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social aspects of industrialization**



Background Paper

The implications of new organizational techniques for developing countries

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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This study was prepared by Raphael Kaplinsky of the Institute of Development Studies, University of Sussex, Brighton, United Kingdom as consultant to the United Nations University, Institute for New Technologies (UNU/INTECH), Maastricht, the Netherlands, and to UNIDO.

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1. Introduction

Comparative analysis has shown a close association between industrial development and high levels of per capita income (Syrquin and Chenery, 1989). This has led many countries to actively foster industrialisation. However, not all industrial growth leads to income growth. This is for two main reasons. First, as the experience of the former command economies has graphically shown, when domestic industrial production occurs behind heavy protective barriers, the 'border price' value added in industry - that is, the value of industrial output when calculated at the cost of imported equivalents - can be much lower than when its value is computed in domestic prices and then converted into international units of account through the exchange rate. And, secondly, some forms of industrial development, especially those based almost exclusively on cheap labour, are only sustainable with a depreciating exchange rate as countries engage in a process of competitive devaluation to lower their dollar wage rates (Kaplinsky, 1993). In these circumstances the international purchasing power provided by industrial production (in the medium- and long-term, if not in the short-term) leads to what might be called "immiserising industrial development".

Both these caveats point to the complexity of industrial development in an open trading world. On the one hand, production behind closed borders may provide a misleading estimate of realisable incomes; on the other hand, "open-ness" *per se* does not lead to sustainable output growth, particularly that consistent with high levels of employment and desirable distributional patterns. But at the same time, exogenous forces at play in global political-economy effectively remove the option of industrialisation behind closed borders and increasing openness is a reality which has to be confronted by industrial planners in both the private and public spheres of policy. It is important to note, however, that there are different structures of integration with the global economy, each with different consequences for meeting economic and social objectives, and industrial policy needs to be fashioned with this complexity in mind.

A key to the development of appropriate policy is a clear understanding of the nature of global industrial development (involving new standards of price and product competition), both because LDCs may want to compete in external markets and because they are facing increasing competition in internal markets. Thus, in both LDCs and the IACs alike, the clarion-call of industrial policy is increasingly one of achieving "international competitiveness". Whilst Krugman's injunction against the dangers of reducing national objectives in both the traded- and non-traded-goods sectors to the imperatives of the global market is well-taken (Krugman, 1994), it clearly remains important that LDCs position their industrial trajectories with a clear perspective on the changing nature of international competition.

As will become clear in the ensuing discussion, the central challenge of industrial restructuring during the 1990s is to move to new forms of industrial organisation - in work; in plant and firm structures; in the relationship between firms; between the industrial sector and the science and technology system; and in the relationship between the state and the industrial sector. This "revolution" in industrial organisation challenges conventional wisdom on industrial policy, and particularly given the human resource intensity of organisation, poses specific challenges to LDCs. In this paper we will consider the nature of these changes in industrial organisation and the experience of LDCs in adopting new forms of organisation. On the basis of this experience it is possible to offer a number of hypotheses on the ability of LDCs to

make effective use of these new organisational techniques and the implications which this has for sustained LDC industrial development. The paper concludes with a discussion of the challenges thus posed for industrial policy formulation and execution.

2. Paradigmatic Change and the Role of Industrial Organisation¹

Recognition of the key role played by mechanisation in industrial development has a long lineage, stretching back not just to Marx's distinction between manufacture and machinofacture, but before him to Adam Smith who believed that one of the critical elements of the division of labour was the emergence of a specialised machinery-building sector. It is thus not surprising that policy thinking has tended to focus on the quantum of investment as the critical constraint to industrial development.²

But in recent years, macroeconomic calculations on the sources of economic growth in the IACs have revealed that a relatively small proportion of increased output was accounted for by increments of capital and labour; the bulk arose from changes in the quality of these inputs and (although this is seldom explicitly theorised) alterations in the manner in which these inputs are combined (Abromowitz, 1956; Solow, 1957). The econometric evidence for LDCs suggests a similar conclusion, namely that economic performance has been critically affected by the quality and effectiveness with which additional inputs of factors have been used. One way of measuring these factors is through the use of total factor productivity (TFP) estimates; as can be seen from Table 1 (which draws together the limited evidence available) there appears to be a loose positive association between countries experiencing rapid economic and TFP growth (notably Korea) and those with low economic and TFP growth (India and China during the relevant periods; the Philippines; South Africa; Zambia). Focusing on the case of India, for example, it is often argued that low economic growth reflected low rates of savings. But the operative measure is not the rate of savings, but the rate of investment, and as can be seen from Figure 1, although India's investment rate lagged that of the IACs and both the first- and second-tier NICs, the shortfall was not significant and was largely made up during the 1980s. Particularly in recent years, the primary source of India's relatively poor industrial performance is therefore not to be found in inadequate investment but in the sub-optimal utilisation of these additional productive inputs (Ahluwalia, 1991; Kaplinsky, 1995).

¹ There are a variety of texts which summarise this discussion. See, for example, Piore and Sabel, 1984; Womack et. al., 1990; Andreassen et. al. (1995); Kaplinsky, 1994).

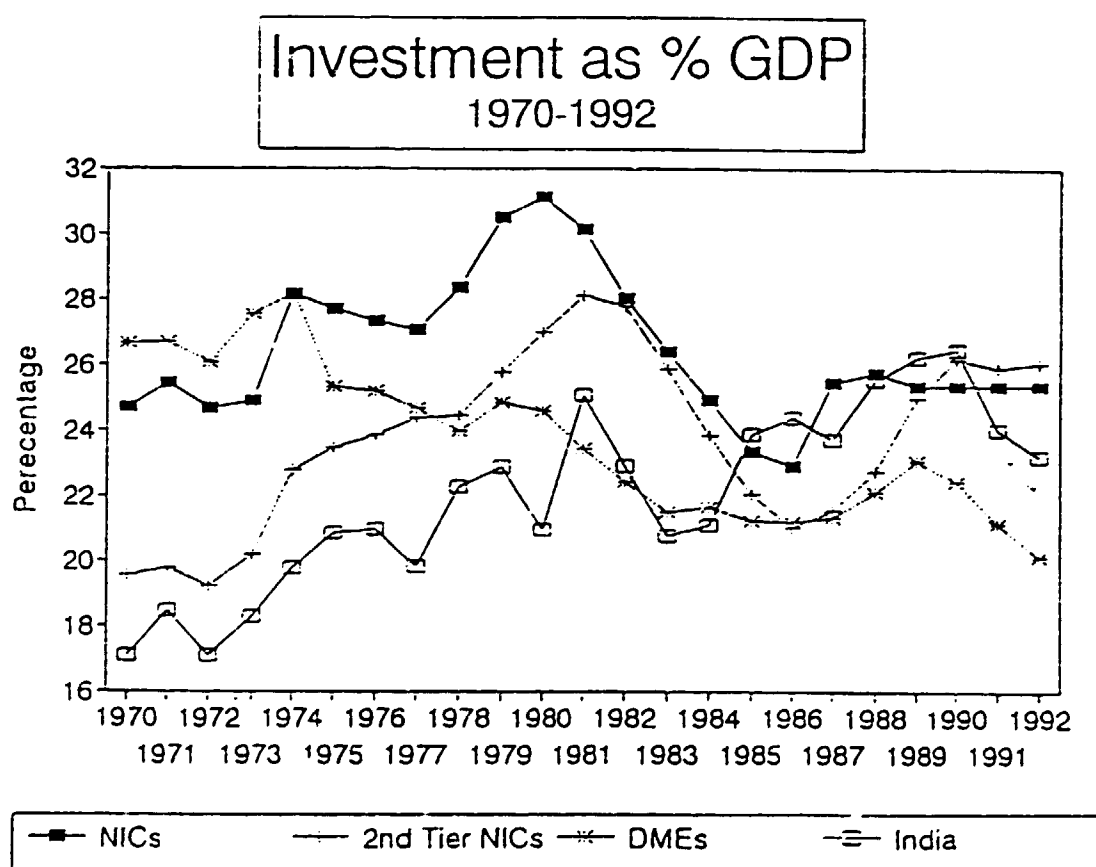
² At the theoretical level, this is reflected in Harrod-Domar type models of economic growth. In policy-terms, for example, both the Harrod-Domar approach and the Soviet emphasis (based on Marx's distinction between Departments I and II) on the capital goods sector lay at the heart of the influential early Indian five year plans.

Table 1: Total Factor Productivity Growth in a Range of Developing Economies.

India (1959-79)	-0.2
China (@)	-0.4
South Africa (@)	@@
Thailand (1963-77)	1.5
Indonesia (1975-82)	1.9
Turkey (1963-76)	1.5
Korea (1960-77)	4.5
Argentina (1955-73)	1.5
Philippines (1956-80)	-0.2
Yugoslavia (1965-78)	0.4
Zambia (1965-80)	-2.6

Source: Ahluwalia, 1991; own calculations for South Africa.

Figure 1.



Source: Calculated from World Bank Tables.

This econometric evidence on the limited role played by the quantum of investment in industrial accumulation is mirrored by a growing body of economic history and business-related literature which has hypothesised the epochal transition between two different paradigms of industrial development with very different organisational parameters (which we will refer to as mass production and mass customisation³). The origins of this body of thinking go back to attempts to explain the post-1973 slowdown of the global economy. Initial thinking had been that this slowdown was caused by high energy prices, but this was soon disregarded when it became obvious that the slowdown in productivity growth preceded the 1973 oil-price increase (Bowles et. al., 1983). Instead, it is suggested that the slowdown of the 1960s followed from the exhaustion of a particular mode of industrial accumulation, that is, mass production. This had developed during the course of the twentieth century, and was characterised by the following central features:

- price competition and product standardisation as the primary characteristics of market competition
- the use of special-purpose machinery, allied to constancy of product
- the development of a fine division of labour and a hierarchical structure of managerial control
- plant economies of scale in production
- "point-optimisation" in efficiency, at the level of individual machines, individual workers, individual plants and individual firms, and
- arms-length relationships between firms in the production-chain

For some decades, and particularly in the "Golden Age" between 1945 and 1970, mass production proved to be extremely effective. It delivered unprecedentedly high growth rates, and these were widely spread through the global economy (Maddison, 1989). But as the 1960s progressed mass production began to run into difficulty, for two different but related reasons. On the one hand, the structure of demand was changing. As per capita incomes grew in the industrialised countries, consumers became more discerning and were not satisfied by homogeneous products ("a Model T Ford in any colour as long as it is black"), low rates of product innovation and poor quality. On the other hand, the labour force working in these mass production factories also registered their opposition; labour absenteeism and turnover grew, and the dissatisfaction spilled over into social discontent in both Europe and the USA during the late 1960s. Moreover, it became increasingly apparent that those firms and economies which had mastered and sustained this mass production approach to production began to experience falling profitability, growth rates and market share.

