
- (ii) A shift in the philosophy of the organization of production.
- (iii) A change in the direction of technological development.
- (iv) A shift in the structure of production in response to changes in market demand, production philosophy and technology.

The saturation of markets for mass-produced goods

The markets began to change around the end of the 1970s when the surfeit of standard products resulted in saturation of markets in the West while those in developing countries were not large enough for economies of scale to be sustained. The legendary Model T Ford, 'available in any colour as long as it is black', thus became unsalable. Consumer tastes became more and more sophisticated and thus differentiation and novelty became increasingly important characteristics of competition in industry. The recession, by making competitive pressures more acute, brought out these developments in full.

The mass-production system in its typical form was ill-suited to incorporating such demands for flexibility, and its comparative advantage began to be undermined as a consequence. Differentiated products require frequent changes in production runs. For this the machinery has to be reset manually, which is a time-consuming task. Short production cycles, increased machine downtime and relatively large stocks meant that the scope for economies of scale became severely reduced. Industry began to shift away from mass production to relatively small batch-production, with some countries taking a lead.

The shift in the philosophy of production organization

Several major industries also changed from the Taylorian production approach on the grounds that failure to provide job satisfaction could be very costly. One of the leading agencies promoting this idea was the Tavistock Institute of Human Relations in London. Leading industries, mainly in Europe, started to experiment with the concept of autonomous group production, under which groups of eight to twelve workers manufactured products which used to be made on the assembly line by some 200 workers. Volvo pioneered this in the production of sedan cars in Sweden. IBM Europe introduced the concept of 'quality circles' in the production of their 'golf-ball' typewriter.¹⁴ These changes heavily influenced production methods and production philosophy in Japan where quality circles are now the preferred form of organization for complicated products.¹⁵

In addition, the growing importance of major Asian economies is leading to a significant change in the philosophy of 'the bigger the better'. Whereas

lack of intrinsic work or company motivation has made wages the major incentive to get work done in the USA, leading to higher wage bills and even further attempts by management to introduce labour-saving production methods, intrinsic values play an important role in Japan and some European countries. Large Japanese firms still maintain the traditional family structure, with the firm taking on a life-long responsibility for the employee. Company commitment is very high and absenteeism and labour mobility between firms are low as compared to the West. This is due to social control as well as cultural values which give rise to a different labour morale.

The change in the direction of technological development

After the oil crisis one can also see a shift away from R&D focusing on processes and technologies making extensive use of cheap non-renewable energy sources, to those less dependent on such energy. For example, while in the 'Golden Age' of 1950-73 major productivity growth in agriculture was realized through the mechanization of processes such as tilling, harvesting and so on, in the period after 1973 such breakthroughs have been achieved through increases in the productivity of the species itself. High-yielding varieties (HYV) were developed and formed the basis of the Green Revolution. Yet, as these developments still required a lot of non-renewable inputs through fertilizers, research focused on further limiting agricultural dependence on energy. New biotechnologies, ranging from the breeding of bacteria that bind nitrogen from the air to the roots of plants, to genetic changes in plant DNAs, have produced high-yielding and high-resistance varieties of plants such as sugar-cane and cloves and have counterbalanced the advantages of large-scale production. While a harvester cannot be operated efficiently or profitably on a small-scale plot (less than three acres), the smallness of plot is no barrier to raising production with a high-yielding or improved plant.

