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TECHNOLOGICAL AND ORGANIZATIONAL CHANGE IN THE INTERNATIONAL CLOTHING INDUSTRY

Challenges for Policy and Practice in Indonesia

Paper Prepared for the Regional and Country Studies Branch, UNIDO

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Introduction

The clothing industry in Indonesia has achieved notable progress in recent years. By 1986, the clothing industry accounted for 1.9% of total manufacturing value-added having risen ten-fold since 1975 and accounted for 3.9 % of total manufacturing employment. Though the industry has traditionally been domestic-oriented, the above expansion has been driven by a spectacular growth in exports. Over the 1982 to 1988 period, exports grew at an annual rate of 18%, rising from a little over $100 million in 1982 to U.S.$771.2 million, accounting for 54.7% of the export value for textile and garments combined and 10.4% of total manufacturing exports. Substantial backward linkages have also been established with garment production now absorbing 55% of domestic textile production, up from 36% in 1980, in the context of an 22% annual rise in total textile production over that period..

Due to these positive impacts on employment, foreign exchange earnings and backward linkages, the government has decided to target the clothing industry as one of the key sectors for promotion in the coming years. Because of its labour-intensive character and foreign exchange earnings potential, the clothing sector is seen to be ideally suited to respond to the government's twin strategic objectives of increasing employment and maximizing non-oil exports.

Underlying the government's perception of the strengths of the clothing sector, there is clearly an expectation that the industry can continue to grow as in the past and most importantly can continue to increase its export earnings by selling into the markets of the

industrially advanced countries (IACs). This confidence in the bright future of the clothing industry in Indonesia is reasonably well founded - at least over the short-term.

However, the determinants of success in the international clothing sector are changing fundamentally. Advanced automation technology has already begun to allow IAC textile firms to re-establish (within the framework of managed trade provided by the MFA) their competitveness in the face of low cost exports from developing countries; in clothing, there are massive R&D efforts underway to achieve the same objective.

More importantly perhaps, the markets for mass produced standardized products (of the kind manufactured for export by Indonesia) in the IACs are contracting. In their place is emerging a diversity of "niche" markets where consumer demand is driven much more by style, quality and variety than by price. The firms who are performing the best in these conditions have been those able to achieve rapid turnaround on orders, deliver in small lots and provide products of high quality and design content.

Surprisingly, it has been small firms, often organized co-operatively who have been registering the most notable successes under these new market conditions. Indeed, it is precisely this feature of small firms collaborating together that underlies the dramatic expansion of exports by the Italian textile and clothing industry in the 1980s. Whereas countries such as the U.S. and U.K. (whose clothing industries are largely oriented towards mass production) had net deficits in textiles and clothing

combined in 1986 of U.S.$-21bn and $-3.85bn respectively, Italy in fact had a positive net trade balance in that year of U.S.$9.00bn. - the highest of all countries, including the newly industrializing countries (NICs).

The above reflects the fact that there has been a fundamental shift in the "rules of the game" that will determine the future winners and losers in the global textile and clothing industry - the locus of competition has moved decisively away from the high volume production of low cost clothing for a mass market (where price determines choice) towards the flexible production of a wide range of clothes for a highly differentiated market where quality is the decisive factor in winning market share. This new reality must be taken account of by countries such as Indonesia who wish to build on their current export success in the sector over the longer term by moving now to strengthen the competitiveness of clothing manufacturers.

The objectives of this paper are twofold. The first is to set out the nature of the changes in markets, technology, organization and structure that are currently transforming this industry world wide and to describe their impact on the determinants of international competitiveness. The second is to explore the short and long term implications of these issues for industrial and sectoral policy and for commercial strategy in Indonesia.

In this context we shall be putting forward ideas and proposals that may challenge directly some of the conventional wisdoms on which government policy and firm strategies are currently based in Indonesia.

This is being done not just for the sake of argument but because the changes that are taking place in the sector internationally are of sufficient magnitude and substance to call for quantum jumps in approach and imagination on the part of government and clothing sector industrialists in Indonesia.

We begin in Section 1 by describing the technical and economic conditions of post-war growth in mass markets, mass marketing and mass production in the clothing sector worldwide that gave rise to the opening for Indonesian exports in the 1980s. We then describe the new competitive context that is emerging. The objective is to show how the conditions that lead to Indonesia's rise as a clothing exporter are in fact much less compelling as the 1990s begin, than they were thirty years ago when developing countries first started to attain the rapid expansion of their exports to the IACs.

In Sections 2 through 4, we explore how these changing determinants of competitiveness are manifesting themselves in three key dimensions - technology (Section 2), industrial structure (Section 3), and the organization of production (Section 4).

In the final part of the paper we explore the implications of the issues raised both for policy makers in Indonesia and also for industrialists.

Section 1: The Changing International Competitive Context in the Clothing Industry: From Mass Production to Flexibility and Specialization

By achieving a rapid expansion of exports to the IACs, Indonesia's clothing industry is following in the well-trodden footsteps of Japan, the NICs, and a wide array of other developing countries.* The simple and widely accepted explanation for this phenomena is that since clothing production is a labour-intensive manufacturing operation, the low wages of developing countries gives them an inbuilt comparative advantage over high wage IACs.

However, underlying this relationship are two sets of "starting conditions" that gave rise to developing country comparative advantage in the clothing sector. It is worthwhile briefly outlining these conditions because they are now changing in a way that is rupturing the neat connection between low wages and trade competitiveness that lies at the root of Indonesia's recent export success. Understanding how these starting conditions are evolving will yield useful insights into the changing determinants of international competitiveness that the Indonesian clothing sector must confront now and in the future.

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*(Wilfred -note- we could have here a short discussion of trade patterns (using tables) and making the standard points about rising LDC shares, characterized by NIC dominance and the advance of second tier countries such as Indonesia, the quick rise of China, and the emergence of those still further down the line (Bangladesh, Sri Lanka, Colombia, etc.). Could also throw in tables on shares of MVA and employment to show importance of clothing industry to domestic economy. Other trends (i.e. shift to Caribbean, rise of fashion goods, etc.) will be picked up later

The Supply Side Determinants of Comparative Costs

The first set of starting conditions are supply related and stem from the nature of the product and the clothing manufacturing process. Clothing production involves three stages - pre-assembly when garments are designed, patterns made and pieces cut from cloth; assembly (typically involving up to 80% of the factory workforce) when the components are sewn together; and finishing when the garment is prepared, packaged and despatched. Of these, the assembly stage has traditionally been considered the most important both because this stage accounts for 80% of value added, and because it is the labour-intensive nature of assembly that has created the opportunity for countries with low unit labour costs to compete against the IACs.

Assembly is labour intensive because clothing is made from limp fabrics that can have highly variable handling characteristics and because the garment takes on a 3-dimensional shape very early on in the assembly process. Thus, assembling a garment from cut pieces requires extensive materials handling by the sewing machine operator. These activities have proved very difficult to fully mechanize for a variety of technical reasons. A skilled human operator, using a standard industrial sewing machine can, however, relatively easily cope with all the handling variations clothing assembly involves while machines face great difficulties in coping with even relatively minor variations.

On the hardware side, the basic piece of eguipment used is a standard industrial machine that is low cost ($200-$1500), robust, simple to operate and maintain, easily adapted to specific operations and are r

readily available to all clothing firms. The combination of a flexible operator and a low cost flexible machine remains the dominant production unit in assembly rooms in clothing factories all over the world.

Given that clothing firms from both developed and developing countries face roughly similar materials costs, the obvious consequence of this situation is that unit labour costs faced by manufacturers thus become the key to competitive advantage. And because, developing country wages are on average substantially lower than IAC wages (see Table ?), developing country clothing producers enjoy a sizeable degree of cost advantage in many product categories despite higher productivity, greater quality and other advantages accruing to IAC producers.

This comparative costs perspective on the determinants of the international division of labour in the clothing industry - along with the well known distorting effects of the MFA (discussed in Section 5) neatly explains much about Indonesia's recent surge in exports and the short term competitive conditions facing the country. First, it shows why Indonesia emerged as an exporter of basic garments in the 1980s, along with Thailand and the Phillipines, in the wake of rising wage costs in the NICs. Second, it suggests that while Indonesia should continue to experience an increase in the rate of growth of exports, the country will inevitably face competitive pressures in its primary IAC export markets from even lower wage countries in the near future.

Third, it also explains why so much effort is currently being directed by the IACs towards the full automation of the assembly stage. These efforts are driven by the belief that only by solving the complex

materials handling problems of garment assembly can IAC clothing producers hope to overcome the low wage competitive advantage of the developing countires that has allowed them to capture such a large share of the IAC domestic market with such impunity over the last thirty years. So far, as we shall discuss later, even with the sophisticated robotics and computer technology that is available, the assembly automation conundrum has not been solved - at least not on a sufficiently pervasive scale to affect broad trading patterns. As a result, the low wage advantage of developing countries is still largely intact, despite earlier fears that it would be eliminated by automation in the North.