By contrast there were a range of economic actors in other parts of the global economy - notably in Japan and in some regions of Europe - which were able to sustain their growth and profitability. The initial reaction of following firms was to focus on the flexibility of these successful competitors and to contrast this with the inflexibility of their previous investments in special-purpose mechanisation. The growing maturity of electronics-based automation technologies during the 1980s suggested a route to flexibility and competitiveness and which

³ The literature on paradigm-shift frequently refers to mass production as "fordism"; the ascription of the new order is variously post-fordism, flexible specialisation (notably Piore and Sabel, 1984), "lean production" (Womack et. al., 1990) and the New Competition (Best, 1990).

built upon past expertise in mastering embodied technologies. Thus, during the course of the late 1970s and early 1980s, a number of costly mistakes ensued. For example, in the paradigmatic automobile industry, General Motors invested \$70bn between 1976 and 1985 as a competitive response to the growing market penetration of Japanese producers; much of this investment was in sophisticated electronics-based automation technologies. Yet it began with a market share of 44 percent, and ended this period of heavy investment with a share of only 33 percent (Hoffman and Kaplinsky, 1988). In similar vein, Jaikumar's well-known study of the utilisation of flexible manufacturing systems in Japan and the USA identified very significant differences in performance with similar sets of machinery (Table 2). Yet more recently, Europe's laggard industrial performance can be seen to arise not from under-investment of resources, but from the ineffective utilisation of these productive inputs (Andreasen et al., 1995, European Commission, 1994).

Table 2: Comparison of US and Japanese FMS installations

	USA	Japan
Number of different parts produced per system	10	93
Parts produced per day	88	120
Number of new parts introduced per year	1	22
Utilisation rate (based on two shifts)	52%	84%
Average metal cutting time (hours per day)	8.3	20.2

Source: Jaikumar, 1986.

As a consequence, these various actors in the industrialised countries have come to realise that although the objective of flexible production was an appropriate response to the challenge of the new competition, this could not be achieved through the utilisation of new embodied technologies alone. Instead, it was necessary to move to a new form of industrial organisation - mass customisation - which both provided for large scale production and met customer requirements for increased product quality and diversity. Within this, embodied technology played a role, but only in the context of far-reaching changes in the organisational infrastructure underlying production. Thus by contrast with mass production, mass customisation is characterised by:

- product heterogeneity and innovation, and enhanced levels of product quality without sacrificing price competitiveness⁴
- the use of flexible machinery, often (but not always) involving electronics-based automation technologies

⁴ In mass production, higher quality meant higher prices, since each factory's output had to be exhaustively checked and reworked to ensure the absence of defects; by contrast in mass customisation, quality at source procedures meant that higher quality simultaneously became the route to cost reduction.

- the introduction of new forms of work organisation involving team-working, delayering of managerial hierarchies and the three-way (up-down, down-up and horizontal) flow of information
- the search for economies of scope rather than of scale, thus promoting firm- rather than plant-attributes, and
- the pursuit of "systemic optimisation" in efficiency, involving teams of workers, interlinked plants, closer "obligational" ties between firms in the production chain, and collaboration between firms in the same sector in technology, marketing and other activities

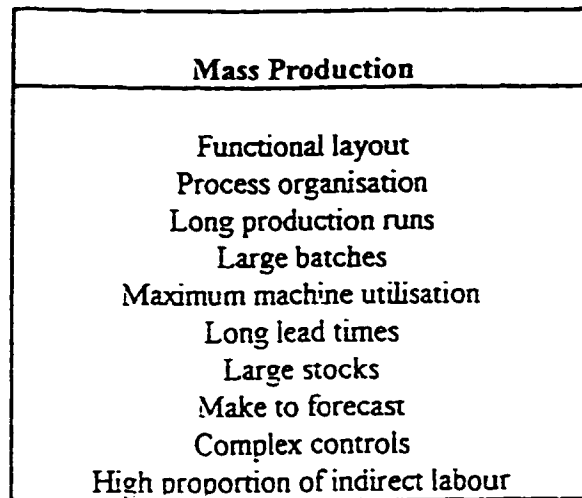
Broadly-speaking, there appeared to be two routes to mass-customisation. On the one hand there were countries such as Japan where the predominant (but not exclusive - see Friedman, 1988) form of industrial organisation was the large, integrated firm. On the other hand, and particularly in parts of Europe (notably the Third Italy and Southern Germany) clusters of collaborating small firms had been similarly successful in global markets.

A detailed specification of these changes in production organisation is beyond the scope of this paper (but see Best, 1990; Bessant, 1991; Kaplinsky, 1994). But it is helpful to briefly distinguish between three essential elements which are relevant to later discussion on the policy implications for LDCs - intra-firm organisation; inter-firm organisation; and the growing importance of systemic integration.

The intra-firm organisational challenge

Mass production evolved in a supply-constrained world which enabled producers to "push" products onto the market, making to forecast in large volumes with the confidence that a predictable pattern of demand would take up production (that is, as long as Keynesian macro-economic management matched overall demand with overall supply). In so doing, production organisation was based upon the related principles of standardisation and functional specialisation. "Efficiency" was achieved by maximising machine utilisation through a functional layout in which special-purpose machinery was grouped together; maintaining adequate inventories just-in-case there were any disruptions to production, perhaps caused by machinery-breakdown; and producing large batch-sizes to minimise machine-downtime during changeovers. The emphasis on maximising machinery utilisation meant that 'indirect' tasks were conducted off the line; for example, in the case of quality control this involved a specialised cadre of workers checking quality and reworking defective components. Finally, balance was maintained between meeting customers' needs for small orders and minimising batch-size by a sophisticated anticipation of market demand - production was thus 'supply-driven' and based upon forecasts of customer needs. When customer demand might be unexpected or require small volumes, the consequence was either that customers had to wait to be satisfied, or the producer satisfied customer requirements from a well-stocked final goods warehouse. The relationship between these various organisational features is shown in Figure 2.

Figure 2: The organisational principles of mass production at the firm-level



By contrast the new production philosophy of mass customisation is premised on production flexibility and small batches rather than on reaping the benefits of specialisation and scale. Minimum batch-sizes are much-reduced because customer demand is more fragmented and volatile. Instead of a supply-driven manufacture-to-forecast schedule, a demand-pulled manufacture-to-order principle is utilised; and 'indirect tasks' such as quality assurance, supervision and machine maintenance are absorbed back into direct production. A primary characteristic of this "demand-pulled" production system is that product characteristics such as quality, differentiation and innovation become critical - price-competitiveness is an "order-qualifying" attribute for producers; "order-winning" arises from the mastery over product technology.

There are a number of key intra-plant and intra-firm requirements to enable this organisational reorientation, of which four are especially significant - the introduction of a new form of factory layout in which individual "mini-factories" are devoted to individual market-segments (this is termed "cellular production"); the introduction of multitasking and multiskilling work practices; the introduction of quality-at-source procedures; and the institution of new social relations of production in which the division of labour between conception and execution is reduced, a process which the Japanese have termed *kaizen* (continuous improvement).⁵ The first of these is largely a technical issue (for more detail, see Kaplinsky, 1994), but the other three identify the key importance of human resources in the new production system. To some extent this is a matter of education and training, but, critically, it is also a function of the social relations of production. This includes a new compact between management and the workforce (often with significant implications for industrial relations), a reduced role for middle management as communication channels within plants and firms are reduced and the introduction of team-work and a significant measure of self-supervision.⁶ To briefly contrast

⁵ Many Japanese firms have been able to achieve significant inputs from their labour forces. For example, in 1990 Kawasaki Heavy Engineering obtained almost seven million suggestions from its workforce. For a discussion of the principles of *kaizen*, see Imai (1986).

⁶ In illustration, one British manager's phrase is apposite - "the beauty of it is that with each pair of hands you get a free brain".

the two production systems' perspectives on labour, in mass production labour was seen as a cost of production to be minimised, reflected in the frequent conflation between "productivity/efficiency" and labour-productivity. In mass customisation labour is seen as a resource to be augmented and whose potential contribution to innovation has to be maximised.

The inter-firm organisational challenge

The roots of the modern multidivisional firm lay in the separation of ownership from control during the mid-nineteenth century in the USA and in the multidivisional structure introduced by Alfred Sloan at General Motors during the 1920s (Chandler, 1977). There were two important related features of this evolving firm structure which are relevant to this discussion of organisational change. The first was the tendency towards vertical integration in which the firm not only manufactured its core product, but also many components (as well as a range of complementary services such as catering and marketing). Secondly, for those components and services which were bought-in, the general tendency was to develop arms-length relationships with a number of suppliers. These were generally short-term in nature, tightly specified, subject to change at the end of the contract, and largely determined on the basis of lowest price.

These structural features are subject to change in mass customisation. The new emphasis on flexibility, speed of response to changing market conditions and product characteristics have led many firms to de-emphasise the degree of value which they add to the final product and to concentrate on core competence. Thus a greater proportion of components and services are bought-in.⁷ At the same time, the adoption of just-in-time (JIT) and total quality control (TQC) procedures in their core operations has meant that they have new requirements from their suppliers - namely that they deliver more frequently in smaller quantities, that they deliver with absolute reliability (since incoming stocks are low), and that their components be produced with "zero defects". Consequently, the arms-length relationship with both suppliers and customers (described above) is no longer functional - close relationships of trust are required as the speeded-up innovation process involves cooperation between these different firms ("concurrent engineering"); the assurance of zero-defect supplies requires close contact in the minutiae of production procedures; flexible output schedules require frequent changes to production and delivery schedules; and so on. For all these reasons the conventional arms-length relationship of mass production needs to be succeeded by a closer, more long-lived and cooperative relationship along the production chain. The American General Electric company refers to this new relationship as one of "cooperation"; (Sako, (1992) terms it as "obligational" - both contrast this new pattern of inter-firm relationships with those of mass production.

All of this has implications for the role played by small, medium and large firms. As the larger formerly mass production firms have begun to concentrate on core competence and to develop new relationships with suppliers, this has frequently led to the incorporation of small and medium sized enterprises (SMEs) in the production chain. But since SMEs frequently do not have the resources to command these new organisational procedures, the larger firms have had to develop the capacities to drive change through the supply chain, including in very small firms. In some cases, as in the Japanese auto industry (Cusumano, 1985), this has led to

⁷ For example, whereas the Japanese auto firms characteristically bought in 40 percent or more of their components, in some cases their US counterparts in the early 1980s were buying in a much smaller proportion, less than 30 percent (Cusumano, 1985).

families of suppliers in which there is cascading responsibility for organisational change through the various tiers of production.

But, mass customisation is not only achieved through the activities of large firms. In some environments, the same competitive attributes of rapid product innovation, high quality and flexible production has been achieved through the participation of small firms. The most significant example of this phenomenon is to be found in the "Third Italy", which has come to dominate a number of industries including those such as clothing, shoes, furniture and food-processing which are frequently regarded as representing the comparative advantage of LDCs.⁸ Schmitz (1995) identifies the critical condition for the success of these small enterprises. He observes that in general, the problems of small firms are not that they are small, but that they are isolated. What distinguishes these mass customisation small enterprises is that their close geographical proximity in industrial clusters means that they gain from a variety of (largely unintended) external economies which allow individual firms to specialise, for experience to be passed between enterprises (often through the labour market), and to attract both suppliers and especially the marketing agents which are critical for small firms to penetrate distant markets. But even more critical to the dynamism of these small clusters is that they cooperate in order to achieve "collective efficiency". Over time a relationship of trust builds in which firms cooperate to achieve common ends - perhaps in marketing and purchasing, and sometimes also in design and lobbying. Once again, as in the case of intra-firm organisational changes, the critical element of this organisational form in mass customisation is to be found in its reliance on different social relations such that small firms network, often with other small firms as well as medium and large firms, rather than act as isolated units.

