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THE TECHNO-ECONOMIC PARADIGM, INTER-FIRM LINKAGES AND NEW MANUFACTURING TECHNOLOGIES: THE IMPLICATIONS FOR CONTRACT MANUFACTURING RELATIONSHIPS FOR DEVELOPING COUNTRIES

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I. INTRODUCTION

The global economy is undergoing a fundamental change that presents both threats and opportunities for developing countries. The process is shaped by three concurrent forces: the globalization of manufacturing, which has integrated national markets and increased the level of global competition; the development of new types of manufacturing technology geared to produce specialized products in small lots as opposed to high volume production of standard products; and the emergence of powerful regional and sub-regional trading groups based on increasingly protectionist trade policies, particularly in the areas of technology and intellectual property (Ernst and O'Connor 1989).

Within this context, the need for developing countries to participate more productively in international markets has become a more critical and complex challenge than ever before. In response, many of these countries, including Brazil, Mexico, Tunisia and others, are fundamentally altering their institutional and policy environments to liberalize their economies and increase their exposure to global and regional markets.

The reforms and the motivations underlying them vary greatly between countries but appear to stem from a common realization that since production and competition are global, economic isolation is tantamount to stagnation. But, by and large, most developing countries are still handicapped by their lack of technological capabilities and competitive industries, inadequacy of technical,

human and financial resources and weak infrastructures. These constraints continue to impede the development of efficient, well-managed, technically competent firms that could compete successfully in the global economy.

Developing countries have undertaken a variety of measures to gain entrance into global markets, including policy shifts toward liberalization of their economies, the creation of free trade zones and state intervention in the form of investment promotion councils, backward linkages programs aimed at increasing the integration of foreign direct investment in the local economy, and other initiatives. Lessons are being learned from the NICs regarding reverse engineering, strategic international alliances for technology transfer and international niche market development (Ernst and O'Connor 1989, Freeman and Perez 1988, Mody 1989).

All of these measures directly or indirectly imply a greater interaction between firms in the developing countries and developed countries, through joint ventures, technology transfer, sub-contracting and trade relations. Out of these, an increasingly common type of transaction is one in which developing country firms become suppliers of components or services to developed country buyers, generally under some form of contractual relationship.

Contract manufacturing has become an increasingly important avenue through which developing country firms can participate in global markets (Dahlman and Brimble 1990). By seeking out and entering into contractual arrangements with overseas buyers, some developing country firms have been able to profitably exploit their

low cost advantages and enter otherwise difficult markets. They have also often benefitted from contract manufacturing in terms of technological development resulting from these relationships. Contract manufacturing CM has been an important element in the development of many NICs, including Korea and Taiwan (Amsden 1985), and is being tried by other countries, including Mexico, Ireland, Singapore, the Dominican Republic, and Thailand, that are at varying stages of development and employ somewhat different policy approaches.

However, CM (contract manufacturing) relationships in the industrialized world are changing dramatically as a result of fundamental changes in the patterns of manufacturing and the emergence of a new techno-economic paradigm (Piore and Sabel 1984, Perez 1989, Freeman 1989) based on a new family of technologies relying on the principles of flexible specialization, the increasing pace of product and process modification and specialization, and new organizational structures and management practices. These developments are altering the nature of CM relationships worldwide, which, as we shall see, has reduced the leverage developing country supplier firms can gain from low wages and shifted the emphasis in production away from mass production toward more specialized products.

This paper is concerned with developing country contract manufacturing in this new global economic era. We shall address the following central question: What are the implications of the basic changes occurring in the precepts of manufacturing and productivity

in the global economy, along with the emergence of FMS (Flexible Manufacturing System) technologies, for the competitiveness and technological capabilities of developing country firms? We suggest that the new paradigm has important implications for inter-firm linkages in general, and for CM relationships in particular. Flexible Manufacturing Systems (FMS) based technologies offer developing country firms the prospect of achieving world class manufacturing standards in certain areas, and the vehicle of CM could facilitate the process. This paper seeks to identify specific implications for firm level actions as well as policy development in this respect.

In section II we will argue that the principles of manufacturing and management based on mass production are giving way in many industries to a new production paradigm that demands a redefinition of such essential concepts as efficiency and productivity, and which suggest new strategies for firm-level industrial development. In section III we briefly describe development strategies based on mass production and begin a discussion of new options presented by emerging technologies, management practices and interfirm relationships. In section IV and V, we will develop a framework for analysis of various types of interfirm relationships and discuss the implications of these variants for enhancing the competitiveness of developing country contract manufacturers under the new paradigm.