Not surprisingly, the comparative cost perspective underlies most analyses of trade and comparative advantage in the clothing industry as well as serving as the basis for much of the policy advice typically proffered to developing countries as to how the industry's competitiveness can be strengthened. However, we would argue that in the particular case of Indonesia, the simple adoption of the comparative cost perspective as a guide to policy formulation and decision making could be profoundly misleading. That is because this approach ignores crucial developments now occurring within the second set of "starting conditions" mentioned earlier. These conditions relate not to the supply side but to the nature of final demand and to the structure of IAC markets for clothing which remain the principal outlet for clothing exports from developing countries, including Indonesia. We turn to these issues below.

The Transformation of the Clothing Market in the IACs.

Though not commonly appreciated, the structure of the clothing retail market and the pattern of demand for clothes among final consumers in the IACs that evolved in the immediate post-war decades was directly responsible for the success of Indonesian clothing exports in the mid-1980s. In a similar fashion, fundamental changes in market structure and in demand in recent years will be equally decisive in determining the ability of Indonesia to continue to export clothes in the future.

By the 1950s, nationwide, well established, retail chains with multiple stores (such as Sears, Macys, and J.C.Penney in the U.S. and Marks and Spencers and Woolworths in the U.K.) were perfectly placed to respond to the needs of the genuine mass consumer market in clothing that emerged in these countries after World War II

During this period and up through the 1970s, clothing markets (as well as markets for other consumer goods such as cars, aplliances, shoes etc) were divided into relatively large, stable segments grouped according to age, sex and price. The large retailers, who because they accounted for well over 60% of all retail clothing sales at that time, were essentially able to dictate both the pace and direction of fashion change to what was basically a captive market. With this sort of purchasing power, the retailers were, in turn, able to pressure the clothing manufacturers (who were heavily dependent on the retailers' business) to capture available economies of scale by adopting the methods of mass production common in other sectors.

This was not easy for clothing firms - largely because of the technical and economic constraints on assembly mechinization described above. Nevertheless, a considerable number of clothing product segments - menswear and workwear, hosiery and household linen, etc. - did lend themselves naturally to long runs of standardized product. And even in those segments, where fashion played a bigger role such as ladies wear, retailers still pressured manufacturers to strive for the longest runs possible to order to achieve lowest unit costs. Clothing manufacturers, while prevented from mechanizing assembly, nevertheless copied mass production methods by pushing the division of labour in the assembly room to its limit. The production of each type of garment was "engineered" so that it could be carried out by long lines of operators, each skilled in only one or a few tasks, who performed the shortest feasible sewing activity on the largest possible "bundle" of clothes, before passing it on the next operator.

Because mass production as practised by the clothing industry did not require expensive, dedicated equipment as it did in other sectors, there were few scale or technology-based barriers to entry. Consequently, concentration and firm agglomeration was constrained so that a relatively open and fragmented industry structure persisted, even in the U.S. where adaptation of mass production methods progressed furthest; while in Europe average firm size in the 1970s (in firms of more than 10 workers) ran from as low as 42 in Denmark to a high of 100 in the U.K.

Of course, international firms (who influenced strongly the production and management structure of developing country firms through

their subcontracting activities) tended to operate plants on a much larger scale, producing in much longer runs than purely domestically oriented firms. However whatever the size of these firms, mass production methods and a price centered approach to competition based on the pursuit of scale economies, was the dominant production philosophy.

Consequently, within the core IAC clothing markets - accounting for upwards of 75% of total clothing purchases - retailers, and the manufacturers selling to them, competed on price and the physical quality of garment construction, with design and variety only playing a role as competitive elements in the slowly re-emerging high fashion sector. Thus very early on in the post war period, the demand of the final consumer (shaped by the advertising and marketing strategies of the retailer) for mass produced clothes manifested itself in a market-driven concentration on price competition.

Given this, it is not surprising that the large retailers and trading companies providing them with goods were soon looking to source overseas from lower wage countries such as Japan and South Korea as soon as these countries demonstrated they could provide reasonably good quality product in large amounts. These countries managed this fairly quickly by literally copying the mass production methods and techniques developed by the early mass clothing producers in the U.S. and U.K., often of course via direct technical assistance provided on these matters by the retailers, their agents and eventually the larger clothing manufacturers themselves.

As should be clear, it is precisely this same set of forces which initially drew Japan and the NICs into the international supply of clothing, that has subsequently underpinned Indonesia's own entry into the export of clothing to the IACs in the backwash of the distortions caused by the MFA. Thus the key point to note here is the central connection between the continued existence of a market for mass produced garments in the IACs and Indonesia's exports of basic garments to these same markets. The equation that lead to this situation has been in place for a long time and is primarily a function of the shape and pattern of demand for clothes in the IAC markets. Low wages (and protection) have certainly given Indonesia a chance to sell into the IAC markets - but only as long as the demand for the type of clothes Indonesia is able to produce, in fact remains stable and price elastic. In the discussion below we present evidence which suggests that the market stability in the IACs on which the international division of labour in clothing has been built has already begun to break down.

Restructuring of Demand the IAC Market

As the 1970s drew to a close, two factors emerged that were to change decisively the nature of demand for clothing in the IACs markets. First, the recession in 1979-1982 led to a severe contraction of IAC domestic demand for clothing, particularly in Europe - where the rate of growth of consumer spending on clothes had already been declining through the previous decade as incomes rose and the share devoted to clothing purchases was reduced. This contraction in demand left retailers and

clothing manufacturers to compete fiercely for a share of a slowly growing market with the situation being made worse by low-cost imports and static retail prices. These conditions led to a dramatic decline in the size of the industry as large and medium sized firms in particular, were forced into closure. (Stats in a footnote? taken from my april paper)

Secondly, from the beginning of the 1980s, major shifts in consumer tastes and in the demographic structure of the population in the IACs resulted in a much higher degree of volatility and differentiation in the clothing market. Consumers across a wide range of product categories began to exhibit a strong preference for individual choice, constant variation and higher style content in their clothing purchases. Where previously this was the case with only certain segments of ladieswear, now, the role of fashion - not as set by individual designers but by the tastes of the individual - has come to the forefront of consumer choice in large segments of the market previously thought immune to the vagaries of fashion such as menswear, sportswear and even home furnishings.

This shift is well demonstrated in Figure 1. compiled by McKinsey and Company,(which shows the relative degree of sensitivity of demand to cost versus fashion factors across a range of product categories) and in the following quote:

" "Even) in home furnishings (bedlinens, towels,...) where there was once a commodity market, there is now a fashion market where colour and pattern sell a product and where consumers expect co-ordination to a very sophisticated degree." ("Now", 1988)

In addition, a whole array of new product categories has emerged as can be seen in the rapid growth of casualwear and "lifestyle" clothing; while at the same time established categories have been divided into ever finer market segments. In short, consumer demand for clothing has become both much more fragmented as well as more sophisticated, with no single fashion or style able to stay dominant for any period of time as was the case in the past. Market surveys show clear that even consumers of mass produced, standard products have become more fashion concious in their purchasing decisions - while still paying attention to prices. There is widespread agreement that the changes in demand and market structure are both widespread and seemingly irrevocable.

The Retail Revolution

The changes described above had a major impact on the marketing strategies of the entire retail sector in the IACs and on the production and competitive strategies of IAC clothing manufacturers. On the retailing side, retailers have been quick to realize that they can no longer sell a mass "look" into a highly differentiated market. Consequently, their central strategy now is to target very narrowly defined market segments with a wide variety of products that can be combined in innumerous combinations. By doing this they give their customers the opportunity to create their own particular wardrobe according to their own tastes.

This shift towards a diffentiated marketing strategy has been

accompanied by the deliberate acceleration of the fashion "season" or cycle on the part of retailers. Previously the whole industry, both retail and production, used to base its planning cycle on the certainty that there would be two or, at most, three well defined seasons. Now it is not uncommon to find that there are four, five or even six fashion seasons in a single year. With the move towards greater variety, this means that reatiler may be showing foru or more collections every year with 200 or more articles in each collection compared to two seasons and fifty articles.

The first parts of the industry to adopt this strategy were the upper and middle segments of mens and womens clothing. Benneton of Italy, was one of the first firms to pioneer this marketing strategy, by tareting the youth segments of the ladies market and by offering a wide variety of styles and colours. By closing monitoring sales at its more than 5500 worldwide retail outlets, the company knows exactly what types of styles are selling in which areas. Through its very flexbile production base (described below), Benneton can restock its shops in as little as five days thus allowing it to respond almost immediately to quite different patterns of consumer and location specific demand.

The strategy has been remarkably successsful. Sales have grown from only 33 billion Lire in 1970 to over 900 billion (US$1bn) in 1986 (65% from exports), while the number of Benneton shops has now reached more than 5500 in more than 50 countries, including many developing countries. More significantly, many elements of the Benneton strategy have been adopted by other firms in the IACs.

The first leading UK proponent was the chain of "Next" shops opened by Hepworth whose "co-ordinated" separates were aimed at fashion concious women in the 25-40 age bracket. The approach boosted sales from £20mn in 1983 to £70mn in 1984, as well as spawning Next's entry into new market segments (young men's clothing, interior furnishings and house plants) but using the same approach. Other UK firms have moved to follow this strategy - Richard Shops, owned by Habitat-Mothercare and "Principles" owwned by the Burton Group have made determined and successful efforts to capture market share through improved design and quality..