The growing importance of systemic integration

The various elements of production organisation introduced by the Japanese in recent decades can be seen in either the limited context of a specific production technique - potentially applicable across a range of production systems - or as an integral component of the new production system itself. For example, at the plant level specific techniques have been developed to reduce inventories (Just-in-Time, JIT) and to ensure better quality procedures (Total Quality Control, TQC). These can be implemented as stand-alone changes in procedure, often within the context of large-batch production of standardised products; alternatively, their introduction can be coordinated and be linked to the use of a battery of additional techniques to enable the flexible production of diversified, high quality products. To operate effectively and to approach the levels of achievement attained by many Japanese firms (and some Western imitators), there is little doubt that these organisational practices must be adopted as part of a wider, coordinated package of measures. Nevertheless, even when introduced in a fragmented manner, the competitive returns can often be high.

These plant-level systemic features (Figure 3) can be contrasted with those practices utilised in mass production. In mass customisation, the emphasis is placed on rapid-response and only making to customer orders. This enables the plant to work with low inventories, but requires a different approach to machine layout - these are now grouped together in "production cells" or "mini-factories". But the transition to flexibility also requires new

⁸ During the mid 1980s, the average size of Italian clothing producers was 5.3 employees; 5.7 in furniture and 17 in shoe production.

quality procedures (since there are no inventories to buffer production in case anything went wrong), that the workers are trained in a variety of skills and perform a number of tasks (hence achieving quick machine changeover) and that relationships with suppliers are restructured. Amongst other things this reduces the number of indirect workers and requires significant changes in social relations, with flexible work-teams substituting for individualised tasks and a much flatter organizational hierarchy. These intra-plant systemic features are mirrored in similar inter-relationships between different plants within a firm, and in the relationship between firms. Once again, whilst individual plants and firms can achieve significant gains in their performance by adopting new organisational procedures, the real gains are to be realised when these changes are complemented by similar changes in other firms. The systemic inter-relation between these different organisational techniques at the plant level is illustrated in Figure 3 (which should be contrasted with the organisational skeleton of mass production described in Figure 2 above).

Figure 3: The organisational principles of mass customisation

Mass Customisation
Cellular layout Product organisation Short production runs Small batches Quick changeover of machinery Short lead times Stocks minimised Make to order Simple controls Lower proportion of indirect labour

As observed, this process of systemic adoption - which has been briefly outlined above at the level of the plant - applies equally to the relationship between firms, both in the supply chain and amongst firms manufacturing similar products. A critical feature of these systemic changes is that they reflect process and depth, rather than the transition from one steady state to another. As Hoffman observes, possibly the most significant change in the transition to mass customisation is the endogenisation of the change process itself, so that the boundaries of systemic integration represent a moving target (Hoffman, 1989).

3. Mass Customisation: Early LDC Experience with Organisational Change

The purpose of this paper is to examine the consequences of these organisational innovations for industrialisation and industrial policy in LDCs. It is consequently not necessary to evidence the impact of these organisational innovations on industrial performance in the IACs. The evidence is however overwhelming, particularly in respect to changes at the plant and firm level.⁹ One interesting and relevant characteristic of the literature on the diffusion of these new organisational principles in the IACs is the evolution of thinking on the transferability of these organisational principles outside of Japan (particularly) with respect to the cluster of JIT/TQC techniques, and from Italy with respect to networking between small firms. Initially it was widely argued that this would be an extremely difficult, if not impossible process, since these techniques were said to be "culturally-based" and difficult to transfer. However the experience of their adoption in other IACs makes it clear that to a significant degree (bearing in mind earlier observations on the depth of systemic adoption) these organisational procedures can be widely introduced. The problem with the earlier, gloomy prognoses had been that they failed to distinguish between the *technics* of these organisational procedures (for example, the principles of inventory reduction and quality at source) and the *social relations* with which they are achieved. The specificity of both the Japanese and Italian experiences arises not from these technical characteristics of organisation, but in the particular pattern of social relations by which they are achieved. Although these are difficult to replicate, there is no need to copy them exactly; alternative patterns of social relations can be utilised to achieve a similar technical outcome (Kaplinsky, 1994).

The central question, therefore, particularly in the context of the opening-up of many LDC industrial sectors to international competition, is whether the same process of diffusion can take place in low-income countries. This process is still at an early stage, but it is possible to draw on an increasing range of evidence with respect to the adoption of new organisational procedures both within firms and plants, and in the relationship between firms. It is clear from this evidence that the competitive enhancement arising from the adoption of these techniques in LDCs is not limited to cost reduction but includes speed of response as well as greater product quality and diversity.

The diffusion of intra-plant and intra-firm organisational innovations

Because of the limited diffusion of these new organisational techniques in LDCs, it is not possible to determine their impact on aggregate industrial or economic performance. Instead it is only at the plant and firm levels that their significance can be measured. In what follows examples are provided on the impact of innovation in Asia, Central and Latin America and sub-Saharan Africa (more detail can be found in Kaplinsky, 1994 and World Development, 1995). This is done through the medium of case-studies to show the possibilities existing within these diverse LDC operating environments.

India: The experience of Modi Xerox.

Since the late 1980s an increasing number of Indian firms have begun to apply new organisational techniques to their operations; by the middle of the decade approximately 30 large firms had made significant progress, including with their sub-contractors. Of these, one

⁹ See, for example, Schonberger, 1982 and 1986; Piore and Sabel, 1984; Bessant, 1991; Porter, 1990.

of the most successful innovators was Modi Xerox, a subsidiary of the Xerox Corporation, which is the largest manufacturer of photocopying machines in the world. In the early 1980s Xerox experienced a rapid fall in its share of global photocopier sales; moreover it largely failed to penetrate the emerging market for small copying machines pioneered by the Japanese. After closely studying its Japanese affiliate, Xerox implemented a significant programme of organisational change in its various enterprises, paying especial attention to the problems of TQC (but also involving a significant input from its design department). This restructuring programme proved to be very successful and Xerox is one of the few United States high-tech firms which has managed to claw-back market share from Japanese competitors.

The Indian subsidiary of Xerox, Modi Xerox, was incorporated in late 1983 and began production in early 1985. In a short space of seven years it was nominated by Business World magazine as one of the 50 'Most Respected Companies in India', and was placed first in the Office Automation category.

The rallying call for efficiency in Modi Xerox was TQM - total quality management - with a Quality Policy which declared that "Modi Xerox is a Quality Company. Quality is the basic business principle for Modi Xerox. Quality means providing our external and internal customers with innovative products and services that fully satisfy their requirements. Quality improvement is the job of every Modi Xerox employee" [*Venkatraman and Krishnamoorthy, 1991: 224*]. Six mechanisms were utilised to implement this principle:

(i) Training

Modi Xerox aimed for all of its workforce to receive some training. In pursuit of this aim, it grouped training activities into two major areas. The first was a nine-step quality improvement process, and the second a six-step problem solving process. The cumulative numbers receiving training were 20 in 1986-87, 280 in 1987-88, 770 in 1988-88, 1,400 in 1989-90 and 1,600 in 1990-91.

(ii) Managerial behaviour

These procedures were designed to ensure that management - at all levels - promoted the philosophy and practices of TQM. This involved the implementation of specific quality inspection procedures and participation by managers in group quality activities. It also incorporated a Management Behaviour Survey in which group members evaluated the role played by their management.

(iii) Transition teams

These teams comprised groups of facilitators - some full-time and some part-time - whose task it was to guide implementation of targeted objectives.

(iv) Standards and measurement

Modi Xerox developed a range of indicators to measure the extent of performance in a range of quality-assuring areas, including inventory control and customer satisfaction. This was seen as a route to continuous improvement since the objectives set in each of these indicators were continually revised upwards.

(v) Recognition and rewards

Individuals and teams receive quality awards. These include cash, awards in kind, and certificates. In 1990 a corporate 'Teamwork' event was organised, involving competition between more than 100 project teams.

(vi) Communications

An extensive programme of information communication was introduced. This not only overturned past practice by ensuring 'bottom-up' vertical flows, but also involved the introduction of horizontal networking. These communication programmes included written material (such as a corporate newsletter), audio-visual media (for example, videos on quality-control) and programmed discussions.

Through the application of these six mechanisms Xerox Modi has achieved significant improvements, which suggests that they have been able to move beyond mere exhortation. Table 3 illustrates the extent of improvement in a number of areas. Labour productivity - as measured by average production hours - rose in one year from 60 to 78 per cent of payroll hours. Defects per hundred machines were halved (although were still over one-third of the total). Modi Xerox's measure of operator efficiency rose by 12 per cent, and inventories fell from 140 days supply to 119 days. Defect free installations rose from 75 to 88 per cent, and customer satisfaction increased, although it remained below the target of 86 per cent.

	Measurement	Definition	Average	Average	Actuals	Target
			8. 8.89	8. 9.90	Sept '90	
1.	Labour Productivity	Standard hours of production/payroll hours	50.67	51.76	66.2	85
2.	Defects (per hundred)	Any defect, cosmetic, functional, etc.	76	64	34	5
3.	Photoreceptor Productivity yield	Input-output ratio (output per 100 input).	89	88	92	94
4.	Operator Efficiency	Hours in productive work	66.61	68.69	76.8	100
5.	Inventory (days)	Value of inventory/forward consumption for next month.	140	128	119	75
6.	Defect Free Installations	Installations without defect.	68	75	88	100
7.	Age of Debt	Percentage of debts more than 60 days	20	14	NA	25
8.	Customer Satisfaction	Overall Satisfaction of MX as a supplier.	78	81	NA	86

Source: Venkatraman and Krishnamoorthy 1991.

The Brazilian automobile components sector

The automobile sector is one of the largest sectors in the Brazilian manufacturing industry. Local content grew from 48.4 per cent by value in 1958 to 96 per cent in 1968 and automobiles have periodically been of considerable importance to Brazil's balance of payments. Amongst the major issues facing these component producers were those concerning the adoption of new organisational techniques. Posthuma's conclusion of the sector's operations is that "...the introduction of new organisational practices was the most significant area of change" (Posthuma, 1992a: 129).

As observed above (Figures 2 and 3) one of the key indicators of the adoption of these techniques is the introduction of cellular production. A detailed study of 21 component firms found that 19 had begun to institute these changes - three of these (one local and two TNCs) had done so in greenfield sites, nine (six local and three TNCs) had reorganised brownfield sites, and seven (three local and four TNCs) had adopted new layouts in both greenfield and brownfield sites. One significant feature of this reorganisation (which will be picked up in later discussion) concerned the capital cost of reorganisation. Not only are these new organisational technologies not inherently capital-intensive, but in Brazil it appeared that the previous forms of factory layout had been wasteful of equipment: "It was surprising to note that many firms in the sample reported that the reorganisation of production actually resulted in an excess of production equipment which had to be removed" (ibid: 172)"

The results of reorganised production appeared to be rewarding for innovating firms, although no data is available to summarise the overall net benefits arising. Table 4 provides information on competitive elements in two firms - one local and one foreign - and Table 5 provides data on performance in two plants of a single locally-owned firm. In all cases it is clear that substantial benefits are to be obtained from the introduction of organisational reform, even in the context of severe economic instability, macroeconomic imbalance, an under educated labour force, hostile middle-management, and senior management which seldom recognises the long-term gains of systemic organisational change and instead focuses in a more limited way on the introduction of isolated organisational techniques.