Similar changes have taken place in the industrial sphere and in the increasingly important service sector. For example, better information on the steel production process in the second half of the 70s enabled producers to not only lower energy costs substantially, but also in the process to develop the capacity to produce multiple steel varieties in the same plant. The closure of many steel plants in the late 70s and early 80s in the USA was a direct result of the shift in the development of technology, which allowed

new industries that could use the modern technologies to get a significant advantage over traditional plants.¹⁶

The shift in structure of production in response to changes in market demand, production philosophy and technology

In this context, a new concept of efficiency has emerged which has come to be known by the term 'flexible specialization'. In short this involves the production of a wide range of items to suit the needs of highly differentiated markets with flexible use of technology that has a wide range of applications (Schmitz, 1989: 6). Piore and Sabel, who coined the term in their study of industrial performance and organization in Europe, drew attention to the fact that there were three industrial clusters in the West (parts of Italy and Germany, and Japan) which had displayed remarkable dynamism in the face of severe recessionary conditions. These clusters of industry were characterized by flexible specialization. They also pointed out that an important precondition for the success of these industries was an institutional environment favourable to innovation (Piore and Sabel, 1984).

Such structural changes have created in industrial countries a more favourable climate for small enterprise development. The changing trends are clearly indicated in the reorganization of industrial structure in the West in general and in the USA in particular. While in 1982, 75% of new employment was still generated in large industry, in 1988 large industry accounted for only 25% of new employment creation, while small enterprise is now responsible for the bulk of new employment (75%) (Business Week, 15 May 1988).

What inferences can be drawn from these developments for the prospects of small-scale industry and appropriate technology in developing countries? First, flexible specialization typically involves cooperation between different firms which makes them efficient on a collective level rather than individually (Schmitz, 1989). Schmitz argues that if this collective efficiency can be an engine of growth in times of economic crisis in the West, it could also play that role in a developing country. Preliminary empirical evidence on this issue does indeed suggest that this is a valid point, particularly if flexible specialization takes the form of subcontracting between small enterprises.¹⁷ Hence this could be of particular interest to countries pursuing structural adjustment strategies which want to

promote small enterprise development. Creating the right institutional climate for innovation (read: AT) in such clusters of enterprises could be an important policy instrument. The relevance of Stewart's structured market approach may be obvious.

However, Schmitz' account also brings out the limitations of the comparison between North and South. He emphasizes that as long as developing countries remain in a condition of labour surplus there are obvious undesirable consequences associated with flexible specialization, especially if it takes the form of subcontracting from large firms to small enterprises. In such circumstances, the system is likely to become one of sweat labour. And if it involves subcontracting within a cluster of small units, labour surplus may lead to multiplication of units and cut-throat competition rather than innovation.

IV. Concluding Remarks

The foregoing discussion has brought out two major determinants of the prospects of AT in the years to come. The first is the oil crisis and the ensuing international recession which have had a definite impact on the long-term economic outlook, particularly in the developing world where the crisis has had the effect of slowing down, halting or even reversing growth, especially employment growth. The problems associated with using the dominant industrialization patterns as a way of providing employment and income for large sections of the population have become particularly acute for local policy-makers. Similarly, the realization has grown that the agricultural sector is not capable of absorbing the growing rural labour force. Faced with severe internal budget constraints and pressure on their balance of payments, governments have been forced to look in another direction. There has been an upsurge of interest in new approaches towards solving the employment problem. It is not surprising, therefore, that in many countries attention has turned to small enterprise development as a possibly viable alternative.

Studies such as UNIDO et al. (1988), ARIES and PISCES testify to the fact that this change in outlook is matched by an increasing interest in this sector from the international and bilateral aid community. More specifically in the AT field, the fact that the AT characteristics listed in Section III.2 have been put together by aid agencies such as USAID and UNEP may be taken as a positive indication that the concern for the small scale and micro-enterprise sector which would be using such technologies is spreading. Other agencies, such as IFAD, are already taking major steps to sponsor implementation of AT projects along the lines of the structured market approach. There is also evidence about local initiatives. In Costa Rica, an AT project among small-scale coffee-growers has been successfully implemented with full-hearted government support (Doryan-Garron, 1990), and in Guatemala an improvement programme covering sheep-rearing and wool production along AT lines has even been sponsored by the business community (Gutierrez, 1990).