While the new retail strategy has been adopted most extensively in the upper-middle segments of the women's and men's markets, it is increasingly clear that they are being adopted right across the clothing industry. The most important converts are the mass market/multi-outlet firms that account for a large share (close to 50%) of clothing imports from developing countries. For example, C&A, who is one of Europe's largets department store chains, is conciously moving away from commodity marketing towards a strategy of increased variety and higher fashion across garment ranges that are now targeted by "lifestyle" such as sportswear, outdoorwear and young fashions. Woolworths (worldwide) is essentially following the same route as are Sears, J.C. Penney and K-Mart in the U.S. and Marks and Spenser in the U.K. (40% of the U.K. market) - a move that has already influenced the strategies of other U.K. multiples targetted on the lower end of the market such as British Home Stores.

Not surprisingly, the retail revolution in the clothing industry described above is having dramatic consequences back through the whole of the garment-textile supply chain. Retailers, because of the new focus of

competition on market segmentation, higher quality and more variety, are having to alter fundamentally their sourcing strategies. This in turn is forcing the clothing manufacturers and the textile firms to recast their own relationships as well as reorganizing their production process and pursuing a wide array of new technological solutions to old problems.

The net result of these market driven changes in retailer strategy is therefore a fairly fundamental transsformation in the determinants of international competitiveness to which the Indonesia clothing industry will inevitably have to respond if it wishes to fulfill its own high expectations and those of the government.

In the three sections that follow we look in more detail at how these changes are manifesting themselves in three areas that have particularly important implications for Indonesian policy and strategy in the clothing industry - in technology; buyer-supplier relationships and the organization of production; and in the new forms of industry structure that have proved so important in allowing countries such as Italy, West Germany and even Japan to achieve notable success in the international clothing market in the 1980s.

Section 2: Technological Change in the Clothing Industry

As is well known, IAC clothing producers very early on in the post-war period began to seek the protection offered by tariff and non-tariff trade barriers against the threat posed by low-cost imports from developing countries. However, it soon became clear that trade barriers could not be used to totally eliminate low-cost imports but only to control their rate of growth. Thus beginning in the mid-1970s, clothing manufacturers and capital goods suppliers became increasingly preoccupied with the search for cost reductions via technological change as a means of competing against the supply of clothing from developing countries.

As the microelectronics revolution gathered pace, it was at first believed that this technology might allow the full automation of the assembly process, thereby undercutting the low-wage based comparative advantage of developing countries. In response to this possibility, there was a significant increase in the amount of R&D and capital resources invested in puruit of automation by clothing manufacturers, by capital goods firms and most surprisingly by IAC governments seeking to assist the efforts of their beleaguered clothing industries to turn the tide against low-cost imports.

At first much of the effort and attention was focussed on the automation of the assembly stage. A number of multi-million dollar public and private sector projects were launched in the early 1980s aimed explicitly at overcoming the perennial technical obstacles to assembly automation. As we shall see, these efforts, while still ongoing, have not yet generated the sort of full process automation that was originally

expected. This means that many of the early fears that developing countries would lose their low-wage based comparative advanatage to the rapid and widespread diffusion of assembly automation technology in the IACs were misfcunded. However, it is the case that the focus on assembly automation has already had important technological spinoffs that are facilitating the efforts by clothing manufacturers in the IACs to adjust to the new conditions of competition in the marketplace. Moreover, as we shall see the work carried out so far on assembly automation clearly points the way to the future - even if that future will arrive some time later than was originally expected.

Before discussing technological developments in the asssembly room we start with reviewing the rapid pace of technological change that has occurred in the pre-assembly stage where CAD/CAM technology is having a profound impact on the ability of IAC firms to meet the demands of retailers for quality, variety and rapid response.

Radical Change in Pre-Assembly Technology

Even before the new retailing conditions began to influence the clothing industry, microelectronics technology had made major inroads in the pre-assembly phase. Both CAD systems and computer-controlled cutting systems have been available since the late 1970s. With the growing pressure on manufacturers to have the capacity to produce variety and provide a rapid response to consumer demand, both types of system, but particularly CAD systems have become an increasingly critical element in the competitiveness of IAC firms

The first generations of CAD system were marketed mainly on their labour and material savings capabilities. By digitizing information regarding the shape and size range of the clothes to be produced, it was argued that the CAD system could then efficiently perform grading and marking tasks previously carried out manually by highly skilled, well-paid workers. Early users demonstrated a 40-50% reduction in labour usage and a 15% improvement in fabric utilization - quite significant given that the costs of fabric are 40-60% of the total cost of the garment.

Similarly, the CNC cutting systems were also promoted on the same basis. By cutting faster (20 meters/minute), more accurately and in more volume (up to 300 lays at a time), computer-controlled cutting systems also demonstrated clear advantages over manual systems. Skilled labour usage was cut by 24-60%, material utilization improved to over 90% and productivity through greater volume increased by 200-300%.

Because of their high costs (from $250,000 up to $1 million) and emphasis on volume production, the initial vintages of CAD/CAM technology were primarily purchased by large manufacturers seeking to compete on the basis of price. Nevertheless their uptake was very rapid with sales advancing by nearly 85% a year through the mid-1980s. By now well over 50% of all clothes produced in the U.S. are done so by firms using these technologies. The impact on productivity has been so significant that the U.S. government estimates that half of the 3% annual incease in productivity enjoyed by the U.S. clothing industry over the last decade has been due to CAD/CAM technology.

More recently, the shift in emphasis towards the need for rapid response by clothing manufacturers has greatly enhanced the attractiveness

of pre-assembly CAD/CAM systems. In particular, manufacturers are beginning to take much greater advantage of the greater flexibility offered by CAD systems via their ability to make rapid alterations to styles and generally enhance the design process and facilitate quick turnaround. By eliminating various stages of the grading and marking process, the time taken to move through this stage can be slashed by two to six times, allowing jobs previously done in days to be completed in hours, and hour long tasks to be carried out in minutes.

Many observers now see a direct connection between the increasingly widespread use of CAD systems and the shorter turnaround time they allow with the growth in the size of model collections and increased frequency of model and season changes described in Section 1. For example, Levi Strauss took only 16 weeks to mark and gradate its 1986 fall collection composed of 442 models, 500 different fabrics aand 700 different sizes. Without CAD it simply would not have been possible - and it has allowed Levi to increase the number of seasons from two to four in only two years.

Another example comes from Liz Clairborne, a manufacturer of knitted wear who subcontracts all production to Hong Kong and Taiwan. Clothes are designed in New York City, grading and marking is done in New Jersey and manufacturing in Asia. CAD systems are in place in all four locations and the efficiencies gained from real-time exchange of data (a style designed and accepted in New York can be in production in a matter of hours in Hong Kong) allows Clairborne to operate on a cycle of six, two month fashion seasons throughout the year with no garment ever being repeated in a subsequent season.

The increasing emphasis on design has also given a dramatic push to the development of CAD systems that are capable of true design work in 3-dimensional space. The strides forward have been considerable in recent years and already it is possible for a designer to use a CAD system to produce an accurate visual impression of a design in colour with near photographic quality. True 3-dimensional design is not yet possible but in addition to a massive private R&D effort, major publicly funded R&D efforts are underway at CETIH in France, Queen's University, Belfast, at Computer Design Incorporated in the U.S.A. and at the Polymer Research Institute in Japan. In addition, MITI has annoucnced they are in the final stages of planning a 9 year, $1.2 billion R&D effort entitled Computer-Wear Designing that will consider all aspects of apparel design from textile charcteristics, to full design to pattern making taking into account the fit and comfort of the garment.

Meanwhile other changes are taking place in pre-asssembly technology that will benefit the IAC producer looking for ways to increase flexibility. For examle, quality concerns are driving the development of low cost, mobile, computer-based colour matching, inspection and quality evaluation systems. The objective of greater flexibility in cutting is being met by computer cutting systems using lasers, water jets and plasma torches that are far faster and more flexible than the original knife based systems and can be used cost effectively to cut only one ply of fabric on a continuous basis - this approach being much more in keeping with the need for manufacturers to produce much smaller lots of garments than previously. At the same time, more automation of relevance to volume producers is also being developed - such as automated spreading systems - but the drive to greater flexibility and quality is powering pre-assembly technological development to a much greater degree than ever before.

We want to make one extremely important point of relevance to Indonesia here. Pre-assembly computer based CAD/CAM systems are expected to spread more widely and rapidly among IAC users in the first half of the 1990s than they did even during the 1990s. Though this may appear surprising, it is important to understand that the full potential of CAD in the clothing industry is only just beginning to be appreciated by IAC manufacturers. However, the attractiveness is not because of the technology's impact on labour usuage or material costs. Rather, CAD systems are now seen to be perfectly suited to the needs of the industry in an era when flexibility and design the keys to competitive success.