Table 4. Percentage Enhancements in Operation following the Adoption of new organisational Techniques in Two Brazilian Auto Component Firms

	Local Firm	TNC Subsidiary
Reduction in initial inventories	70	NA
Reduction in overall stock	NA	Significant
Production lead-time	60	30
Direct labour	10	70
Machine set-up	60	NA
Factory space	40	50
Scrap and rework	70	Yes

Source: Posthuma 1992a: 175 and 178.

Table 5. Impact of Japanese Manufacturing Techniques in Two Brazilian Auto Components Producers

	Plant 1			Plant 2		
	Before	After	% Reduction	Before	After	% Reduction
Lead time (days)	20	1	95	40	4.4	89
Distance travelled (metres)	216	50	77	289	160	45
Set up (hrs)	10-15	3	70-80	40	7	83
Space (m ²)	540	359	34	266	207	22
Maintenance	40	0		70	41	41
Work in progress (units)	1,140,000	20,000	98	8,800	1,380	84

Source: Posthuma 1992a: 181 and 182.

The Dominican Republic.

Considerable progress in the implementation of new forms of organisation has been made in a subsidiary of one of the world's largest electrical engineering companies. The Dominican Republic affiliate has approximately 400 employees, of whom three-quarters are involved in production. Production control is potentially complex, with over two million units manufactured monthly, involving seven major types of product, with over 600 variations.

In the early 1980s the parent undertook a major audit of its operations by comparison with Japanese competitors, and concluded that 30 to 40 per cent of costs were due to poor quality (for example, rectifying errors built into final products). Strategic objectives were thus set to reduce these costs-of-poor-quality, and this was seen to involve the adoption of both TQC and JIT procedures. The Corporation is now well organised in its presentation of JIT and TQC concepts and has a group devoted to their implementation, involving prepared presentations and training courses; it even possesses a specialised training centre in the United States which is utilised to assist restructuring in individual affiliates.

Some six to seven years previously its parent had lost its dominant market share in the product produced in the Dominican Republic and responded with a two-pronged strategy of introducing JIT/TQC and assembling offshore whenever possible to take advantage of low labour costs. This strategic reorientation proved to be successful and its market share

subsequently increased from six to seven per cent to 14 per cent, and the firm is targeting an enlarged share of 25 per cent.

The extension of JIT/TQC practices to the Dominican Republic plant occurred in 1989 and provided tangible benefits (Table 6). As can be seen, overall inventories (including work in progress, raw materials and finished goods) fell by 25 per cent. But since this subsidiary had more control over its work in progress (WIP) than its incoming and outgoing stock, the savings on WIP stocks were considerably higher, generally improving by a factor of ten. The result was that the space required in production fell significantly, and the time elapsing between inputs entering and leaving the shop floor was similarly reduced by a factor of ten. In addition, the defect rate has fallen from ten to four per cent and labour productivity (measured in terms of parts/operator/month) rose from 2,982 to 4,692 between 1989 and 1990. The lead-time in three product groups was reduced from over 12 months to two to six weeks.

Product	Total Inventory (US\$)	WIP (Units)	Space (Sq.ft)	Throughput Time
A - Before JIT	47,322	25,000	4,960	12
- After JIT	35,435	2,340	1,984	0.84
% Improvement		91	60	93
B - Before JIT	188,060	1,750	2,010	5
- After JIT	141,045	320	1,340	0.38
% Improvement		82	33	92
C - Before JIT	40,858	960	4,112	3.3
- After JIT	30,644	120	1,286	0.29
% Improvement		88	69	91
D - Before JIT	1,297	4,000	712	4
- After JIT	972	250	712	0.25
% Improvement		94	0	94
E - Before JIT	67,142	1,200	1,571	8
- After JIT	50,356	210	829	1.30
% Improvement		83	47	84
F - Before JIT	175,193	2,820	1,812	4.16
- After JIT	131,395	182	1,106	0.42
% Improvement		94	39	90

Source: Interviews, Kaplinsky, 1994

Zimbabwe.

The reorganisation of a Zimbabwean office-furniture enterprise provides a good case-study of the possibilities of introducing new organisational techniques in low income countries in sub-Saharan Africa. Partly because of problems in obtaining raw materials and partly because of its manufacturing organisation, the firm in question had experienced considerable difficulty in meeting customer orders with an adequate response time. As can be seen from Table 7, only 39 per cent of opened orders were worked on in September 1990. A further 19 per cent had been started but were standing as WIP, and almost half the outstanding orders had not yet been begun. The value of the WIP which had not been worked on during these four weeks (that is, over and above the WIP tied up in work which was being processed) was equivalent to ZS276,000, two-and-a-half per cent of the firm's total annual sales. Even where orders were being worked on, WIP levels were high. For example, in the woodworking section minimum lot-sizes were so large that at least three weeks elapsed before the first completed unit emerged from the production line. As a consequence the sales department quoted a six-to-eight week delivery delay, built upon an estimated 22-day manufacturing throughput time; this for a product whose construction time was only 6.02 hours (of which five hours involve glue-drying).

Table 7. The WIP situation prior to reorganisation, end of September, 1990

Description	Number of Works Orders	Percentage of Total Orders	Value (ZS'000)	% of Value of Orders
Orders on which work was carried out, including month of September	263	39	814	74
Orders not worked on in September	127	19	276	25
Orders opened but not worked on in September	280	42	NA	NA
Total	670	100	1,090	100

Source: Kaplinsky, 1994.

The long lead times which resulted from this large-batch manufacturing organisation were not only costly (since they required working capital to finance production) but were also becoming a major obstacle in final markets. Since they were coupled with the associated uncertainty about when orders would be completed, export orders were being lost. (Exports are particularly important since they provide access to additional foreign exchange.) Many domestic customers orders were unmet and the value of these outstanding orders was estimated at ZS3.5m, equivalent to one-third of 1990 sales. The large levels of WIP also created a variety of extra 'hidden' costs in terms of floorspace, loss of production control and supervisory management.

In early 1992 this enterprise began to make the transition to cellular production and to introduce a range of JIT/TQC techniques. Although there is not adequate evidence to compute the impact of this organisational change on the total operations of the firm, it was clear by mid-1992 that in those areas where the changes had been introduced, the impact on competitiveness was significant. For example, in the industrial shelving cell (which accounted for 15 percent of total sales), labour productivity which increased by more than a factor of five (Table 8). Throughput time (that is, the time taken for materials to pass through the factory) also fell significantly. The distance travelled by the components halved and there was consequently a large fall in space requirements. Although this office furniture enterprises was at the leading edge of application in Zimbabwe, it was one of over fifty enterprises which had begun to implement these organisational changes by the end of 1992.

Table 8. The Impact of Production Reorganisation: Industrial Shelves

	February 1991 Pre-re- organisation	July 1991	November 1991	March 1992
WIP	715	7	6	10
Throughout time (minutes)	NA	4	3.7	2.7
Distance travelled (metres)	20	20	9	10
Space required (m ²)	90	90	27	27
Output per hour	NA	51	56	288
Number of workers	13	14	10	16
Output/worker (units/hour)	NA	3.6	5.6	18

Source: Kaplinsky (1994).

The diffusion of inter-firm organisational changes

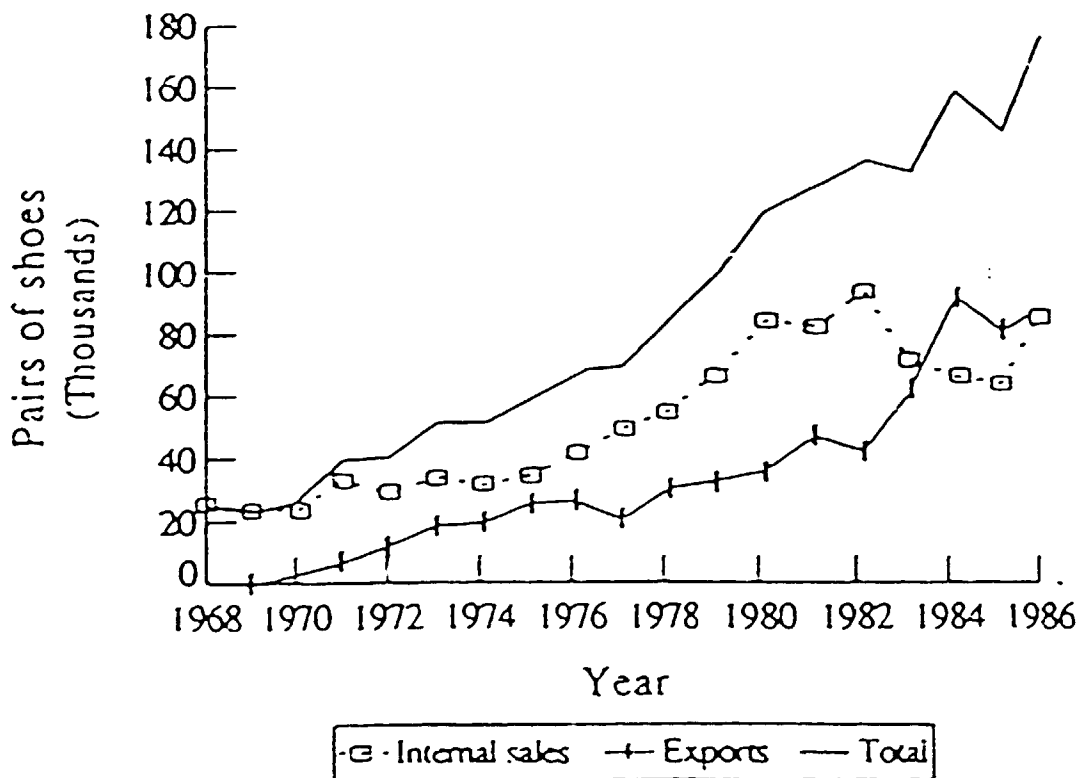
As observed earlier, the transition from arms-length to obligational relationships between firms takes a number of forms. For convenience this can be divided into two broad families - the development of collective efficiency amongst clusters of geographically proximate small firms operating in industrial districts, and that involving complementary changes by different firms across the supply-chain.

Collective efficiency and industrial districts

Although the existence of industrial districts in LDCs is not well-researched, there are a significant number of instances of this form of collective efficiency in LDCs. Reviewing the evidence of such clusters in LDCs, Humphrey concludes that this "... provides ample proof that clusters of spectrally specialised enterprises can compete successfully in international markets". Significantly, although "within these clusters there are small firms ... [i]t is [also] common to find large firms emerging in industrial districts" (Humphrey, 1995:157).

Possibly the most elaborate and thorough documentation of such districts in LDCs is to be found in Schmitz' recounting of Sinos Valley in the Rio Grande de Sul leather shoe industry in Brazil (Schmitz, 1995). Between 1970 and 1990, the Brazil's share of global trade in this sector increased from 0.5 to 12.3 percent, and it became the third largest exporter after Italy and Korea.¹⁰ The Sinos Valley saw the greatest concentration of production, accounted for most of this region's output and experienced the highest rate of growth. In 1991 there were approximately 1,821 firms in the Valley, employing 153,000 workers, producing not just leather shoes, but the components used in shoe production, in tanning, and in machinery supply and repair. Of these firms, around 500 produced shoes. All of this occurred within a radius of 50 km. from the major town, Novo Hamburgo. Almost 50 percent of these firms employed less than 100 workers in 1991. The rapid growth of Sinos Valley shoe production, especially for exports during the 1980s, is shown in Figure 4 below.

Figure 4. Sinos Valley. Shoes produced for the internal and external markets, 1968-87.



Source: Schmitz, 1995.