IIA. THE NEW TECHNO-ECONOMIC PARADIGM

The 1980s witnessed a change from a global industrial structure based on mass production to a fundamentally different approach that is altering intra-firm and inter-firm relationships in key industries throughout the world. The nature of the change has been described as a paradigm shift by several writers. Sabel (1986), for instance, defines the mass production paradigm as "the manufacture of standard products with specialized resources (narrowly-skilled workers and dedicated machines)." Within the firm, it is characterized by separation and specialization (Hoffman and Kaplinsky 1989, Hoffman 1989, Kaplinsky 1990), meaning tasks are segregated into discrete units (marketing, finance, operations, R&D, etc.). Inter-firm relationships are even more segregated and are dominated by price considerations as opposed to cooperation and quality assurance.

At the heart of the new paradigm is the new FMS (Flexible Manufacturing Systems) technology based on advances in microelectronics and composed of a series of semi-autonomous work-stations (as opposed to a single, large assembly line), connected by automated material handling systems, each of which can make a variety of parts at low or medium volume. One station encompasses almost an entire production process in co-existence with other stations within a larger plant (Jaikumar 1986). Sabel refers to this approach to production as "flexible specialization" and defines it as "the production of specialized products with general

resources (broadly skilled labor and universal, typically programmable machines)."

Compared to the mass production assembly line, in which all equipment and labor contribute to a single, high volume production process, FMS requires a redefinition of production and enterprise organization. FMS and mass production therefore cannot be effectively integrated into the same organization and for this reason may properly be considered alternative production paradigms.

Perez (1989) has developed a conceptual framework for examining these paradigmatic distinctions. She uses the term "techno-economic paradigm" (TEP) to describe the "guiding model for commercial technological advance." At any given moment, she writes, the full range of technical possibilities for production is far greater than the range of choices that actually find application in the marketplace. Factors that determine which technologies and applications become dominant, and which are shelved or never fully developed, include market forces, the organization of production, and the policy and institutional environment in which firms and markets operate. Each factor is related to and influenced by the others, such that economic policy decisions (i.e. local content requirements and tariff barriers) influence the range of available technological options[1]; the

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[1] See, for example, Dahlman and Brimble's analysis (1990) of the impact of protectionist policy on technological development in Thailand

introduction of FMS based on production automation likewise impacts the organization of production (Hoffman 1989).

The TEP concept attempts to account for the interrelationship between these factors and to partially explain the business cycle and the relative competitiveness of national economies and individual firms in terms of the degree to which economic players are synchronized with the trends that characterize the TEP at a given time. Within the TEP terms such as productivity, quality and efficiency are given their meaning and techniques for optimizing them are derived.

The TEP includes at least four elements:

1) the socio-institutional framework as determined by the set of national economic development policies and international trade policies that govern commercial behavior;
2) the current state of technology and the pace and direction in which it is changing;
3) the interrelationships between firms and between firms and markets that shape demand;
4) and the firm level environment, where management and labor respond to the constraints and opportunities created by the other three elements.

During extended periods of growth such as the 1950s and 1960s, Perez contends that the **socio-institutional framework** in a country is well matched to "the requirements of the wave of technical change that is shaping the economic sphere" (Perez 1985, 1989). The most promising production technologies fit and effectively

serve high-priority national development policies. For example, when the dominant "technological trajectory" of production process R&D is focused on more efficient production of standard products requiring progressively lower labor skills, and national policy emphasizes leveraging an abundance of low skilled labor to achieve an advantage in mass production, then such a "fit" exists. If, on the other hand, the thrust of new process development places a premium on the ability of skilled workers to control programmable production machines designed to make custom products in small lots, and national policy continues to favor de-skilling technologies for mass production, a mismatch results in which the policy framework "is not only unprepared to respond to the challenges and requirements of the new techno-economic paradigm, but, by continuing to apply the erstwhile successful recipes, acts in a counterproductive manner."