Rapid diffusion will also be enhanced because unit-costs of the CAD/Cutter systems are coming down dramatically as patents expire, the technologu develops further, new suppliers enter the market and smaller companies increasingly become a specific target market for the systems suppliers. The combination of these factors will push the diffusion process ahead rapidly. And it is critical to note that this diffusion will occur not just in the IACs but in developing countries as well where the spread of the systems has been picking up in recent years.

All the evidence suggest that manufacturers in these countries (and many other developing countries) are fully aware of the benefits of the technology. This relates of course not only to the flexibility and design capacity inherent in CAD systems but to the fact that usage allows subcontracting firms to offer "online" facilities to IAC agents and manufacturers - as in the case of the Liz Clairborne example given above.

Indeed, one sign of this growing use of CAD in Asia is that there are

already nearly 60 of the more CAD systems in place in Hong Kong, South Korea and Thailand alone, with over 60% of these having been installed in the last three years. All the major suppliers have opened regional sales and service centers in either Hong Kong or South Korea and have been agressively marketing their systems through direct visits and sponsored seminars in the region. As prices come down, it is clear that use of CAD systems will become increasingly commonplace not only in the NICs but in second tier countries as well.

This means that Indonesia will be encountering competitive pressure from firms in both the IACs and the NICs and possibly other second tier countries that will inevitably be based on the advantages they derive from the use of CAD systems. Another form of pressure is arising from the changing pattern of IAC sourcing, particularly by U.S. 807 firms. Indeed, the evidence suggests that the use of these systems by U.S. 807 firms has already been responsible for a 5-10% shift in the U.S. offshore assembly trade from Asia to the Caribbean. This trend works directly against the the long term interests of Indonesian clothing industry.

This reality coupled with the shift towards fashion, design and responsiveness in the international clothing market makes it a necessity that the Indonesian government and clothing industry develop a viable plan to promote the use of this technology in the country in the near future - Even for a second tier country such as Indonesia, the use of CAD is really no longer an option as it was 4 or 5 years ago. It is now a necessity. And the given the time it takes to develop and acquire the skills necessary to effectiely use CAD within a developing country context, this is a necessity that needs to be acted on in the near future. This is an issue we return to in detail in the final part of this report.

Incremental Progress Towards Assembly Automation.

The application of microelectronics technology to sewing has proceeded at a much slower, more incremental pace than in pre-assembly. Nevertheless the same forces are at work and below we review three lines of technological development in this area.

Retrofitting of standard industrial sewing machines. The first is well established and essentially involves established capital goods firms adding microelectronic-based control units onto different types of industrial sewing machine - from basic machines to more complicated units handling complex tasks such as pocket welting, trouser serging or button holing. This has largely been done without any major redesign of the machine but nevertheless represents one of the main thrusts of the R&D efforts of individual capital equipment suppliers.

There are significant gains in machine productivity with this equipment over conventional machines via greater speeds (up to 60% faster), deskilling and more accuracy - though the machines are much more expensive and in most cases would not be either cost effective or even necessary in Indonesia. The basic point to note here is that the critical one machine/one operator link referred to earlier has not been broken by this type of application.

Development of sequential work stations. A second line of development paralleling the above is the development of work stations that are normally dedicated to a high volume, single small part operation. Examples are pocket-setting, top stitching of collars and cuffs, shirt placket manufacture, etc. In these work stations, the operative loads and unload the workpieces but does not actually control or guide the fabric. Companies such as Pfaff, Yamato, Brother, Juki and Babcock are all working in this area, with the leading edge represented by efforts to link separate work stations together sequentially via some kind of transfer system. So far however, because of their cost and relative inflexibility the equipment is still used to only a limited degree by large IAC users.

The two points to note about these workstation developments are first, that they are all driven by the conventional mass production, volume approach to clothing manufacature that has developed over the last forty years in the IACs. Second, their flexibility and hence universal appeal as a major source of labour cost reduction is severely limited by the central materials handling problems difficulties historically faced by the industry.

This type of equipment is again unlikely to have much direct relevance to Indonesian clothing firms as prospective users of the technology. However, it would appear that sequential work stations do offer IAC users significant labour cost savings in mass produced items that had previously been uneconomical to produce at home. These advantages are likely to increase if equipment manufacturers can successfully link up a number of these workstations into a production line. However, achieving such a degree of integration is still further in the future.

Slow progress towards full asssembly automation. There are however other technological developments underway that are attacking the assembly automation problem in a much more fundamental fashion. For the most part, these developments involve public sector funded R&D initiatives all of which are focusing on cracking the assembly automation problem. The basic approach is similar as well with state funds being used to complement the investment of substantial resources in R&D projects that are being carried out on a collaborative basis between clothing manufacturers, equipment producers, automation specialists and inthe case of the U.S. projects, trade unions as well.

The most important of these projects are taking place in the U.S., EEC and Japan, Sweden and collectively they represent the most significant new element to be injected into the innovation process in the clothing sector for the last 50 years.

The U.S. project is a joint initiative between the textile-clothing industry (including firms such as Singer, Palm Beach, Hartmax and Greif), leading trade unions and the government known as the

Textile & Clothing Technology Corporation (TC2). The objective of TC2 is to produce asystem using computers and robots that could automatically load, fold and sew cut fabric into a fully finished garment.

It is still far too early to judge the technical and commercial success of this initiative. On the technology side, a variety of prototype machines involving automated assembly of sleeves, coat backs and trousers and the automatic pick-up and positioning of a single fabric ply, have been developed and subcontracted to equipment manufacturers for further commercial development.

For example, Singer is further developing, along modular lines, a system for the forming and sewing of a jacket sleeve using a sophisticated programmable flexible manipulator linked to a vision system and a mobile sewing head. However, at the same time, the deadlines for achieving some of the more ambitious technical goals have been postponed. Nevertheless the commercial results of TC2s work are eagerly awaited by the industry.

The EEC project falls under Section 9 of the **BRITE** programme (BAsic Research in Industrial Technologies for Europe) that ois specifically targeted at "New Production Technologies Suitable for Producst Made From Flexible Material." Again it is a collaborative effort involving Courtaulds Clothing, Courtaulds Research Institute, GEC and Pfaff.

There are a number of projects aimed at various aspects of the clothing industry. A central one inoles the development of a flexible manufacturing system for garment assembly through sequentially linked sewing and manipulative robotic units - albeit still on a two dimensional basis. An interesting aspect of this approach is the aim of developing standard modules that can be reconfigured esily to allow changeover from one product to another.

The **Japanese** project, sponsored by MITI, was planned with a longer term perspective, greater funding and more industry co-operation than the U.S. initiative. Established in 1983 with a 7-10 year timetable and $100 million of government and industry support,

the Japanese Automated Sewing System project (involving 3 research institutes and 28 companies) covers the whole assembly process from design through cutting to sewing, pressing and finishing and retail.

The target is to develop the necessary automation technologies for all aspects from fabric evaluation to the final pressed garment. One objective is to cut sewing time on a women's blazer by at least 50% by using a flexible manufacturing system (FMS) approach to the assembly stage.

The commercial aim of the project is not solely or primarily to revitalize the Japanese apparel industry - but to develop commercially viable systems that can be sold worldwide. Prototypes are expected early in 1990 with full-scale commercial production of the equipment expected to start some time in the early 1990s.

These developments appear to have quite dazzling potential. However it is critical to bear in mind that no matter what progress has already been achieved, there are still major technical, structural and attitudinal obstacles to be overcome by the automation initiatives currently underway in the industrialized countries. These should not be underestimated for they have so far stymied assembly automation efforts. Thus there is a great deal of uncertainty still surrounding both the question of when automation of the assembly room will arrive and the nature of its eventual implications for developing countries such as Indonesia.

Other dimensions of computer-based technological change in the assembly stage. Computer technology is making significant inroads in other areas of assembly room activity in clothing production that should be noted. In one area, that of materials transport, the notion that inventories need to be reduced has given rise to computer-based materials transport systems known generically as unit production systems (UPS) have become increasingly popular, particularly among large firms. Work flow and component movement between work stations can be optimized and directed centrally while garments are moved automatically from station to station by means of a computer-directed

overhead delivery system linked up to terminals that can also monitor operator performance.

The advantages offered by such a system are much greater flexibility, reduced inventories, less handling time and greater control. The industry press reports that UPS has allowed firms to cut production times for individual garments from weeks to days and slashed 40-70% off work-in-progress inventory figures.

UPS systems do have problems however in terms of having enough flexibility to met the needs of the small manufacturer while they are still quite expensive on a workstation basis ($3900-$4500). This will restrict their use to large firms - but they could nevertheless spread rapidly among these in the future as the technical problems are overcome and as unit costs come down.

Another aspect involves electronic communication within the firm which is rapidly emerging as the nerve center of the advanced clothing manufacturer's technological strategy. Increasingly sophisticated, yet lower cost computer-based management information systems are now diffusing rapidly through the clothing industry in the IACs. Larger firms can now use their CAD systems or main frames to estimate costing as well as do cut-order planning and production scheduling. At the smaller scale end where most firms operate, cheap micro-computers are being equipped with software and peripherals that carry out many tasks previously done manually such as the preparation of work dockets, stock control and fabric sourcing sheets.