¹⁰ As observed earlier, most of these Italian exports were accounted for by very small firms operating in industrial districts.

One significant feature of this cluster is the large degree of subcontracting, with approximately one-fifth of all workers being employed in this capacity; many of these sub-contractors were small firms. Thus there is a significant degree of inter-firm cooperation, based in this case on close geographical proximity and firm specialisation. Another significant and related feature is the prevalence of cooperative institutions, including those dedicated to trade fairs, tannery technology, a technical school for related chemical and mechanical technology, a school of shoe design and manufacture and a technological centre for shoe and leather industries.¹¹ There have also been a number of associations grouping various types of producers with common interests together. Thirdly, a critical role has been played by marketing agents, which have provided the intermediation between locally-grouped producers and distant consumers, particularly those in external markets.

This experience of the Sinos Valley is not unique. A similar export success has been experienced for industrial districts in Pakistan producing medical instruments (Nadvi, Forthcoming), for cotton knitwear in Tirappur district in India (Cawthorne, 1995), and for water pumps in Coimbatore in India. Similar clusters of activity can be observed throughout the developing world, including with respect to the informal sector in which production often occurs in close proximity, including the clustering together of similar enterprises within informal sector "industrial estates"; but this process is largely undocumented. But what is unclear in this emerging body of enquiry is how far these agglomerations reflect the existence of "unintended" external economies and how far they involve the purposeful collective action which has contributed to the dynamism of these clusters of small firms in Europe. In Mexico, following her comparison of shoe-producing industrial districts in Italy and Mexico, Rabellotti concludes that "the relationships between the suppliers and shoe producers are less collaborative than in Italy and are based mainly on a pure market mechanism". Moreover, the familiar story of poor supplier development prevails - "[a]mong the sample firms, many complain about the low quality of components and raw materials, the scarce attention to fashion changes and the bad service provided by their input suppliers. In their turn, suppliers do not accept responsibility for their low development and accuse shoe entrepreneurs of having adopted a strategy more focused on price than on quality..... The suppliers of components and the manufacturers blame each other and the main deficiencies are of communication and collaboration between the two linked sectors" (Rabellotti, 1995:36).

Driving re-organisation through the supply chain

The analysis of mass customisation's reorganisation at the level of the plant and the firm frequently makes the distinction between two stages of implementation - Bessant refers to these as JIT1 and JIT2 (Bessant, 1991), others as "internal" and "external" JIT. The first of these stages refers to the progress made by an individual plant in restructuring its internal operations so as to minimise WIP and finished good stocks and to introduce new procedures to enhance innovation, speed of response and flexibility of production. But this will only carry the plant and firm some of the necessary distance which needs to be travelled. As has been shown in earlier analysis, for substantial progress to be made, it requires matching changes to be made by suppliers (and indeed customers), that is to move to JIT2.

¹¹ Significantly, "the five institutions... would not have emerged without participation of the state sector" (ibid:19), a subject to which we will return in the concluding discussion in this paper on policy implications.

There is only limited evidence on the extent of these changes in the supply chain in LDCs although it would appear that the weakness of LDC supply chains is one of the primary observed factors constraining the diffusion of these new organisational techniques in LDCs. There are two major reasons for this weakness. Firstly, many LDCs are characterised by the fragility of SMEs, particularly in the modern-small scale sector and middle sized enterprises (as opposed to informal-sector micro-enterprises which flourish in many LDCs); this has often been characterised as the problem of "the missing middle" (for example, Joffe et. al., 1995). But secondly, the application of these new organisational techniques is, relatively speaking, still in its infancy in most LDCs and thus not many large firms have yet got to the stage in which they are constrained by their suppliers and customers.

One exception to this is a large Indian firm, Crompton Greaves, which manufactures a range of electrical equipment such as motors and fans. It has been one of the forerunners of organisational change in India and has made considerable progress in restructuring the internal operations of some of its plants (Kaplinsky, 1994). As a consequence it has been forced to confront the weakness of its supply chain and has begun to focus on the deliveries which it receives. This is a three-stage process. The first is to ensure that suppliers manage to deliver on time, more frequently in appropriately sized batches and with "zero defects". This enables Crompton Greaves to reduce its incoming inventories and to respond flexibly to changing market conditions. There are an increasing number of LDC firms which are encouraging and forcing the adoption of these changes by their suppliers, especially the large TNC subsidiaries which are driving the transition to mass customisation through their global networks. This process has been documented for Brazil (Posthuma, 1992a; Fleury and Humphrey, 1992), Mexico (Carrillo, 1995; Ramirez, 1995) and South Africa (van der Riet and Hendy, 1986).

The second stage of supplier development strategies is for these leading firms to "open up the black box" which constitutes their suppliers and customers and to work with them on their internal procedures. This is because it is possible for suppliers to deliver small batches of zero defect components with appropriate frequency, but to do so from large holdings of final stocks and through the traditional procedure of post-production quality inspection and rework. But this provides only limited benefits to the production chain itself, since many of the savings and the increase in flexibility and quality of the "core", leading firm are drowned out by higher inventories and costs of quality in their suppliers. Thus for greater systemic efficiency, it is necessary that the same principles of mass customisation be implemented in the supply chain and by customers. The Japanese and other IAC experience is that requires the core firms to "open-up" their suppliers and to work intensively on their manufacturing operations. Here there is much less evidence of LDC adoption of new forms of inter-firm organisation.

This limited pattern of diffusion is even more marked with respect to the third stage of changes in inter-firm organisation. This involves the diffusion of these organisational techniques amongst sub-subcontractors, both down and up the successive tiers of the supply chain. Invariably, in LDC environments this requires working with very small microenterprises which presents severe problems in institutional development. For example, in the case of the Indian washing machine industry, one of the major final customers is Whirlpool which is forcing JIT/TQC through its global operations. This requires it to encourage change through its supply chain, but since one of its key components is manufactured by Crompton Greaves which is independently adopting these same techniques in its corporate operations, there is some evidence of matching change amongst suppliers. (This is however an exceptional process in the Indian context). But it is only when Crompton Greaves opens-up the black box

of its suppliers' operations (which is only just beginning to happen), and in turn amongst its suppliers' suppliers, that a process of systemic adoption can be said to have occurred. As observed, LDCs are making only limited progress in this process.

The systemic adoption of organisational change in LDCs

It is possible to summarise this brief overview of the diffusion of the new organisational paradigm in LDCs by focusing on the extent of systemic diffusion. This is described in Figure 4, which relates to the adoption of Japanese-inspired management techniques; a similar process of systemic integration can be charted for the Italian-inspired industrial districts (distinguishing, for example, between unintended external economies and various layers of collective action). At the early stages of diffusion, individual techniques are introduced in isolated fashion, and generally only apply at the level of individual subprocesses. But as the systemic adoption of these techniques deepens, so they are introduced in complementary fashion (for example, JIT and TQC procedures) and apply to individual plants and firms. At the more advanced stages (to be found in Japan and in a few copying Western firms) mass customisation involves close inter-firm collaboration and the involvement of the whole workforce in a process of continuous improvement. Thus whilst a few leading Western IAC firms can be said to have reached the "successful follower" stage, in general the leading LDC firms lie at the boundary of the "moderately successful/successful follower" stages. More to the point, though, it is not so much the few leading firms which are germane to the process of diffusion, but the rump of the manufacturing sector (including the supply chain for these leading firms). Here LDC experience is less encouraging, and although no systematic evidence is available, it would appear that the "tail" of laggard enterprises in LDCs is much larger than those in the IACs.

The attraction of mass customisation for LDC

As observed earlier, mass customisation developed in the IACs as a response to changes in both supply and demand parameters. It is the latter of these two factors which frequently leads observers to be sceptical of the relevance of mass customisation for LDCs. This is because the desire by consumers for differentiated and high quality products reflects an economy which has few relatively few supply constraints. However, the large unfulfilled demand of most LDCs (and indeed of the former Soviet Union and Eastern Europe) presents a very different picture, one in which consumers are willing to accept virtually anything which domestic suppliers offer. In these circumstances, it is thus argued that the developing world with low per capita incomes will continue to find mass production more relevant than mass customisation; this was indeed the position of Piore and Sabel in their pioneering text on paradigm shift in industry (Piore and Sabel, 1984).

Figure 4 Typology for adoption of Mass customisation, with some examples

High ←===== Spectrum of Adoption of Mass customisation =====⇒ Low

Type of Firm	The Eastern Archetype	Successful Follower	Moderately Successful Follower	Weakly Successful Follower	Outright Failure/Regression	Traditional Mass Producer
Arena of Implementation Organizational Procedures Include	Throughout Firm Cellular production Small lot production JIT and TQC Multi-skilling Team working Small batch production Continuous improvement	Throughout Firm Cellular production Small lot production JIT TQC Multi-skilling Team working Small batch production	Individual plant(s) Cellular production Smaller lot production JIT TQC Multi-skilling Team working	Individual(s) sub-processes Cellular production Smaller lot production JIT TQC Multi-skilling Team working	Little change in procedures Attempts at JIT and TQC	None Functional layout Extended division of labour and Quality control Just-in-case inventories Standardised products Large lot production Large batch production
Supplier relations	Close and frequent contracts with suppliers and customers	Growing contacts with suppliers and customers	Little contact with suppliers and customers	Adversarial relations with suppliers and customers	Adversarial relations with suppliers and customers	Adversarial relations with suppliers and customers
Degree of diffusion	Many Japanese firms Some Western IAC firms	Increasing number of Western IAC firms; a few leading LDC firms	Increasing number of Western IAC firms; a few leading LDC firms	Increasing number of Western IAC firms; a few leading LDC firms	Some Western IAC firms; a few leading LDC firms	A decreasing number of Western IAC firms; the bulk of LDC firms

However, it has become increasingly obvious that this is a largely mistaken presumption. In part this is because production with large inventories and poor quality is in fact economically wasteful - mass customisation offers the simultaneous benefits of low-cost production, higher quality and greater product differentiation. It also follows from the fact that as trade barriers are reduced, mass production enterprises are confronted by greater competition in the domestic market, including by external suppliers who are successfully managing the transition to mass customisation; similarly, competitiveness in external markets requires the attributes provided by the new forms of production organisation. For these and other reasons listed in Figure 5, there are strong reasons to argue the relevance of mass customisation to LDC operating conditions. This does not mean that it applies equally in all sectors, or in all respects (for, to some extent, customisation of products does add to product cost). But as a "central tendency", mass customisation is as relevant to LDCs as were the principles of mass production which guided industrial resource allocation in previous decades. This being the case, it is necessary to consider the related questions of what LDC-specific obstacles exist to limit the diffusion of mass customisation, and what policy implications follow from this.

Figure 5. Potential Benefits Arising from the Successful Introduction of Mass Customisation Techniques in Developing Countries.

- 1 The costs of adopting mass customisation techniques are low;
- 2 The barriers to entry are low;
- 3 Mass customisation techniques are not capital extensive;
- 4 Mass customisation techniques are not foreign exchange intensive;
- 5 Mass customisation techniques increase productivity growth and reduce production costs;
- 6 Mass customisation techniques are beneficial to corporate profitability;
- 7 Mass customisation allow firms to better serve their customer needs;
- 8 By promoting flexibility, mass customisation techniques reduce economies of scale;
- 9 By improving quality, reliability in production and lowering costs, mass customisation techniques facilitate exports; and
- 10 By promoting flexibility, mass customisation techniques allow firms to respond to exogenous shocks which affect the demand for their products and the supply of their inputs.