The current state of technology and the pace and prevailing direction of its change is therefore an essential element in development and demands an in-kind response from policy-makers. Product life-cycle theory (Vernon 1966) proposes that when a new technology is introduced, the innovator will attempt to maintain ownership for as long as possible, while imitators try to "design around" the protective patents or trade secrets (Teece 1988). During this phase, competition based on the new technology will be risky and expensive, as competing designs vie for dominance. Later, however, dominant designs will emerge and begin to take on commodity characteristics. Developing countries, the argument

goes, can wait out the early, risk-laden period and incorporate the new technology after it has been standardized and is easily available at a more or less set price.

By viewing technological development from a paradigmatic perspective, Perez is able to identify a much earlier, and potentially more fruitful stage for LDC incorporation of new technology that occurs during the period of "technological transition." At a given moment in time, she says, the most advanced producers will be "those who have made the fullest commitment to the prevailing paradigm," and who are therefore "bogged down by the weight of previously successful practices." Countries that have not been successful under the old paradigm will undergo a less severe period of adjustment, provided policy makers and firm managers can recognize a paradigm change when they see one, and accept the fundamental nature of the changes it brings.

Interrelationships between firms play a central role in the adaptations required by paradigm change. Adaptations by finished product manufacturers that are not supported by equivalent changes in supplier networks will practically eliminate the possibility of long-term productivity gains. In the same vein, the adaptation of new technology has economic value only if it is used to produce goods and services that meet market needs either more cheaply or more precisely than previously available technology.

At **the level of the firm**, these changes in institutions, technology and inter-firm relationships must be accounted for in

an over-arching managerial and operational strategy that optimizes their value to competitiveness.

In developing such a strategy, it must be recognized that at the firm level, the technological and managerial elements of a TEP are inextricably connected (Hoffman 1989). The scientific management principles of Taylor and Ford, for example, are based on the rationality of the mass production assembly line, which in turn is based on machinery designed to rapidly execute precisely repetitive assembly operations under the minimal control of low-skill labor, which optimizes Taylorite and Fordist concepts of efficiency.

At the firm level, the emergence of a new TEP is heralded by the increasing pressure on firms to alter both the tools of production and management practices. Change on one side that does not require qualitatively equal change on the other is, by definition, incremental change within a given paradigm. Such change could be of the type Dosi (1982) calls "movement along a techno-logical trajectory," such as a new technology within the mass production TEP that reduces the need for skilled labor by transferring the "skilled" operation to a machine that repetitively performs that single task. Indeed, the technology can properly be called "new" in that it did not exist before, but its impact on the organization of production and management is only to further the goals of that TEP, not to alter the TEP itself.

To facilitate an examination of the firm level implications of paradigm change, we will focus on the technological and

managerial elements of the TEP, which we suggest form the subset of the TEP that require an active response by individual firms to increase (or at least maintain) productivity, quality and other values in a period of paradigm change. We argue that paradigmatic changes now underway in technology and management have direct relevance for LDC firms using CM relationships as a strategy for improving productivity and competitiveness and that they offer LDC firms the possibility of enhanced participation in global markets. These changes must therefore be examined in some detail.

IIB. GLOBAL MANUFACTURING AND THE THEORY OF PARADIGMATIC CHANGE

In his "Structure of Scientific Revolutions" (1962), Kuhn contends that the advancement of scientific understanding in Western culture has not been an incremental process of gradually deepening knowledge based on the acquisition of data of progressively higher and more comprehensive quality (as most historians and philosophers of science had thought). Rather, he developed a theory of scientific progress founded on wrenching, revolutionary change of paradigm that destroys old theory to make room for new theory that owes little or nothing to the old.

Kuhn argues that at various points in the history of a scientific field, new information enters the knowledge base which is incompatible with the theory that adequately explained previous data. For example, the theory of uniform circular motion, which said that objects subjected to no external influences would move

in a circle, had for centuries explained the movement of celestial bodies satisfactorily; until Kepler, using the observational data meticulously collected by Tycho Brahe, determined that the path of Mars described an oval slightly off center of the sun. Kepler's finding could not be incorporated into existing theory as an incremental improvement because the finding and the theory were incommensurable.

However, the finding does not in itself represent a new paradigm. Kuhn calls the new observation an "anomaly," which will pester those who believe in existing theory, but which may, after further investigation, find its place within standard thinking. Nonetheless, the new data has, for the time being, cracked the bulkhead of that thinking, leading to what Kuhn calls a "paradigm crisis".