Perhaps the most far reaching innovations are occurring in the area of computer-based production control systems (such as MRP II or its variants) that allow "real-time" monitoring of work-in-progress on a continuous basis and assist in production planning, line balancing and work measurement. One of the largest U.K. producers, Courtaulds, have introduced these techniques into 24 out of 40 companies and in one division producing nightware, sales have risen by 50%, "seconds" have been cut to 1% and raw material stocks have been reduced by 30%.

These systems have begun to come down in price substantially and along the way have started to accumulate a positive "track record" in terms of cost-effective results. This trend is bringing these systems more within the reach of small firms. Small firms, constrained by limited managerial resources, should find these systems will prove a great help in reducing unit costs, improving flexibility and shortening lead time.

The same technology also allows electronic communication between firms thereby facilitating much greater buyer-supplier responsiveness. When linked up to electronic point of sale systems (EPOS) at the retail end, in-house computer links with manufacturers allow instant communication of production, product and delivery requirements. As mentioned earlier, this is the way Benneton operates. The Italian clothing firm links its headquarters via computer and EPOS to its franchised stores. The system allows rapid analysis of sales trends that can be immediately translated into production plans. Production scheduling in its own factories and those of two hundred subcontractors is tied directly to actual orders. The success of this approach (rapid restocking has increased Benneton's sales by an average of 15% over similar shops) has virtually forced other firms to follow the same strategy.

Another example of this comes from the U.S. textile firm, Greenwood, who is hooked up computer to both its fibre suppliers and its major customers. The real time communication between these different entitites has allowed major reuctions to be made in inventory holdings and fixed investment. (See more detailed discussion in next section).

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While there is clearly a great deal of technological advance taking place in the clothing industry in the U.S. the immediate relevance of many of these developments to Indonesia is open to

question. Clearly high volume applications of pre-assembly automation such as CNC cutting automatic or automatic spreading and inspection; or the three type of sewing automation projects reviewed above (retrofitting, workstations and full assembly automation) have little relevance to Indonesia. At any rate as noted above, few of these systems are likely to be cost effective if introduced into the country's clothing factories.

Of course, there is much that can be done to upgrade the industry's technological base. This need not involve resorting to investment in expensive automated equipment in the assembly room. We discuss these issues in the last section..

Much more significantly, few of these technologies generate cost savings for IAC firms of sufficient size to threaten Indonesia's cost advantages - at least in the short term. What this means is that for the present and near term future, Indonesia does not face a technology driven erosion of its low wage based competitive advantage.

However, it would be wrong to go on to conclude that there are no developments of relevance to Indonesia currently taking place in the clothing industries of the North, because a number of points can be made here which we explore more fully below.

First as highlighted above, because of the growing importance of flexibility and design, CAD systems have become an indispensable weapon for virtually any firm that chooses to enter the highly competitive arena of international trade. This ia as true for Indonesian firms as it is for U.S. firms.

Second, there is clear evidence that quite apart from CAD, the trajectory of technological development in the sector is being influenced by the market-driven push for rapid response, reduced inventories and greater flexibility. Single ply cutting, flexible assembly systems, UPS, computer-based managements systems and EPOS are all examples of technical change that is moving away from the automation of mass production as represented TCI and the BRITE programme toward more flexible, less scale intensive systems of

production. Even if these technological innovations are not directly applicable to Indonesia, they constitute further indicators of the pervasive effects of the sorts of change in demand and market structure that we discussed in Section I and which Indonesia must now be taking account of.

Finally, this market driven, retail revolution is having its most profound effects not in technology but in the areas of inter-firm relations and in the organization of production. Unlike most of the technology elements discussed above, we believe strongly that these developments are in fact directly relevant and directly applicable to Indonesia. They are discussed in more detail in the next two sections.

Section Three: NEW FORMS OF RELATIONSHIPS BETWEEN FIRMS AND THE RE-OGANIZATION OF PRODUCTION WITHIN FIRMS

In this section we review two areas where the retail, marketing and distributional changes highlighted in Section 1, are manifesting themselves most visibly within the international clothing industry. The first relates to changes in what can be called "buyer-supplier relationships." These include relations both between retailers and the domestic manufacturers, and also relations between IAC clothing manufacturers and fabric suppliers. All of the major actors throughout the whole of the textile and clothing chain are having to readjust their relationships with each other in response to the new conditions.

The second area, where the changes, though dramatic, have not yet diffused very far, relates to the way in which the very production process itself that goes on within the firm is being reorganized to give firms the flexibility demanded by the market and their customers.

Changes in Relations between Buyers and Suppliers - From confrontation to co-operation

The clothing industries of the IACs are seeking to strengthen the responsiveness and competitiveness of the textile-clothing complex by developing closer links within the industry between the major actors. Clothing manufacturers in Europe and the U.S. are increasingly taking a concious decision to base their sources of competitive advantage on their ability to provide a speedy service to retailers by shortening design and production cycles. The evidence of the nature of these moves toward closer integration are visible in a number of areas.

Firstly, the design relationship has altered substantially. Before, the design process was entirely separate from the manufacturing process. Designers rarely came into direct contact with clothing manufacturers or textile firms during the design process.

Now there is a pronounced trend towards more extensive consultation between these groups during the design phase. Rapid style change means the retailers simply cannot cope with the design demands and planning requirements on their own. So they are beginning to select fabrics on a joint basis with clothing manufacturers as well as interacting on the development of entire ranges. In some cases they are entering into informal and sometimes formal committments to cover cloth purchases and set up costs. These new relationships are beginning to be seen even among retailers who have historically had a much looser and more traditional "arms-length" relationship with suppliers such as Woolworths and Richard Shops.

Second, a parallel development in buyer-supplier relationships is the growing necessity for manufacturers to be able offer a greater variety of product lines. Most significantly this means they must be able to switch production between styles rapidly in response to short term trends. Consequently, lead times for the supply of products right across the board in the clothing industry have become much shorter than was ever thought possible before - from an average of 15 to 22 weeks in the U.S. and Europe to between 2 to 8 weeks respectively. The Benneton production system can respond to re-orders from its domestic and foreign shops in as little as five days.

Typically, retailers will now only finalize a portion of their order (30-70% on average) at the beginning of the season and place additional orders as sales data indicate which lines are selling the best. To allow this, retailers dealing with independent manufacturers now increasingly reserve a fixed amount of production time or capacity (over the course of a year) with producers and then allocate it among styles as the season progresses.

Correspondingly, these increases in variety and seasons and the reduction in lead times inevitably mean the production runs have become much shorter. Before orders would only need to be produced in thousands of dozens, now the order can be for 5 to 100 dozen, with specialist retailers such as NEXT averaging only between 1000 to 3000

units per style. Small lot sizes and short lead times also imply greatly reduced inventory levels since the whole thrust of Quick Response is to eliminate the need for stock ordering and production. When turnaround times are reduced to a matter of 10 days to 2 weeks, there is no longer any need for inventories.

Third, and finally, in order to provide the foundation for the much altered "rules of the game" governing buyer-supplier relationships, a new element of stability and trust is deliberately being sought in the contractual linkages tying buyers and sellers together. One way this is emerging is by retailers being prepared to work with fewer suppliers on a longer term basis. At the same time, the retailers expect the manfacturers themselves to become more independent than previously, with a more diversified customer base. It is now increasingly common for the larger manufacturers to keep their dependence on any one customer to well below 50% of their business.

In the industry literature and among industrialists and consultants, the three elements described above are now commonly subsumed within the the concept of "Quick Response." This is simply the textile-clothing industry's specific term for what is commonly known throughout the rest of the manufacturing sector as "Just-in-Time" (JIT) production . As with JIT systems, the thrust of Quick Response is to tighten links all along the producer-supplier chain, to keep inventories to a minimium and substantially reduce turnaround time.

In the clothing sector, no one knows what will sell until the products actually get into the store. Having a Quick Response system in place makes it possible for retailers to start a season offering customers a broad selection with only few units in stock. As stocks of particular items get low, the retailer can reorder and expect fast delivery - while having only a very small exposure on slow moving items.

For clothing and textile manufacturers, the locus of competition and co-operation is thus beginning to shift, with contracts being increasingly awarded on the basis of quality, ability to change at short notice and reliability of delivery rather than on price alone. At the same time, less dependence between buyer and supplier has benefits for both groups - manufacturers are less susceptible to monopsonistic pressure from retailers, while their competitive edge in design and response has to be cultivated to secure a wider customer base, consequently making them less vulnerable to competition.

Retailers are in turn strenghtened in the marketplace, are more willing to look to domestic suppliers, and no longer carry full responsibility for the survival of individual firms. Both sides benefit from being able to greatly reduce their inventory carrying costs. Price is still important but there is now an assumption that by creating a degree of contractual stability between producers and users, producers will be able to better improve efficency and thereby reduce costs that can in turn be passed on to the retailer.

The extent and rate of diffusion of these new relationships in the IACs is hard to estimate at the current time. Some observers suggest that so far the response has only been partial with many firms being reluctant to make the changes unless forced to by their customers. Many more are simply refusing to change their ways.