4. Are there LDC-Specific Obstacles to the Adoption of New Forms of Industrial Organisation?

In the discussion surrounding Figure 4 it was observed that the diffusion of mass customisation in LDCs was relatively limited, both in relation to the depth of adoption by the leading firms and in relation to the breadth of adoption across the industrial sector. In principle, two factors could explain this picture of low diffusion. The first is that adoption is a sequential process, a matter of time. Because LDCs are relative newcomers to flexible production (in part because of their insulation from external competition), it is thus natural that the degree of diffusion is low.¹² The second is that there are a range of LDC specific factors which inhibit successful adoption of these new organisational techniques in production. It is important to sort through these two sets of explanations if appropriate policy instruments are to be developed.

As far as the time-factor is concerned, a distinction is to be made between those factors which are necessarily sequential in nature - for example, the transition from JIT1 to JIT2 discussed above - and those which reflect a process of sub-optimal information flows due to imperfections in the information market. As will be considered in the discussion of policy instruments in the concluding section, many IACs have identified significant market failure in the diffusion of these organisational procedures and have developed appropriate policies to speed up the process of diffusion. In this respect there is no reason to believe that LDCs present a different picture to the IACs. But it is also possible that there LDC-specific operating conditions which inherently constrain the diffusion of these organisational techniques in industry. Three such constraints can be identified - the low level of human resource development, the weakness of the supplier and physical infrastructure, and management and industrial relations

Human resource constraints to the successful transition to mass customisation

As observed earlier, mass customisation requires both processes of continuous improvement and the diffusion of multi-skilling through the labour force. But what does this boil down to in relation to human resource development, particularly with respect to the skill endowments of LDC? Here it is necessary to distinguish between two related elements. The first is formal education which is generally full-time and pre-vocational. The second is training, which may occur on a full-time basis (the French model), on a dual-basis (the German system) or within the place of employment (a system frequently utilised in Japan). Generally the discussion of human resources and development tends to conflate education and training, but in the context of flexible production it is especially necessary to separate out education and training since they represent different arenas for policy-making.

Clearly, the relative importance of education to flexible production depends upon the sort of organisational techniques which are being introduced. With respect to the introduction of cellular and small batch production, it would seem that education is relatively unimportant as is confirmed by much LDC experience (Kaplinsky, 1994). In Zimbabwe some firms have made considerable progress with a largely unskilled labour force and in most adopting firms

¹² As the CEO of a leading American computer firm observed in a different context (that considering the diffusion of computer aided design technology in the early 1980s), "You can't make a baby in one month with nine women"!

(including those which made most headway), there was an average length of schooling of approximately six-seven years per worker, with low standard deviations. At this level of schooling, workers are barely literate. Perhaps more significantly, there was no difference in the formal schooling of workers in the relatively successful and unsuccessful adopter firms, or in those parts of individual plants which were restructured and those which continued to operate with traditional practices. Similarly, in India one of the more successful innovators was a jute-spinning mill in which many of the participants in quality circles) were either illiterate (8%) or barely literate (22%).

But as the range of techniques introduced widens, so the requirements for formal education tend to grow. Moreover, as workers become more involved in processes of continuous improvement, so it is likely that they will be aided by a greater understanding of underlying technical processes and this, in turn, is likely to be assisted by the depth of formal education. In the long run, therefore, as the Japanese clearly believe, formal education is an important adjunct to the systemic utilisation of these organisational techniques, even though in the short run continual progress can be made with low levels of literacy on the shop floor.

By contrast, training appears to be more closely related to successful adoption in LDCs, even when these techniques are utilised as individual techniques rather than in a systemic package. In Zimbabwe, the degree of success in implementation seems to be closely correlated with in-plant investment in training and in the least successful cases, management explicitly refused to expand training despite specific requests from shopfloor management. By contrast, in Mexico, Ford not only located its relatively successful Hermosillo plant in an area in which there was a multiplicity of educational and training institutions and but then invested heavily in training and subsequently sent many workers abroad to other Ford plants in order to increase their skills. In India the Escorts motorcycle plant, built in collaboration with Yamaha, also located in an area in which the labour force was relatively highly educated, but unlike Ford, it did not subsequently invest to any great extent in providing industrial training. It is significant that implementation in the Escorts plant was not nearly as successful as that at Hermosillo. It is also perhaps significant that this relative lack of success was not simply due to Escorts' Indian location since Crompton Greaves (the most successful large implementer in India) saw training as one of its primary areas of investment and developed a series of training targets which were ratcheted up every year (Nohria and Gladstone, 1991):

However, the relative importance of training to flexible production clearly reflects the sector of production, as well as the nature of the operations undertaken by individual firms. It is notable that firms in the Dominican Republic export processing zones appear to be uninterested in an educated labour force (and provide little subsequent training). This reflects not only the low-tech nature of the clothing and shoe industries, but also the types of production undertaken in export-processing zone (Mathews, 1994).

It is possible to draw a number of general conclusions from the experience of these implementing firms with regard to education and training and the systemic adoption of the new organisational techniques. First, it can be deduced from the evidence of adoption in LDCs that the educational and training barriers to entry for the application of individual techniques are often negligible. Second, training - generally intra-firm - appears to be more important than formal education in the successful utilisation of these techniques. Third, the greater the degree of flexibility required in production, the more the need for multi-skilling; this multi-skilling necessarily applies across a broad range of workers rather than only

amongst the elite of the "skilled" workers. Thus it is not merely a matter of increasing the number of "skilled workers", but rather of spreading a multiplicity of skills through large segments of the workforce. And, finally, both because of this requirement for a multiskilled workforce and because worker participation in continuous improvement requires a greater understanding of underlying technical processes, it would appear that the systemic adoption of the new organisational procedures is likely to require both an educated *and* a trained labour force. In this, LDCs are disadvantaged in the adoption of these new organisational techniques, but it is difficult to evaluate the relative significance of these requirements. It is not clear how much education is required for appropriate training to be successful or, indeed (and perhaps more importantly) what forms of education are required.¹³

Inter-firm cooperation and successful transition to mass customisation

As seen in earlier sections, the transition towards the more systemic adoption of the new organisational techniques tends to be associated not only with the development of processes of continuous improvement, but also with changed inter-firm relations. In Japan, the major assemblers form "clubs" of suppliers where each tier takes responsibility for the efficient performance of its own suppliers. In western following economies, this realm of innovation has proven to be particularly difficult to replicate. LDC experience suggests a significantly exacerbated problem with these inter-firm linkages, particularly when inputs are sourced from SMEs. It has long been noted that the supplier infrastructure tends to be very weak in these countries and that many firms have been forced into a much greater degree of vertical integration than they would have preferred - this goes against much of the new conventional wisdom in which firms are being induced to concentrate on the core activities.

These problems of poor supplier capability are compounded by poor physical infrastructure. Bearing in mind that in Japan, Toyota (possibly the most advanced large-scale exponent of mass customised production) has traditionally achieved low inventories by locating its suppliers in close proximity (in Toyota City), this requires an efficiently functioning transport infrastructure. The transition to electronic data interchange (EDI) in coordinating production scheduling also places demands on a new form of telecommunications-intensive infrastructure ("infostructure"). Few firms in LDCs have made significant progress in this aspect of the systemic adoption of JIT. In the Dominican Republic, for example, in the early 1990s clearing items from the harbour took between 30 and 60 days, putting paid to any attempts to reduce incoming imported inputs. In an effort to reduce dependence on these imports, Colgate-Palmolive offered a 30 percent price supplement to local carton suppliers who would deliver reliably, in short batches and with zero-defects, but was unable to induce the necessary changes in any of its domestic suppliers.

Given the role played by Mazda in the design and operation of the Ford's Mexican plant at Hermosillo, it is not surprising to find that elaborate measures have been taken to promote JIT operation (Shaiken and Browne, 1991). In the early 1990s, 65 percent of initial component purchases by value (and 80 percent by weight) were imported from Japan. The large share of imported components arises directly from problems with local suppliers and

13. For example, team-working and continuous improvement may require the ability to analyse problems, to communicate ideas and to work cooperatively. The traditional schooling curricula in many LDCs, by contrast, teach rote knowledge and encourage individualised performance.

with infrastructure. Roads are poor and rail deliveries - even over short distances - take 10-30 days. Thus the plant is deliberately located near a deep-sea port to facilitate inventory minimisation of imported components. JIT deliveries to the plant arrive daily, having been dispatched from Japan, and consolidated and stored on a "one-day-at-a-time" basis near the port in Mexico and then delivered "JIT" to Hermosillo. Hermosillo has one day stock on hand, one day in its warehouse, and one day in transit from the port consolidation centre. Deliveries by sea are carefully programmed (Hermosillo is directly linked by satellite connections with Ford in the United States and with Mazda in Japan) and take 21 days; three ships per month serve the plant's needs. Twelve Mexico City component suppliers ship directly to this consolidation centre which then programmes JIT deliveries to Hermosillo. These problems with poor supplier capability and infrastructure are mirrored in both India and Zimbabwe, both because of weak physical and supplier infrastructure.¹⁴

There is thus a common story in this LDC experience with changing inter-firm relations. Even more than in the case of the western followers of Japan, considerable difficulties have been experienced in reorienting these relations, and thus in making more progress towards the systemic application of these new organisational techniques. It is clear, thus, that in this respect there are indeed LDC specific barriers to implementation.

Management, industrial relations and culture

There is widespread belief that management, industrial relations and cultural factors play a critical role in the success with which mass customisation diffuses, determining both successful and unsuccessful outcomes. As in the IACs, there is abundant evidence that various forms of managerial failure underlie the slow pace of diffusion in LDCs, especially with regard to deeper forms of systemic adoption.

International experience makes it abundantly clear that the extent to which firms make the transition to mass customisation is directly related to managerial commitment at all levels of the enterprise. Thus the factors determining the quality of LDC management are thus of considerable importance and it is important to bear in mind the following issues. First, many enterprises are often family-owned, and corporate growth and effective management are constrained by the reluctance of the family to devolve responsibility to professionally-trained outsiders. Secondly, and this partly reflects the lack of effective demand from the corporate sector, the training infrastructure in LDCs is frequently underdeveloped and much of the curricula and teaching techniques are still modelled on the now-outdated managerial practices of mass production - this is especially the case in smaller and lower-income LDCs. Third, partly because of entrepreneurial and managerial weaknesses, the industrial structure in many LDCs is often not extensively diversified. Consequently these managerial weaknesses make for an inefficiently organised large-scale sector - many LDC enterprises have weaknesses in the mastery of traditional practices of mass production and this makes it that much more difficult to introduce and sustain the managerial practices of flexible production. But in addition the weakness of LDC management also partly accounts for the frailty of the SME sector. Consequently, for these various reasons, it would seem that there are indeed a range of LDC specific managerial factors which undermine the adoption of these organisational techniques.

¹⁴ See Kaplinsky (1994) for supporting evidence.

With regard to LDC experience with industrial relations and the transition to mass customisation, it is difficult to generalise, partly because the empirical information is thin and partly because industrial relations are highly specific - to individual plants, firms and countries. In principle, it could be supposed that since industrial relations have evolved to support particular divisions of labour - for example, craft unions developed in the UK to support the power of skilled workers - those countries shifting their industrial sectors from mass to flexible production are likely to run into difficulties. In these circumstances there would be advantages in locating production in "greenfield sites", that is, in areas in which there is little history of production and thus few impediments within the structure of industrial relations to the adoption of new organisational procedures. If this were true on a global scale, then it might be thought that LDCs are in fact advantageously placed in the diffusion of these new organizational techniques.