As the number of such anomalies grows over time, confidence in the paradigm will be increasingly shaken. But it will not be abandoned until a new one comes along to replace it: "Though [scientists] may begin to lose faith and then to consider alternatives, they do not renounce the paradigm that has led them into crisis. They do not, that is, treat anomalies as counter-instances... once it has achieved the status of paradigm, a scientific theory is declared invalid only if an alternate candidate is available to take its place." (Kuhn, 1970, p.77)

In the case of planetary motion, 17th century astronomers were unwilling to reject the tidy model of a perfectly balanced circle in favor of the seeming randomness of a skewed oval. After years

of painstaking work, Kepler developed a formula that related the period of planetary orbit to its apogee, or farthest point from the sun and demonstrated the validity of this relationship for all known planets. The anomaly of Mars' orbit was removed, in the sense that it now had a home in a larger body of data relating to all planetary motion, but so was the theory of uniform circular motion. Kepler's demonstration that uniform circular motion did not describe the orbit of planets, and that their true motion appeared to be reducible to mathematical formulas, eliminated the incommensurability and related all relevant data, but it did not go so far as to provide a new theory of motion. He cast serious doubt on existing theory without suggesting a replacement. Kuhn refers to this situation as "paradigm crisis," a period of uncertainty during which several alternative theories will compete for dominance. In the history of motion theory, the crisis continued for a generation, until Galileo proposed the theory of uniform rectilinear motion, which states that objects subjected to no external forces will move not in a circle, but in a straight line. Kuhn describes the process by which one theory is abandoned an another is adopted as a "scientific revolution." The old world view is not incrementally modified, but abandoned altogether in favor of the new paradigm.

To be sure, the fit between Kuhn's model and the emergence of new approaches to production is less than perfect. It is not our intention to suggest, for instance, that the emergence of flexible specialization necessarily means that mass production is dying out

altogether. Several MNCs, including Black & Decker, Hankel and Pepsico, have successfully increased product standardization and strengthened their global market positions, at least for the time being. For flexible manufacturing to be "right," in the sense that it is a valid new road to competitiveness, mass production need not be "wrong." Indeed, a central premise in Kuhn's thesis is that revolutions are necessary for scientific progress precisely because no single paradigm is ever entirely right or wrong. "To be accepted as a paradigm," he writes, "a theory must seem better than its competitors, but it need not, and in fact never does, explain all the facts with which it can be confronted" (Kuhn, 1970, p.17-18).

Kuhn uses the term "paradigm crisis" to describe the inevitable period of contention between old and new paradigms. Along the same line, Perez (1989) suggests that there will necessarily be "a significant overlap between the maturity phase of the prevailing paradigm and the infancy of the new." The analogous relationship between Kuhnian "paradigm crisis" and the state of modern manufacturing therefore allows us to build a framework that incorporates much of the current data and trend information related to global production, and it serves to underscore the fundamental nature of the changes taking place.

Several writers (Dosi 1982, 19[illegible]6, Teece 1988, Perez 1989) have borrowed the Kuhnian notion of paradigm to explain prevailing "theories" of competitiveness, including firm-specific behavior. Dosi (1986) develops the concepts of "technological trajectory" and

"technological paradigm" to explain industrial product development and R&D trends. Teece uses the term "design paradigm" to describe the emergence of the dominant design phase of the technology life cycle. Perez, as we have seen, used the term more broadly to describe the social, economic and technological environment in which firms operate. In some of these instances, the Kuhnian concept of paradigm, while providing a useful structure on which to build an argument, is perhaps used imprecisely in that a true Kuhnian paradigm represents something akin to a world view. A dominant design, for example, may be explicable within the context of paradigm, but it does not in itself constitute a paradigm[2]. However, this is not to suggest that the paradigm concept has no place in the analysis of production. In fact, Kuhn himself resorted to a manufacturing analogy to identify the moment when paradigm crisis occurs:

> "As in manufacture so in science - retooling is an extravagance to be reserved for the occasion that demands it. The significance of crises is the indication they provide that an occasion for retooling has arrived." (Kuhn, 1970, p.76)

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[2] The "design competition" phase of new product development can be considered a paradigm crisis only if the adoption of one design over another implies a fundamental shift in the nature of production or the structure of markets. Most design changes represent incremental changes within a paradigm. The microscope, for example, has been redesigned hundreds of times since its invention 300 years ago. Indeed, the earliest versions bear virtually no resemblance to modern electron microscopes. But all microscopes are in fact part of the same paradigm, which states that large scale phenomena are often the result of small scale interactions.