The second determinant of AT's future relates to the industrial changes in the West. Here, a final remark is needed about the search for increasing flexibility and adaptability, particularly about how this interacts with the development of new technologies. For example, recent developments in computerization have made possible the introduction of equipment that can overcome the sort of problems described above concerning resetting of

machinery. Such technologies are now beginning to be applied in areas such as small batch-production of fashion footwear and textiles that had been difficult to mechanize earlier in view of the nature of the materials involved (Schmel, 1989). These two, leather goods and textiles, based on labour-intensive subcontracting, have been the traditional first stepping-stones for developing countries on the road to export-oriented industrialization.

Thus, while the socio-economic conditions for the growth of small enterprises and the application of appropriate technology in developing countries are more favourable than at any time after the Second World War, yet those very conditions might also lead to a shift in comparative advantage back towards industrialized countries. Factors such as nearness to rapidly changing markets and access to quick-changing technologies (which is easier for small enterprises in the economically advanced countries than for small and rural industries in developing countries) are becoming more and more important.

NOTES

1. See Kaplinsky (1990) for a useful review of theories concerning temporal variations in technological change.
2. For an excellent, more elaborate overview of these and related aspects concerning the post-War development experience, see Singer (1989).
3. It is, however, not wise to ascribe all the industrialization failures of developing countries to import substitution as a system. See Singer (1989) for a qualified statement on this issue.
4. This is a practical, straightforward characterization of the concept of appropriate technology. A more precise meaning of the concept is given in Section III.
5. For a good overview of the emergence of AT organizations, their objectives and organization, see Jéquier and Blanc (1979, 1983).
6. Interesting excerpts from some of the leading criticisms and responses are contained in Carr (1985: 22-45). See also Willoughby (1990: 225-8).
7. Weiss and Jéquier (1984) provides good case studies on this.
8. A recent critique of the AT movement that raises these issues in more depth is Willoughby (1990).
9. See, for example, Kaplinsky (1990) for an analysis of the adoption of inappropriate technologies in the sugar and bread industries in Kenya and the brick industry in Botswana; and James (1987) for a study of inappropriate choices made by parastatals in Tanzania and Kenya.
10. Incidentally, the idea of balanced rural development represents a return to Schumacher's views on the issue. In the 1960s he argued, 'This weakening of traditional industries in rural areas affects the ability of agriculture to meet essential food needs,' and that 'it thrives only when in contact with industrial crafts of all kinds and when vivified through cultural influences coming from thriving towns nearby' (Schumacher, 1961: 43).
11. For a good overview of the various criticisms of the AT concept and approach, see Willoughby (1990: 223-63).
12. For a succinct discussion of the essential differences between the two main approaches to defining 'appropriate', namely the specific characteristics approach and the social welfare approach, see Stewart (1987: 2-5).
13. Kaplinsky does not specifically refer to technical efficiency in his review, but it has been included since this aspect has been treated elsewhere in his book.
14. While the argument is often made that these production changes were introduced on the basis of humanistic values, in reality it was more economical to produce in quality circles than on assembly lines when costs of production were looked at in a broader context, taking into account factors such as absenteeism, rejects due to bad quality and the consequent loss of market due to lack of trust in the product, and the high costs of introducing quality control measures. An example of such costs was Remington Rand's use of one quality controller for every three workers on an assembly line to produce portable typewriters.
15. For an extensive discussion of this, see among others van Beinum and de Bel (1968), Emery and Thorsrud (1969, 1976) and Schouten (1974).
16. This explanation for the closure of USA steel plants is not accepted by everyone. F. Byrom, CEO of Koppers Company, would argue that the reduced labour cost in the construction industry in Japan resulted in a significant reduction in the fixed capital required for new plants, thus drastically reducing the share of unit cost of capital in Japanese steel products. This then gave Japanese products a competitive advantage over American ones.
17. See, for instance, Dawson's (1988) account of the resilience displayed by the informal sector under structural adjustment conditions in Kumasi, Ghana.

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