Thus, although the evidence is limited, there are not strong grounds for suggesting that LDC industrial relations are any more of an impediment to the systemic adoption of these new organisational procedures than those in the western LACs. Indeed, the fact that trade unions are often weak in LDCs suggests that in this respect they may be relatively favoured sites for the transition to mass customised production.

"Culture" is a third factor which might impinge upon the ability of LDCs to adopt the new organisational techniques in a systemic fashion. For example, it is sometimes argued that non-Confucian cultures are inherently conflictive and this makes it difficult for them to develop the trust relations which are critical to the success of total quality control, JIT production and continuous improvement. Similarly, the detailed evidence emerging from Japan on the mechanics of continuous improvement (Williams et al., 1992) suggest that peer group pressure is critical - this can be related to the so-called "shame culture" of Japan, which is contrasted with the (individualised) "guilt culture" of the West.

There are two points which can be made with respect to these cultural factors. First, the evidence suggests that with one exception, virtually all of the particular elements of new organisational have been transferred abroad successfully.¹⁵ The exception is the so-called *ringi* system of consensual decision-taking (which might be more accurately described as consensual decision legitimisation) which whilst being an important component of the systemic adoption of new management techniques by the Japanese, is not critical to their success. Secondly, Dohse et al. (1985) draw the distinction between cultural factors and those resulting from specific management attempts to alter the attitudes of their workforces.¹⁶ They identify cultural attributes such as the combination of loyalty and paternalism which arises out of Japan's feudal past, the group orientation stemming from the structure of feudal agricultural relations, and the commitment to hard work. By contrast, specific programmes such as payment and promotion systems and lifetime employment have been introduced by Japanese firms to elicit particular types of commitment from their workforce. These specific management techniques are often characterised as cultural attributes which are assumed to reflect long-lived social traditions. However, in reality their origins are much more recent. For example, life-time employment was introduced after 1945 in the face of a tight labour market, and the compliant company trade unions arose after the destruction of the independent trade unions in the early 1950s. Many so-called cultural

15. See Smith and Misumi (1989) for a review of this literature.

16. For a discussion of these cultural factors, see also Whitehill (1991).

factors - by implication difficult to alter - thus turn out on reflection to be much more ideological in content and thus more open to manipulation.

Thus, there is little evidence to support the contention that culture is a significant constraint to the transition to mass customisation - especially in regard to "deeper" techniques such as kaizen which are critical to the systemic utilisation of these techniques. There are also few grounds for arguing that LDCs are specifically disadvantaged in this respect. Moreover, even if this were to be the case, the cultures in many LDCs in east Asia are closer to that of Japan than are those of the "old industrial centre" IACs.

5. Implications for the Formulation and Execution of Industrial Policy.

The Policy Agenda

It is widely recognised that market failure is endemic in the process of technological change. Arrow postulated three major reasons for this market failure - because innovations are often risky and uncertain, because R&D inputs are indivisible, and because it is difficult to appropriate the benefits of change (Arrow, 1962). Mass customisation organisational techniques represent a particular type of innovation, that is, one in which technological change is essentially disembodied in nature. These disembodied manufacturing techniques have a relatively low "scientific" content and central principles are intrinsically easy to understand. Of the three areas of market failure flagged by Arrow, risk and uncertainty are the most important in the diffusion of these organisational techniques. The difficulties of implementation lessen the problem of inappropriability, and the low scientific content means that the resource costs of innovation are not high. It might be expected, therefore, that market failure was relatively unimportant in the diffusion of these new forms of organisation into production.

Yet, if anything, the evidence would seem to suggest the contrary. Take, for example, the case of quality-at-source procedures. In the central ideas were set out 1931. But they were first on a wide scale in post-war Japan and it was only in the late 1980s that quality-at-source began to be implemented widely in other sectors of western industry. In essence, therefore, it took well over 50 years for the conceptually simple principles of TQC to be widely applied in production. This suggests a new form of market failure, one not noted by Arrow and one seemingly intrinsic to changes in organisation, and particularly to the organisation of work. This arises when innovation requires fundamental attitudinal changes in relation to authority and the division of labour. In these circumstances organisational systems are particularly resistant to change, so that left to market forces, the pace of technological change will be socially and economically sub-optimal.

It is when market failure is endemic that government participation becomes important, either to substitute directly for the failure of private initiatives, or to provide a market-friendly incentive structure to promote socially optimal investment. There are four key respects in which the state has a role to play in speeding-up the diffusion of mass customisation techniques - to increase the demand for organisational change in production; to increase the supply of organisational capabilities available to implementing firms; to ensure that these initiatives are obtainable at the national, local and sectoral levels; and to provide a macroeconomic environment in which they can operate effectively.

Increasing the demand for organisational change in production

Part of the problem in diffusing these new organisational principles in production occurs as a result of imperfectly functioning information markets. This is a particularly acute problem in many LDCs and the government thus has a role to play in promoting widespread knowledge of the benefits accruing from successful innovation, the potential obstacles to success, and the range of services available to assist implementing firms. There are various ways in which this failure in information markets can be addressed, and four are especially efficacious.

The first involves a programme of promoting awareness as in the UK's low-cost Enterprise Awareness Scheme of the late 1980s. The second form of support for imperfections in information markets is through pilot-plant schemes. This involves the government providing support for the introduction of new organisational techniques in key enterprises on the understanding that they would make their plants available for other firms to visit. In the Dominican Republic this scheme has been promoted and assisted firms have committed themselves to allowing their experience to be recorded, allowing visitors and to not retrenching any workers as a result of the innovations involved. Third, governments can provide financial support to encourage user firms, most effectively when it is only on a part-financing basis. Finally, governments can respond to this form of market failure by promoting a programme of "learning by visiting". This form of technology transfer has proved to be one of the key catalysts for the introduction of new organisational techniques, in both the IACs and in LDCs. However, not only is this seldom recognised as an effective form of technology transfer by potential implementers, but many of these firms lack the wherewithal (and particularly the foreign exchange) to permit this to occur. These informational and financial constraints are particularly apparent for SMEs, who often have a critical role to play as suppliers in a production chain.

Increasing the supply of organisational capabilities

When technology is embodied in capital goods, its supply can be augmented by assisting R&D and/or by making foreign exchange available for the purchase of capital goods or for technology licensing agreements. But these mechanisms are largely inappropriate for the disembodied technological changes involved in the introduction of new organisational techniques. Instead these organisational technologies are embodied in people and hence wholly different mechanisms to promote supply are required. Three channels exist for this process of technology transfer.

The first is through the internal operations of a TNC. Here the firm compensates for market failure through a programme of internalisation. The second potential mechanism is where the firm absorbs the principles of organisational reform itself, perhaps through visiting other implementing firms and through reading the literature. This was largely the route utilised by Japanese firms. Finally, organisational change can be implemented by contracting specialised sellers of technique and information, that is by links with the producer services sector. It is in this regard that market failure is most apparent.

The producer services sector is coming to play an important role in this form of technology transfer in many countries. In the IACs this sector is often well developed, but in LDCs the consulting sector (which includes producer services) is mostly in its infancy. A World Bank survey of this sector in over 50 LDCs noted that a combination of factors - inefficient policies and practices of governments, the lack of professional institutions, difficulties in hiring and

retaining skilled staff and the poor infrastructural environment - was hampering the performance of consulting services (Kirmani and Baum, 1992).

The producer services sector suffers from one of the three major elements of market failure identified by Arrow (see above); that is, its "technology" is difficult to appropriate since it is disembodied in form and since its central ideas are widely known and relatively easily understood. To maintain their innovation rents, the producer services firms thus often create mechanisms to block technology transfer.

Government support for this market failure thus has to be carefully crafted. On the one hand the producer services sector needs to be provided with enough scope for (Schumpeterian) technological rents to maintain the incentive to supply services. On the other hand diffusion is maximised when these mechanisms of appropriation are minimised. At the very least programmes can be developed to increase the supply of consultants who are equipped to assist enterprises with the adoption of new organisational techniques, but it is also important that the education and training system adopt teaching programmes which widen awareness and restructuring expertise.

Organisational capabilities at the national, local and sectoral levels

Italian success in industrial development has largely been based upon collaboration by small firms, generally located in a confined area and often (but not exclusively) manufacturing in the same sector. These small firms cope with the growing indirect costs in production (such as marketing, market intelligence and purchasing) by grouping together into consortia. These consortia offer their members a cluster of 'real services' which include new organisational techniques and other knowledge inputs provided by the producer services sector (Pyke and Sengenberger, 1992). Many of these Italian consortia display the characteristics of the classical Marshallian industrial districts. Amongst the key features of these industrial districts are the externalities which arise from a geographical locus to these firms' operations. The economics of location are such that proximity to suppliers, to customers, to skilled workers, to financial and marketing services and often also to competing firms is a critical part of systemic efficiency. In these circumstances market failures are often best addressed by local rather than central governments. Thus in Italy municipal government has played an important role in policy development (Best, 1992). Similar trends emerge in Japan at the level of the Prefecture (Friedman, 1987) and in Germany at the level of the Lander.

Although common principles are involved in the adoption of new organisational techniques across a range of industrial activities - and indeed also in the service sector - there are nevertheless particular nuances which are specific to particular industries. For example, the steps required to achieve "rapid response" system in the garments industry are distinctive from those utilised in textiles; in turn, both differ from the "ring system" found in the shoe industry and from mixed model assembly techniques in the automobile sector. Similarly, although there are generic training requirements posed by new organisational techniques, each industry has particular needs. Thus the effective diffusion of these organisational techniques not only requires a geographical locus, but also a sectoral focus. In many countries this sectoral focus is partly provided by industry associations or industry training boards and indeed these appear to be most effective when they have been established and are supported by the industry itself. But seldom do these associations and training boards operate both entirely independently and successfully and governments are involved in providing support, some of which is overt and

some of which is less visible. Thus at both the local and central levels, government has an important role to play in this particular aspect of institutional development.

Providing an appropriate macroeconomic environment

The industrial success of the East Asian latecomers is based upon a complex interaction of three processes - an appropriate and effectively functioning system of incentives; specific actions taken to grow technological capabilities, both within the state and private sectors; and the development of suitable institutions designed to respond to market failure (Lall, 1990). Organisational capabilities such as those involved in the adoption of mass customisation organisational techniques require the same types of environment if innovation is to be successful. Some of these incentives have already been identified in previous discussion such as the possibility of subsidising the price of producer services. But there is a range of additional macroeconomically defined incentives and other policies which have an impact on the growth of organisational capabilities. The first of these concern the need for macroeconomic stability. If aggregate demand, inflation or the foreign trade regime fluctuate wildly this may make flexible production relatively less adverse than mass production, but it nevertheless dulls the incentive for innovation of all sorts whether these be in inflexible or flexible production systems. Another important incentive which has an impact upon the effective utilisation of new organisational techniques arises from the observed link between exports and organisational change in production. Although there are circumstances in which exports may be counter-productive for flexible production (as, for example, when large export orders encourage large production runs), in general the relationship is a positive one. Thus a trade regime is required which provides a stable and positive orientation towards external markets, at least until the process of diffusion has been endogenised through the growth in appropriate forms of domestic competition.