1. The Evidence of Paradigm Crisis

In global manufacturing, many industries exhibit "symptoms" of undergoing such a crisis. In the U.S., the development of efficient mass production had, by the 1960s, created the most robust economy the world had ever seen. Higher efficiencies meant higher volumes and lower cost per unit, which meant higher profits, higher wages and more jobs. Some of the wealth created by mass production went into capital investment pools for new venture development and R&D, which increased efficiency still further and created still more jobs. But during the 1970s, even the U.S. auto industry, the shining light of mass production, began losing market share, not just internationally but domestically as well, to Japanese and European manufacturers.

In reaction to the disruptions of the 1970s, U.S. automobile firms struggled for competitive advantage by globalizing the mass production model. They developed the "world car" strategy, producing a few models suited to all markets and containing a maximum number of common components. Component production was dispersed globally to take advantage of cheap labor and coordinated from a single central office. The deterioration of economies of scale as the foundation of competitiveness in the domestic market therefore led to the development of even greater, global economies of scale (Sabel 1986).

However, the increasing flow of new technologies such as semiconductors and high strength steels into the automobile

industry made it difficult to freeze designs to the extent required by a globalization strategy based on standardization. These new technologies and the product improvements they offered gradually forced even the major U.S. auto makers to pursue alternative strategies to some extent. But the massive sunken investment in plant and equipment built to produce standard automobiles made it difficult for them to incorporate low mileage engines and other market-savvy design changes as frequently as they were becoming available.

In an environment dominated by mass production, functions vital to innovation, such as finance, marketing, design and operations, are organized into discrete departmental units. Innovation at any stage of production inevitably involves some units more than others, even though the complete and efficient exploitation of the innovation usually requires some degree of adaptation by all of them.

Marketing departments, for example, typically have closer contact with customers than manufacturing engineers. Marketing people are therefore in a position to identify product modifications to better suit customer needs, but lack the detailed understanding of their firm's manufacturing capabilities that are necessary to translate the needs into design specifications.

Design for Manufacturability and Assembly (DFMA) strategies developed by Boothroyd and Dewhurst in the early 1980s represent an effort to bridge a similar gap between designers and

manufacturers.[3] When the entire chain of production is viewed as a whole, it is clear that an innovation at the design stage can enhance competitiveness only to the extent that the innovation can actually be incorporated at the manufacturing stage and be successful in the marketplace.

Kaplinsky (1989, 1990) suggests that the functional segregation that characterizes the mass production paradigm slows the innovation process so that it does not keep pace with the proliferation of options made possible by the rapid advance in new product and process technologies. In other words, the technological and organizational elements of the TEP are out of synch.

The loss of market share and the inability of mass production manufacturers to keep up with technological change can be viewed as Kuhnian anomalies, in that the ability of mass production to capture markets and promote technological advances were historically its essential strengths. The onset of its failure to

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[3] DFMA consists of design guidelines and CAD programs that emphasize ease of assembly during the design phase of product development or modification. The use of screws, for example, is discouraged in favor of snap together parts wherever such a switch is possible; likewise, the designer is steered away from parts or connectors that must be custom machined or molded toward sizes, shapes and materials that are in stock or readily available. The designer can implement the guidelines even at the earliest, most conceptual stages of product development, which shifts the focus away from the creation of a prototype that may or may not be easily manufactured, toward a design that minimizes the number of parts and maximizes ease of assembly. DFMA therefore incorporates the goals of the designer to produce products that perform well with those of the manufacturing engineer, who seeks to assemble the product as cheaply and efficiently as possible.

do so cannot be explained within the mass production TEP, yet this failure undeniably existed. But in the absence of an acceptable alternative to mass production, the range of options pursued by the U.S. automakers remained within the mass production TEP.

By the 1980s, the success of more flexible manufacturing strategies, which achieved their fullest development in Japan, had to be acknowledged. But like the Copernicans, who were disturbed but not converted by the elliptical orbit of Mars, manufacturers still wedded to mass production could attempt to graft more flexible tactics on to mass production strategies and continue to be successful, for a time.