This is not surprising since the same pattern of reluctance has been found in almost every other industry sector where JIT and the new modes of buyer-supplier have begun to emerge. The changes being asked for in perceptions, attitudes and relationships are fundamental and far reaching. Such a shift will inevitably take a long time in any industry. Since the clothing industry is perhaps more traditional than most others, it is perhaps surprising that these changes are happening at all!

Yet the available evidence suggests that in fact some industry leaders are aggressively pursuing these strategies and are achieving impressive results. Benneton, of course, in Italy has developed

extremely close, responsive relations between its retail shops and its suppliers. In the U.K., NEXT, Marks and Spencer, Woolworths, C & A and Richard Shops have, to various degrees, introduced these changes into all of their supplier relationships. In the U.S., big retailers such as Wal-Marts and K-Mart, manufacturers such as Levi Strauss, Kellwood and Lee, and textile firms such as Greenwood and Milliken have adopted a similar tactices.

The mode of operation differs beteen companies but the objectives and end results are similar. For example, Bennetton has built on the tradition of "putting out" in the Italian clothing industry to organize an elaborate subcontracting network composed of 300 firms, many having been formed by previous employees with its encouragement. The company provides extensive technical and operational support to these firms to aid their productivity as well as a profit sharing system and long term stability in terms of ordering. This mode of operation also benefits Benneton because it means the company saves on overheads particularly on managerial costs, generates a 40% saving in unit labour costs and maximizes its flexibility.

As mentioned earlier, Benneton has developed an EPOS-based system for organizing subcontractor production so that production is only on the basis of orders and re-orders from its shops. Responsiveness is enhanced for some knitted products because Benneton uses a "post-dying" method for dying completed garments in response to orders that minimizes time delays, optimizes the production cycle and increases capital utilization. Likewise inventories are reduced - the shops do not carry inventories relying instead on the rapid turnaround capacity of the production system to meet product demands on a just-in-time basis in precisely the product mix demanded by the market.

In the U.K., Courtaulds has just engineered a major reorganization in its foundation garment division in order to allow it to compete in what is essentially an entirely new market for women's underwear. This previously very staid and slow moving market has literally been transformed and significantly expanded by the sales

success of a single, small U.K. firm, Janet Reger, who above all else emphasized design, fashion and affordability in the line of women's underwear it began to market in the early 1980's. Getting Courtaulds to be competitive in this market, as CEO John Hall states, was not easy:

> "Redesigning the product range was one thing, tightening up the company's reflexes to keep pace with accelerating trends in the fashion world was quite another. Closer contact with customers and faster reading of product trends have allowed a quicker response from the producion floor. warehousing has been reorganized to respond overnight." ("No-", 1988)

The advantages of these new approaches are perhaps most visible within the U.S. industry which has traditionally been more committed to a mass production than European firms, and where buyer-supplier relations were short term and based strictly on price competition. U.S. firms are now realizing that closer links within the industry can lower costs more effectively than investing in machinery for mass production as well as introducing stability into the system - both aspects giving an edge to domestic producers.

For example, consider the case of Greenwood Mills (mentioned earlier), a large U.S. textile firm that specializes in the production of denim. Until 1985, Greenwood shopped around between four suppliers to drive fiber prices down; Greenwood in turn was on the receiving end of similar tactics from its garment customers. This situation was unstable and reduced profits dramatically. Now Greenwood buys from two suppliers on the basis of quality, service and innovation. All parties are committed to long term relationships. One example of the benefits is that Greenwood now knows (via a computer link) when the truck leaves its suppliers' the plant, what it contains and where it is headed. As a result Greenwood's fiber inventories have been cut from three weeks to 2 days;

Greenwood has worked to get the same relationship with its customers. For example they now pre-sort their deliveries and

guarantee quality so that deliveries can be unloaded directly to customers's cutting rooms, as needed with no inspection. As a result they have allowed their customers to cut their inventories from 4 weeks to 3 days in one case and in the case of another allowing warehouses to be done away with entirely. Greenwood has never missed a shipment under this system, while its own inventory turns have risen from nine a year to thirty, and it can hold $40 million less in inventory.

Other U.S. examples of the benefits of Quick Response relationships can be cited in relation to retailers and garment manufacturers. Wal-Mart stores after experimenting with Quick Response re-ordering schemes with two major apparel firms that its sales of men's slacks were up 31% and inventory turns and gross profit margins were up by 30 percent.

Similarly J.C. Penney, using Quick Response with some of its suppliers, reported increased sales of 59% and inventory turns up by 90% compared to control stores. By using EPOS linkages, it has been able to achieve replenishment of basic styles in two weeks and fancy styles in three weeks leading to a 20% reduction in inventory, reduced markdowns and improved customer service.

There must be a sizable "demonstration" effect associated with the fact that firms of this substance and importance in the international clothing industry are committed to developing quick response relationships with each other. this suggests that in time, these new buyer-supplier relationships will be a general feature of the clothing and textile industry in the advanced countries.

In contrast to the technology issues discussed in Section 2, these developments do have major and immediate implications for Indonesia. Some are potentially negative since the new relationships do mean that IAC firms may be able to significantly expand their competitive scope into market segments where Indonesia might choose to move in the near future. However, there are positive aspects as well to these developments. But before discussing these issues further, we

first turn to the second set of market-driven organizational changes being reviewed in this section - the reorganization of production within the firm.

Intra-firm Changes in the Organization of Production

These changes in market demand and buyer-supplier relations have begun to erode the economic advantages of long-run garment (and textile) manufacture by shifting the focus of competition from price to variety, style, flexibility and rapid response. This is having major implications for the way manufacturers organize their production Clothing manufacturers in particular (but also textile firms) have begun to discover a common wisdom that is also being embraced by industrialists in other sectors. Rather than seeking enhanced flexibility through the use of automation, the necessary response capacity is being sought - albeit still by a minority of firms - in the redeployment and retraining of their assembly workforce, and in a basic reorganization of their production line.

This is evident in a number of changes currently being introduced to standard manufacturing practice. For example, machinists are being trained to be proficient in a variety of sewing tasks rather than just one. Multi-skilled workers minimize the "learning" costs associated with changeover to new styles, a factor which in conventional approaches normally leads firms to train their workers in one task only and keep lot sizes high.

However as discussed above, the retailers now demand smaller lot sizes. So firms ae trying to cope with this demand via elimination of the "progressive bundle" system (which required an operator to perform the same task on a large number of workpieces contained in the bundle). As noted, the aim now is to strive for reduced in-plant inventories, thus allowing work to be produced and delivered on a continuous, "just-in-time" basis.

Reducing inventories is not simply an aid to saving on working capital. It has all sorts of other benefits well known to JIT practictioners in other industries but just being discovered in the clothing sector. For example, high inventories delay identification of quality problems. This not only increases quality costs but can now eliminate the supplier from competing for contracts from quality concious retailers, of which there are more and more every day.

High inventories also delay the identification of line imbalance and the subsequent elimination of those inefficiencies - which can account for up to 15% of the total cost of the product on a short run. High inventories also occupy valuable factory space that could be usedfor more producive purposes, eeping those-

In order to achieve lot size reduction, the physical configuration of machinery, the actual pattern of workflow and the organization of workers is being recast according to unit flow, "group" technology and "quality circle" principles. This means small lots of garments are assembled from start to finish by small groups of mulit-skilled workers.

Along with this change, operators are also increasingly being given responsibility for quality control, for making suggestions to improve efficiency and for planning their work schedule. If strict JIT principles are at work in the plant, groups are only expected to produce a given output per day - no more, no less. If the target level is reached before the end of the day, then the extra time is used for minor maintenance and problem solving, group consultations on the next day's schedule,etc. This time is not unproductive time, but productive time because it helps to improve overall manufacturing efficiency.

Increasingly, piece rates in the IACs are now perceived by some as actually hindering productivity, particularly when a JIT approach is being followed. Consequently, in some firms payment and incentive structures are being altered as well. Whereas before uniform piece rates were the norm, now the pay scales for individual workers go up

as they acquire additional skills through in-house training. At the same time, the basis for calculating payment is shifting from individual piece-work performance to the completed product performance of the group.

Individual examples abound. In Europe one of the first to adopt these ideas was Top-Print AB of Sweden; another was the Clayeux Group of France. In the U.K., Claremont, a large supplier to Marks and Spencers, has seen a regeneration in its fortunes and profitability due to a combination of the introduction of the new production methods and pre-assembly automation. It is now able to finish a garment in in eight hours compared to four weeks, it has the highest margins of all Marks and Spencers suppliers, and it has boosted its return on capital employed to over 50 percent. In the U.S., U.S. Shoe and Oxford Shirts have converted all their factories to this approach.

A Case Study from Brazil. We can give more details of how these ideas work in practice by discussing the case of a large Brazilian clothing firm, Alpergatas, producing footwear, shirts, jeans, pantsand textiles has generated outstanding results. The system put in place in Alpergatas works in the following manner. In each factory, operators are organized into groups who decide the quickest way (in terms of work allocation and line set up) to meet the day's production targets. Group size ranges from 14 to 22 people depending in the garment.