Further, although the new organisational techniques are not a close substitute for costly capital goods (since as shown earlier, it is virtually impossible to achieve flexibility through automation without changes in the organisation of production), many entrepreneurs believe that they have a choice between reorganising production or utilising flexible automation technologies. Thus a second incentive influencing the adoption of these new organisational techniques concerns factor prices. The new organisational techniques are inherently labour intensive in nature and if factor prices are heavily skewed in favour of capital rather than labour, the possibility arises that entrepreneurs will be drawn to the embodied technology path to flexibility. However, this is unlikely to be a major factor limiting the diffusion of these techniques since there is little evidence that price, as opposed to problems in restructuring power relations in the workplace, has been a significant issue affecting the transition to flexible production, including those in countries where factor prices are widely regarded as being out of line with economic costs.

A third macroeconomically determined factor influencing the adoption of the new organisational techniques concerns physical infrastructure. A well-functioning infrastructural network is obviously an important component for the widespread diffusion of new organisational techniques. Related to this is the question of *infostructure* which refers to the development of an effective broadband telecommunication networks. Information is a critical component of the systemic diffusion of new organisational techniques throughout the production chain and, if anything, is becoming increasingly important as techniques of simultaneous engineering develop.

Finally, a key part of the economic infrastructure is the network of suppliers who are important in facilitating JIT production and who are capable of producing to high levels of quality. In Japan, Italy and parts of Germany, the robustness of this supplier network in large part arises from the strength of the small and medium enterprise sector (SMEs). In many LDCs these SMEs are poorly developed and specific measures will need to be taken by government to support not only their general development, but also their ability to utilise new organisational techniques in production. Some of these government measures might be generic to all SMEs, and others might be specific to particular industries and industrial districts.

The Policy Process

It is one thing to identify an appropriate policy agenda in order to foster the transition to mass customisation; indeed, many policy prescriptions are available. But this is not the same as having these policies implemented successfully. For successful implementation to occur a number of prime conditions are required. First, policies must be fashioned to meet the needs of individual circumstances. Each plant, firm, network of firms, sector, region and country has particular circumstances, resource endowments and trajectories, and these need to be taken into account in the definition of suitable policy instruments. Secondly, the central government is only one institution of the "state". In many cases, and particularly where industrial districts and SMEs are involved, public policy might involve not just central government, but also local and municipal government. Third, and again particularly when SMEs are involved, policies may not best be directed at individual firms, but rather at networks of firms, preferably when this reflects collective action by the industrial sector itself. Fourth, policy is not just relevant for government - firms, producer associations and trade unions also require a strategic policy framework - and this generally requires purposive action if it is to reflect the needs of paradigm transition.¹⁷ Sixth, a strong conclusion of international experience to facilitate change at the enterprise level, particularly with respect to SMEs, is that this support is most effective if it involves a co-operative process between industry and government. This refers not only to industrial training schemes, but also to support for strategic focusing, organisational design, marketing, technological development and other forms of change required in the transition to mass customisation.

But, finally, and without doubt most importantly, the successful implementation of policy requires the development of consultative processes whereby the relevant actors are deeply involved in the development of the policy agenda and the definition of policy instruments. However appropriate, clever and sophisticated a policy agenda might be, if it is thrust on or presented to the prime actors as a tableau of change, it is likely to remain merely that - an agenda for change. Conversely, a process of policy definition and implementation which involves all of the key actors might in fact have only a thin veneer of textual backing. In this case, as elsewhere, actions speak louder than words.

¹⁷ For a discussion of the challenges faced at the enterprise level in LDCs and for the implications this holds for government support, see Bessant and Kaplinsky, 1995.

Bibliography

- Abromovitz M (1956), "Resources and Output Trends in the United States since 1879", American Economic Review, Vol 46, pp 52-3.
- Ahluwalia, 1991;
- Andreasen, Lars, Benjamin Coriat, Friso den Hertog and Raphael Kaplinsky (eds.) (1995), Europe's Next Step: Organisational Innovation, Competition and Employment, London: Frank Cass.
- Arrow, Kenneth J. (1962), 'Economic Welfare and the Allocation of Resources for Invention', in The Rate and Direction of Inventive Activity: Economic and Social Factors, National Bureau of Economic Research, Princeton University Press.
- Bessant John (1991), Managing Advanced Manufacturing Technology, London, Basil Blackwell.
- Bessant John and Raphael Kaplinsky, "Industrial Restructuring: Facilitating Organizational Change at the Firm Level", World Development, Vol. 23 No. 1, pp. 129-142.
- Best Michael (1990), The New Competition, Oxford, Polity Press.
- Bowles, S. S., Gordon, D. M. and Weisskopf, T. E. (1983). Beyond the Wasteland: A democratic alternative to economic decline. New York: Doubleday Press.
- Carrillo Jose V (1995), "Flexible Production in the Auto Sector: Industrial Reorganization at Ford-Mexico", World Development, Vol. 23 No. 1, pp. 87-102.
- Cawthorne, Pamela M (1995), "Of Networks and Markets: The Rise and Rise of a South Indian Town, the Example of Tirappur's Cotton Knitwear Industry", World Development, Vol. 23 No. 1, pp. 43-56.
- Cusumano Michael A (1985), The Japanese Automobile Industry: Technology and Management at Nissan and Toyota, Cambridge, Mass., Harvard University Press.
- European Commission (1994), White Paper on Growth, Competitiveness and Employment, Brussels-Luxembourg: ECSC-EC-EAEC.
- Fleury Afonso and John Humphrey (1992), "Human resources and the Diffusion and Adaptation of New Quality methods in Brazilian Manufacturing", Report presented to Instituto de Pesquisas Economicas Aplicadas (IPEA), Brasilia.
- Friedman D (1988), The Misunderstood Miracle, Ithaca, Cornell University Press.
- Hoffman Kurt and Raphael Kaplinsky (1988), Driving Force: The Global Restructuring of Technology, Labour and Investment in the Automobile and Components Industries, Boulder, Colorado, Westview Press.
- Hoffman Kurt (1989), Technological Advance & Organizational Innovation in the Engineering Industry, Industry and Energy Department Working Paper, Industry Series Paper 4, Washington, World Bank.
- Humphrey, John (1995), "Industrial Reorganization in Developing Countries: From Models to Trajectories", World Development, Vol. 23 No. 1, pp. 149-162.
- Imai M (1986), Kaizen: The Key to Japan's Competitive Success, New York, McGraw-Hill.
- Jaikumar, R. (1986), "Post-Industrial Manufacturing," Harvard Business Review, November-December, pp. 69-76.
- Joffe Avrii, David Kaplan, Raphael Kaplinsky and David Lewis (1995), Improving Manufacturing Performance: The Report of the ISP, Cape Town, University of Cape Town Press.
- "Export Processing Zones in the Dominican Republic: Transforming Manufactures into Commodities", World Development, November 1993 Vol 22 No 3, pp. 1851-1865.
- Kaplinsky Raphael (1994), Easternization: The Spread of Japanese Management Techniques to Developing Countries, London: Frank Cass.
- Kaplinsky Raphael (1995a), "India's Industrial Development in the New Millennium: Sustaining Income Growth and Meeting Developmental Objectives", Brighton: Institute of Development Studies, mimeo.
- Kaplinsky, 1995b. "Technique and System: The Spread of Japanese Management Techniques to Developing Countries", World Development, Vol. 23 No. 1, pp. 57-72.

- Kirmani, S. S. and W. C. Baum (1992), 'The Consulting Profession in Developing Countries: A Strategy for Development', World Bank Discussion Paper, No. 149, Washington.
- Krugman Paul (1994), "Competitiveness: A Dangerous Obsession", Foreign Affairs, March/April, pp. 28-44.
- Lall, Sanjaya (1990), Building Industrial Competitiveness in Developing Countries, Paris: OECD
- Maddison Angus (1989), The World Economy in the 20th Century, Paris, OECD Development Centre
- Mathews, Dale, 'The Impact of Export Processing Zones on the Dominican Republic Economy', D. Phil. Dissertation, (Brighton: University of Sussex, 1994.).
- Nadvi Khalid, (Forthcoming), "Export Competitiveness of Small Producers: the surgical instruments cluster of Sialkot, IDS Mimec.
- Nohria N and Gladstone J A (1991), "Crompton Greaves Ltd", Case Study N9-491-074, Boston, Harvard Business School.
- Piore Michael J and Charles Sabel C (1984), The Second Industrial Divide: Possibilities for Prosperity, N York, Basic Books.
- Porter Richard (1990), The Competitive Advantage of Nations, London, Macmillan.
- Posthuma Anne C. (1992a), 'Changing Production Practices and Competitive Strategies in the Brazilian Auto Components Sector, D. Phil. Dissertation, Brighton, University of Sussex.
- Posthuma, Anne C. (1992b), 'Japanese Production Techniques in Brazilian Auto Components Firm; Best Practice Model or Basis for Adaptation?', in T. Elger and C. Smith (eds.), Global Japanisation? Transnational Transformation of the Labour Process, London: Macmillan.
- Pyke, F. and W. Sengenberger (eds.), (1992) Industrial Districts and Local Economic Regeneration, Geneva: ILO.
- Rabellotti, Roberta (1995), "Is There an 'Industrial District Model? Footwear Districts in Italy and Mexico Compared", World Development, Vol. 23 No. 1, pp. 29-42.
- Ramirez Jose C (1995), The Emerging Locational Structure of the Mexican Automobile Industry, D Phil Dissertation, Brighton, University of Sussex.
- Sako, Mari, Prices, Quality and Trust, Cambridge University Press, 1992
- Schonberger, Richard J, (1986) World Class Manufacturing: The Lessons of Simplicity Applied. New York: The Free Press.
- Schonberger Richard J (1982), Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity, N York, The Free Press.
- Schmitz, Hubert (1995), "Small Shoemakers and Fordist Giants: Tales of a Supercluster", World Development, Vol. 23 No. 1, pp. 9-28.
- Shaiken Harley and Browne H (1991), "Japanese Work Organization in Mexico", in Szekely (ed) Managing Across Borders and Oceans, Centre for U.S-Mexican Studies, Monograph Series 36, San Diego: University of California San Diego.
- Smith, P. B. and J. Misumi (1989), 'Japanese Management - A Sun Rising in the West?', International Review of Industrial and Organizational Psychology, Chapter 10, pp. 329 - 369.
- Solow Robert (1957), "Technical Change and the Aggregate production Function", Review of Economics and Statistics, Vol 39, pp 312-320.
- Syrquin M and Chenery Hollis (1989), "Patterns of Development: 1953 to 1983", World Bank Discussion Paper No 41, Washington, IBRD.
- Van der Riet Derrick and Hendy Ian M (1986), "'Just in Time': An Analysis from the South African Perspective with Particular Reference to the Western Cape", MBA Research Paper, Cape Town, University of Cape Town Graduate School of Business.
- Whitehill, A. M. (1991), Japanese Management: Tradition and Transition, London: Routledge.
- Williams K, Haslam C, Williams J and Cutler T, with Adcroft A and Johal S (1992), "Against lean production", Economy and Society, Vol 21 No. 3, pp 321-354
- Womack, James P., Daniel Jones and Daniel Roos (1990), The Machine that Changed the World, New York: Rawson Associates.
- World Development, Vol. 23, No. 1, Special Issue on Industrial Organization and Manufacturing Competitiveness in Developing Countries (Edited by J. Humphrey).