According to Jaikumar (1986), flexible manufacturing systems, as implemented in the U.S., show "an astonishing lack of flexibility." Even when the equipment is largely the same as that found in genuinely flexible organizations, management is not. Based on his study comparing U.S. and Japanese machine tool firms, Jaikumar[4] claims that U.S. plants produce an order-of-magnitude less variety of parts. For every new part introduced in the U.S. in 1986, 22 new parts were introduced in Japan; and while the average annual volume per part in the U.S. was 1,727, it was only 258 in Japan. The source of the discrepancies, according to Jaikumar, is that U.S. firms have adopted FMS as a means to mass

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[4] Jaikumar (1986) examined the implementation of FMS in 95 machining facilities in the U.S. and Japan, which was more than half of all FMS plants in operation at the time.

produce a few parts rather than small lot production of a variety of parts at low cost per unit.

The critical point here is not whether small lot production of specialized parts is "better" than mass production of standardized parts in any absolute sense, but that essentially flexible manufacturing technology is being grafted on to production facilities in the U.S. that otherwise remain dedicated to the mass production idea. The result is an incompatibility of production capabilities and management strategy, causing both to be less than fully realized.

In the U.S., Jaikumar wrote, "Management treated FMS as if it were just another set of machines for high volume, standardized production - which is precisely what it is not. Captive to old-fashioned Taylorism and its principles of scientific management, these executives separated the establishment of procedures from their execution, replaced skilled blue-collar machinists with trained operators, and emphasized machine uptime and productivity. In short, they mastered narrow-purpose production on expensive FMS technology designed for high-powered, flexible usage." (Jaikumar, 1986, p. 71)

In other words, the U.S. firms converted to the new TEP in terms of technology, but not in terms of management. One important result of the disharmony is that the average utilization rate of FMS technology in the U.S. plants was only 52%, while the figure for Japan was 84%. In contrast to U.S. machine shops, the Japanese saw FMS not as an incremental improvement in mass production

technology but as an element in a new production paradigm based on product flexibility and customer focus, necessarily connected to a complementary organizational structure in which flexibility played an equally important role.

The differences in the U.S. and Japanese approaches to FMS therefore extended beyond mass vs. batch production. Japanese plants had an average of 2 1/2 times as many CNC machines and four times as many people trained to use them. Operators on the shop floor were qualified and empowered to make programming changes to the system and even to write new programs.

In mass production regimes, firms gain competitive advantage by achieving the market share required to maximize economies of scale. In a true FMS production environment, the key to competitive success is not sheer volume but the ability of a firm to identify and respond quickly to the changing needs of specialized markets. Management's role in the flexible enterprise, Jaikumar suggests, is primarily to "create and nurture the project teams whose intellectual capabilities produce competitive advantage" by identifying new customer needs and designing and manufacturing to meet them.

This mission for management conflicts fundamentally with the Taylorite or Fordist view of the world, leading to what Jaikumar calls a "new managerial ethos," but which we prefer to see as the emergence of a managerial theory of the new TEP, within which the very concept of economy of scale must be reevaluated. Jaikumar's study indicates that competitive production efficiencies are

achievable in a single work-station of about six machines and even fewer people. "The critical ingredient here is nothing other than the competence of a small group of people," Jaikumar wrote. "The behemoth is gone."

2. The Dimensions of the New Techno-Economic Paradigm

Sabel identifies two major new trends in managerial strategy resulting from the shift from mass production to what he calls "flexible specialization": one based on Japanese mass production practices, or kanban, and a second focusing on marketing that emphasizes product specialization instead of price as the primary competitive tool. Each of these trends is central to the managerial foundation of the new TEP. They have the characteristics of a new paradigm in that they represent a new way of looking at management that demands an almost ground-up reevaluation of manufacturing operations, firm organization, and interfirm relationships.

Kanban production integrates suppliers more closely into the manufacturer's design and assembly operations and requires that all workers be trained and empowered to spot and eliminate defects. It is a strategy designed to reduce in-process inventory and waste, and increase product quality and the speed with which new products incorporating features based on new technologies can be introduced.

According to the second strategy, the goal of the organization shifts from producing standard goods at lower cost to producing specialized goods that meet the needs of particular markets better than standard products. Where a firm once looked at a large group

of customers and saw one market, it will now see many smaller, related markets. The products required to serve them are similar, but differences are great enough that tailoring of basic products could provide the decisive competitive advantage.