Cross training of operators is essential in this system. This is done within a family of operations - for each product there might be three or four families of operations. Within each family, different but related skills are required and the operators are intended to master them all. This allows them the flexibility needed to move back and forth between tasks and work stations to ensure line balance.

This cross training is linked to each employee's base rate so there is incentive to learn more than one task - the more skills that are mastered, the higher the base rate. The pay rate for each operator is determined by the productivity of each group - providing

an additional incentive for the group to work together. When unit performance reaches 110% of the day's goal, each operator gets paid for the number of hours worked times 110% of her base rate. Importantly, each production unit only gets paid for quality work so each operative is very quality concious.

Another important feature of the approach adopted by Alpergatas is the circular configuration of workstations. This allows work to be passed from one workstation to the next without indirect labour. It is the responsibility of each operator needing work to reach back to the preceeding operator to collect just finished work.

So far the benefits accruing to the firms from its adoption of JIT methods are impressive. Firstly, the firm is more flexible than previously. When a change is necessary in the product mix or in fabric or thread type, the whole line need not be changed over - only one or a few groups may be involved.

Second, excess work-in-progress has been eliminated. The overall cycle time is down from weeks to days, and from days to weeks. Workplace engineering is not required because products are assembled within two days or less of coming out of the cutting room. The average throughput time is now 2 days.

Third, productivity has increased enormously. Before the system was introduced, the output per worker was approximately 1½ shirts per day. Now the average is 3½ shirts per day and management is confident that it can reach 6½ per day on average - with no additional investment in labour saving machinery. Finally, there have also been significant workspace savings. Before introduction, each woirkstation used to occupy 70-80 sq.ft. of factory space. Today that figure has been reduced to 30 sq.ft. per workstation.

A Slow Process of Diffusion - except in Japan. The above examples notwithstanding, compared with their uptake of the new forms of buyer-supplier relations discussed in the first part of this section IAC clothing firms are moving even more more slowly to adopt the new approaches to production organization.

In Japan, not surprisingly, the story is different. At the beginning of the 1980s, Japanese clothing firms began applying JIT principles to their operations and Toyota developed the "Toyota Sewing System" to support these efforts. This system has all of the above features - U-shaped production line; rapid changeovers, low WIP; high degree of operator involvement and collective responsibility.

This approach to the management of production is combined with some innovative, but inexpensive and non-computerized, equipment designed to allow the operator to stand while working and to operate 2-3 machines at a time. For example, twin needle sewing machines can have different colours of thread and operated independently so that the frequency of thread changing is reduced and one machine can carry out pocket sewing and marker sewing (with different threads) continuously. Alternatively, a rotating sewing table can be mounted with a lockstitch machine in front and an overlock stitch machine inback so the operator can choose which to use according to task; a pressing table can be mounted on the side so that overlocking, seam pressing and sewing can be done continuously. Finally the whole set of machines and tables are modular in design and movable as well so they can be easily reconfigured and linked together to allow for different products.

Interestingly, the Toyota System was introduced at a time when the focus was still on developing dedicated machinery to allow the full cycle automation of single tasks in high volume. The success of the Toyota System in Japan - 100s of Japanese clothing firms, large and small now use the system - has begun to attract other suppliers into the market. Juki is now producing this equipment in a modular form, as is Rimoldi of Italy and SPP of Sweden.

Clearly a momentum is building up towards the wider adoption of these practices in IAC firms. Many articles are beginning to appear inthe trade press discussing the concept of JIT of "modular manufacturing" as it is also called. And as we have seen, some IAC

firms are already using the new approaches and by their example, spurring others in the same direction.

We expect the process of diffusion in the clothing sector will very much follow that of the adoption of JIT in other manufacturing sectors. The process will be slow for some time as firm management comes to grip with what the new approaches actually imply - both interms of change and in terms of improvements in profitiability and productivity. However as in other sectors, the momentum will build until there is a literal "frenzy of adoption" as is now occurring elsewhere.

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In this section we have outlined the emergence of two profoundly different approaches to standard practice in the clothing industry. - new forms of buyer-supplier relation based on trust and co-operation; and new approaches to the organization of production within the firm. Two things stand out about these organizational innovations. First, they clearly allow firms to develop their competitive advantages in a way that is currently being demanded by the market calling for rapid response, higher quality, and more variety. There can be no doubt that under the new conditions of competition in the international market, they stand out as a moe attractive alternative than the standard mass produciton model.

Second, nevertheless, despite these attractions, the diffusion of these ideas - though gaining speed - is still very slow among IAC firms. This has less to do with their implications for profitability than with the simple fact that clothing factory managers find it very difficult to cope with the very different "perspective" and way of thinkiing about production that is required to introduce these changes. In short the obstacles to diffusion in the IACs are neither technical nor economic but are rooted in human nature.

The implications of this situation for Indonesia are both challenging and intriguing and we explore them further in the final part of this paper.

Section 4: SMALL FIRM CO-OPERATION: A NEW STRUCTURAL MODEL

As mentioned in the Introduction, one of the standout success stories of the international textile and clothing industry during the 1980s has been the rise of Italy as a world power in terms of production and exports. In only ten years, the industry's turnover has risen in real terms by 35% while real exports have grown by a staggering 211% Italy's net export surplus in textiles and clothing in 1986 was an astonishing $9 billion as a result of being first in clothing ($6,4 bn in surplus) and a close second in textiles to China (with $2,59 bn).

The country is the largest exporter of knitwear, menswear and ladies wear in the world - with weel over 50% of all production exported in all areas, and with exports heavily concentrated in three of the most demanding fashion and price sensitive markets in the world - France, West Germany and the U.S. Indeed it is largely due to the success of the Italians, that the overall composition of imports into EC countires has been shifting towards higher value-added IAC products as opposed to developing country products in recent years, for example, in the U.K. the share of developing countries in U.K. imports fell from 45,7 % in 1980 to 38,9% in 1985 while that of the EEC and Western Europe rose from 26,2% to 36,2%, with the imports concentrated at the upper end of the market where quality and design count for more than price alone.

As a result of this performance, the Italian textile and clothing sector occupies a more important position relative to the total economy than in any other major IAC. Employment in 1986 was about 880,000 workers or 13% of manufacturing employment (compared to 9-10% in other EC countries); industry sales accounted for 10 per cent of GNP; exports accounted for an enormous 21% of all manufacturing

exports, with imports coming to less than 10% of total imports. This is a truly notable accomplishment since the sector has long been considered to be in decline in IACs generally. Yet the expansion of Italian exports came at time when the textile-clothing industry in some IACs such as the U.K. and U.S. was in dire trouble due to low cost imports.

The keys to the Italian success in textile and clothing are to be found at three levels. The first is the presence of a set of intangible characteristics such as design and marketing "flair", a willingness to absorb new technology, a spirit of entrepreneurship a culture well suited to running a fashion oriented business, such as the ability to anticipate changing lifestyles.

The second, as discussed in Section I, was the coincedental emergence of a structure of demand in the major clothes consuming countries that was biased in favour of design, quality and variety - precisely the qualities that the Italian industry was able to provide.

The third and most important factor in our view was the development of a unique industry structure that facilitated the production of clothes with a high design content; extreme flexibility (Italian firms can deliver garments in under two weeks even at the busiest time of the season) and strong price competitiveness.

The unusual industry structure responsible for this competitive capacity features close links between retailers and small producers - as in the Benneton case - but also an extensive degree of regional co-operation between small producers, who in other countries might normally expected to be fierce competitors. Finally, there has also been an unusually high degree of co-operation between regional governments and groups of small firms working together in the way described below.

What is particularly striking about the structure of the Italian industry (and of interest we would suggest to Indonesia) is the overwhelming dominance of small firms. The average size of Italian clothing firms is only 5.3 employees, much smaller than the average in OECD and NIC firms. Table 4 which compares the structure of the Italian and West German knitting industries demonstrates this well.

Interestingly, many of the small firms came into being either as a result of the earlier and deliberate "deverticalization" of larger Italian firms who were replaced by smaller firms specializing by products or processes; or by the efforts of larger groups such as Bennetton to conciously promote the development of small firms. This structural shift comes through clearly in Table 5.

Industrial Districts

These small firms gain considerable benefit from their regional concentration in particular states, cities or industrial districts. Emila Romagna (part of the so-called "Third Italy") is a state in the central North-East of Italy whose industrial development has been based on small firms (ninety percent of the regions firms employ fewer than 99 people). The region (with a workforce of only 1.7 million people) had a GNP of $43.5 billion in 1985 and accounted for 10.2 percent of all Italy's manufactured exports in 1986.

Emilia-Romagna is the home of some of the most notable industrial districts specializing in clothing. An industrial district is a system of hundreds of firms located in a relatively small area, producing the same kind of product. There is one such district in Carpi, for example, (at the center of Emilia-Romagna) which is a town of around 31,000 people. The Carpi industrial district specializes in knitwear (and accounts 25% of national output) with 2500 small firms

employing around 15,000 workers. Each firm specializes in one or a few phases of knitwear production or in related sectors producing complimentary products for the mother industry.