IIIA. DEVELOPMENT STRATEGIES UNDER THE MASS PRODUCTION PARADIGM

Gerschenkron (1972) argues that the later a country enters into direct competition with the industrialized world, the more likely it is to require capital investments that are beyond the capacity of its private sector, requiring direct, "tutelary" support by the state.

This premise acted as the guiding principle for economic development policy in 1970s. Government subsidies and restrictive trade practices such as import substitution requirements were designed to protect emerging industries in LDCs from direct competition with the manufacturing giants of the developed world while the LDCs went through a "limited" period of adjustment to acquire the technical and managerial competencies and the pools of capital necessary to protect their domestic market shares under more liberal trade regimes, and perhaps even to penetrate foreign markets with their own high value-added exports.

The failure of this state-sponsored development scheme can be attributed in part to the state itself; primarily its borrowing and protectionist policies, which made these countries hypersensitive to recession and which shielded firms from the stimulation of free

competition. However, the failure may also be the result of the high priority given to mass production in virtually all development strategies, the socio-economic element of the TEP. Evenson (1990) suggests that investment in infrastructure and capital formation has been approximately as high in countries that have failed to industrialize as it has been in those that have succeeded. This suggests that the problem with development strategies is not in their implementation but in the paradigmatic assumptions underlying them. The failure may not be in the inability of LDCs to compete in mass production, but in their attempt to do so in the first place.

In their analysis of World Bank development strategy during the 70s and 80s, Broad and Cavanagh (1988) argue that the Bank assumed that NICs such as Taiwan, South Korea and Brazil would progress along economic lines similar to those of the West, moving from basic, unskilled labor-intensive industries such as textiles into more advanced processing operations with a higher value-added. The abandoned industries would then fall to LDCs such as the Philippines, Colombia and Pakistan, which would face little competition from stronger economies. However, the NICs did not leave off basic manufacturing and in fact increased production significantly in these areas.[5] Low value added subassembly

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[5] Between 1979 and 1985, for example, Broad and Cavanagh report that textile exports from Hong Kong, Singapore, South Korea and Taiwan rose by 60 percent. Hong Kong exports of footwear doubled during the same period and the value of Korean toy exports more than doubled.

processes were exported, but the LDCs seeking to enter or expand these sectors found they faced heated competition, which put strong downward pressure on local wage structures and export prices, and forced many governments greatly to increase financial incentives to attract MNC assembly operations. The result, they argue, was not economic development, but labor repression, exploitation and a loss of fair tax revenues.

At the heart of Bank policy was the assumption that "LDC" and "NIC" status are stages in the evolutionary development of nations, with each country moving through a sequence of historical epochs on the road to "Industrialized" status. The assumption ignored the deep economic and technological changes that took place between the period of ascendance of the Asian NICs and the present, which altered the nature of industrialization. Broad and Cavanagh point out that, in the 60s, the then emerging NICs of Asia received complete industrial processes for the mass manufacture of ships, machinery and other products, while emerging NICs such as the Philippines and Mexico have typically been able to win only low value-added sub-assembly operations in such industries as consumer electronics and textiles.

In essence, the Bank's assumption failed to account for the fact that changes in production that occurred in the intervening years were paradigmatic. It therefore believed that basic principles of industrial development that held a generation ago still held. In fact, the industries that developed in Taiwan or Korea two decades ago were based on mass production. What

developed were therefore large, labor intensive plants. Today, however, production technology, particularly as it is used in the U.S. and Europe, makes it far easier to break out small, low value-added steps in the overall production process and relocate them into a country with an abundance of low skilled, low wage workers.

The last 20 or 30 years have also witnessed a great increase in the number of artificial materials that substitute for LDC raw materials, and labor saving technology that decrease the leverage an LDC can gain even from low wages.

IIIB. DEVELOPMENT STRATEGIES UNDER THE NEW TECHNO-ECONOMIC PARADIGM

On the surface, it may appear that the possibility of dissecting production processes and relocating only the low value-added sub-processes to developing countries makes the potential for Third World economic development more difficult than ever. However, when the broader ramifications of flexible specialization are considered, there is perhaps good reason for optimism.