In Carpi, as in other clothing industrial districts such as Modena (also knitting), Prato (woolen clothes), Biela (worsted),and Como (silk), each small firm is specialized in one or a few phases of production with the structure commonly broken down as follows:

- final firms that face the final market selling to wholesalers, department stores, importers and foreign buyers. These are small firms (10 to 50 employees) who purchase raw materials, do design, styling and sample preparation as well as organizing and controlling subcontracted work. Some have long lead times but many operate on a JIT basis, producing models upon request by importers who observe the pattern of sales in their markets and then expect the final firm to deliver within one month. These firms are frequently the critical organizing force within the district and they sit at the centre of a set of relationships that serves to expand know-how and link foreign demand with local production.

- subcontractors who work for final firms and carry out one part or a phase of production, or even co-ordinate other subcontractors. These would either produce the cloth (often in small lots of between 500 to 2000 yds) cutting thepieces, assemble a whole gament or a sub-assembly, or do either embroidery, ironing, finishing or packaging.

- complementary firms involved in forward or backward linkages to final firms or subcontractors and supplying containers, labels, transport and small items of machinery and machinery attachments.

Consortzia and Collective Services

Within the industrial districts, the small firms have overcome the alleged disadvantages of scale by coming together and formally setting up a wide variety of co-operative associations - termed *consortzia* in Italy - which essentially undertake the activities normally carried out by the head office in a larger firm or sometimes

by the final firm if it is big enough. Small firms, because of size and financial constraints, are typically unable to effectively carry out activities such as the development of their own designs, fashion forecasting, market research, training and technological development - activities often critical to maintaining market position. They also suffer from limited purchasing powers and from a limited capacity to undertake large orders.

Small Italian clothing and textile firms have evolved specialized consortzia to deal with all of these activities - and others. For example, individual firm members of a consortzia (The Centro Dati Abbligliamento) in the Modena district often share out orders among themselves that previously they would have had to turn down. Over 400 firms are registered with a data bank kept by the co-operative. A firm that wants to subcontract work, provides to the co-operative details of the work it wants done and within a few hours it receives a list of addresses of firms able to carry out the work. In 4 years (1984-87), the Centro successfully organized 1465 subcontracts.

Another similar example from the Carpi district is "Video Moda", set up in 1986 to connect wholesalers, department stores, importers and small firms. Its aim was to reduce the search costs facing the many buyers and 100s of suppliers in the district. At Video Moda, in addition to getting a comprehensive listing and description of wholesalers and producers in the district, a buyer can view slides of the smaples produced by different firms before deciding which to visit. The service is free to buyers as it is paid for by the associated firms

There are even consortzia that deal with straight forward accounting and financial matters. One consortzia in Biela provides accounting, payroll and tax services for its members. In another case, one co-operative in the Carpi district was set up to guarantee

the bank loans of its members. Each loan application is vetted by a committee composed of factory owners who are far more expert in assessing the viability of the loan than any bank official. Once approved the application is passed onto the bank.

This approach has been remarkably successful. The failure rate has been slashed from the Italian average of 7% to .003%; and because the commercial banks were so delighted with this they have cut four percentage points off the prime interest rate on the loans made to this consortzia.

The consortzia are typically financed and run by the firms themselves with the staffing requirements being met either directly through secondment or by hiring full time employees - the advantage of the latter approach being that collectively the firms can both afford to hire expert personnel and their involvement in selection means they will ensure the competence of the people hired.

As noted above, however, in many cases, regional or city governments (rarely the national government) have played a key role in providing "seed money" for the project to get off the ground - but always with the proviso that the firms themselves must actually run the consortzia and take over its financing.

Innovative Support from Regional Governments

The role played by regional governments in the establishment and support of consortzia in Italy has often been critical to their long trm success. The various modes of collaboration and supoort that have been developed have in effect defined a new model for public sector-industry collaboration. In Italy, regional government has supported the efforts of industrialists to provide the necessary inputs through

their own consortizia - rather than the state taking on the role of providing these inputs directly.

It has also funded training schemes and established industrial estates providing facilities at reasonable rents that are insulated from speculative investment. Municipal government too has encouraged co-ordination between firms and the ironing out of interruptions wherever public authorities are involved. Incentives are given to export and financial consortzia and to industrial resource centres.

Among the many examples is the establishment of CITER, an industrial service center for the Carpi knitting District established in 1980 as a limited liability company with the support of private firms, ERVET (the Emilia Romagna Regional Development Corporation), the Artisanal Federation and the Industrial Federation. Initially started with 100 member companies and now with 500 members (80% of which produce for their own trade names), CITER is now 80% self financed. The Center does not offer consultancy serices but rather works for the sector by furnishing information via a staff of ten and a network of consultants. Three services are offered:

- the supply of fashion-related information and forecasts on trends, colours, materials and styles;

- the supply of commercial information about market trends in consumer tastes nationally and internationally;

- and the supply of technology related information to allow firms to evaluate new materials and equipment.

CITER is one of a series of hihgly successful industry specific service centers established by ERVET, which also include centers for the shoe firms in Rimini, for agricutltural machinery firms in Reggio Emilia, and for construction firms and mechanical and metalworking firms in the region.

The ERVET strategy in creating these network centers is first to ensure that ERVET always plays a prmotional rcle rather than an operational role; second to ensure that the identification of the services needed and the design and operating of the center is the result of collaboration between member firms; and three to ensure that the centers are manned by highly competent staff who are recognized as professionals and therefore able to offer the member firm a valuable service.

A different type of support is provided by the City of Modena who started building "artisanal" villages in the late 1950s in response to major layoffs by large industrial firms including textile and clothing firms. The first was built to provide homes and workshops for 74 metalworking firms. Subsequently an additional nine mini-industrial estates (including factories, cafeterias and sports fields) were built to accomodate 1200 businesses and 7000 workers (35% of which are involved in the textile-clothing sector).

The City provided the engineering, architectural and design inputs (for modular, prefabricated, concrete structures that can be as small as 1500 square feet); and worked with business organizations to organize small firms into consortzia to carry out the building projects. Land is leased to firms for a renewable 60 year term. This approach to development and the use of standard buildings means these projects result in accomodation being made availble to the entrepreneur at only 50% of average market prices.

The Net Effect. As noted above, the competitive advantages offered by these small firm-related structural features have catapulted Italy in the space of 10 years into a position of world leader in textile and clothing exports. Surprisingly, in many subsegments of the clothing industry these small firm consortzia account for a astoundingly high degree of world exports - 34% of

footwear; 35% of leather handbags; 21% of mens suits; 35% of knitted pullovers.

This is a remarkable feat considering that wage costs per direct employee (including social costs) are nearly twice those in the U.K., four times those in Hong Kong and twenty times those in countries such as Sri Lanka. What is also remarkable is that other segments of Italian industry such as agricultural machinery, furniture and ceramics are organized along the same lines as the textile industry - small firms operating in co-operatives with regional government support - and enjoy similar shares of the world market - 56.3% in the case of ceramics and 21% in the case of chairs.

Interestingly, the same or similar features are found not only in other segments of Italian industry as mentioned above but also in parts of Germany, Denmark and in the textile and clothing industry in Japan (which also as noted earlier features the use of JIT principles in the intra-firm organization of production.

Small Firm Collaboration in Japan

Here, the *keritsu* system which throughout the manufacturing sector in Japan binds different segments of the industry together is very much in evidence in the textile-garments sector. The chain extends from the spinner who provides the yarn, through weaving and knitting, to the cloth wholesaler or apparel manufacturer who buys the fabric, produces finished goods and sends them on to the retailer.

Big firms are involved at the retail, fiber making and spinning stages but weaving and knitting is done mostly in small family-run firms, with no more than 20 looms, two or three employees and a few family member workers. In addition , the weaving stage is typically split up into separate enterprises, with specialist beamers, sizers,

texturizers, yarn and cloth dyers as well as weavers who run the looms. These small scale weavers can typically produce runs of 3,000 yards of yarn-dyed cotton fabric for exports and 1,000 yards for the homemarket - all at competitive prices despite wages ten percent above the U.S. average.

What makes the system work is, as in the case of the Italian consortzia, someone to organize it. Sometimes this is a large trading company or more often an intermediary who does purchasing and selling on behalf of the smaller members of the kerietsu. In the early 1980s, only 20 percent of Japan's cotton and cotton blend cloth was made by weavers who were free to buy yarn on the open market; at the other end, 75 percent of small firms sell their fabric to a single purchaser; while most garment firms make 70 percent of their fabric purchases from no more than three suppliers. The advantage is security - selling yarn cloth and garments on the open market might bring a slightly higher price but the *kereitsu* ties ensure that the firm sells all that it can make.

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The structural features of the Italian (and Japanese) clothing and textile industry - but particularly the collaborative effforts between small firms and the promotional role of goverment - represents a fundamental break with the mass production model followed by other western firms; a model that is, not surprisingly, also followed by most textile and clothing firms in countries such as Indonesia. However, there are also in Indonesia certain structural characteristics - like a preponderance of small firms and the existence of a strong network of subcontracters that suggests that efforts to transplant these ideas might well find a more fertile ground than would at first glance be expected.