First, Jaikumar's analysis reveals that economies of scale are achievable in a far smaller enterprise if FMS is properly used. Efficient production using state of the art technology can therefore be achieved, in many cases, within an almost exclusively domestic market context. Export markets can then be pursued because the products are world-class, not because efficient

production must necessarily outstrip local demand. The theory, founded on the mass production model, that efficiencies necessary to reach product standards that are competitive in export markets require massive infusion of capital by the state (Gerschenkron 1972), may no longer hold. The growth of the debt burden of developing countries could be slowed and the need for stifling protectionist trade policies further reduced.

Second, investment in flexible specialization systems is cost-effective. A single work-station properly manned can produce a variety of parts for a number of niche markets, and reprogramming of the equipment allows firms to modify products quickly without major new investment. Further, the management practices needed to achieve flexible production efficiencies are not costly in themselves. They are simply a way of thinking that can be acquired from consultants, seminars, journals or through close contractual relationships with sophisticated manufacturers of the kanban type (Hoffman 1989).

Third, the closeness of relationships between manufacturers and suppliers enhances the transfer of technology and management know-how, which offers LDC supplier firms a better opportunity to acquire the equipment and learning-by-doing that will make them globally competitive. If Jaikumar is right in stating that "intellectual capabilities produce competitive advantage" more so in flexible manufacturing than in mass production, then the potential benefits of technology and know-how transfer to the developing world holds more promise than ever before.

As industrialized nations more fully adopt the principles of flexible manufacturing, the definition of industrial progress and even of "development" will have to change. The potential for development in many countries that have struggled with mass production may become far greater in a world that sees flexibility, not gross production volume, as the essential measure of a firm. Sabel puts it thus:

> "...in light of the principles of flexible specialization, the traditional communities, numerous small firms, and seeming inefficiencies of large plants in third-world countries could turn out to facilitate, not obstruct economic progress." (Sabel, 1986, p.44)

When prevailing business principles assume that the efficiency of a firm will increase with production volume and the substitution of automatic, inflexible machines for skilled labor, economic development becomes an effort to acquire the largest possible production capacities. Flexibility, however, opens up another road to economic progress. Sabel writes: "Successful examples of flexible specialization in the first world and the growth in demand for semi-customized goods which success would encourage could well lead third world countries to experiment with the new model of industrialization in their own economies. Instead of competing with each other in a desperate struggle to conquer first world markets for mass produced goods...at least some developing countries could turn to the production by efficient methods of products truly suit-ed to their own and their neighbors' needs." (Sabel, 1986, p. 45)

In Latin America, for example, the effort to compete in mass production has left several countries with production capacities far too large for their own markets. Further development along these lines is not likely because the growth of large manufacturing firms has not been supported by the development of equally sophisticated suppliers. This has left the large firms saddled with having to develop and maintain the technological and managerial capabilities for the entire production process (Katz, 1982). The result is that many Latin American firms have become inefficient producers of goods that must find customers in export markets, in direct competition with the world's most sophisticated, specialized producers.

IV. FORMS OF CONTRACT MANUFACTURING (CM) RELATIONSHIPS

Kaplinsky (1990) describes the nature of inter-firm relations based on mass production as essentially "arms length negotiations" between buyers and sellers. Since mass production places a high value on standardization, price is the central criterion when selecting suppliers. Finished product manufacturers maintain large, shifting networks of potential suppliers, using more than one supplier for each outsourced product, to preserve price competition. The relationship between buyers and sellers is therefore inherently unstable. Finished product manufacturers typically select suppliers using a process of competitive bidding and seek to keep the relationship with suppliers short-term, often

extending only to the completion of a single purchase order, so they can switch suppliers easily if another provider offers a better price. The tenuousness of the relationship does not permit close cooperation between buyers and suppliers, so that suppliers have no incentive to invest in equipment or skills development to produce components more tailored to the needs of the buyer. At the same time, buyers are reluctant to provide the supplier with details of product design or to encourage the supplier to develop components that would improve their finished products, but which the supplier could also sell to the buyer's competitors.

However, modern production has reached such a level of complexity - in terms of the technical content of the finished products as well as the processes by which they are made - that few if any individual firms, regardless of size, can cost-effectively incorporate the full range of capabilities needed to produce competitive products and remain at the forefront of innovation (Nelson and Winter). Here again, we see an incompatibility between the technological forces of the new TEP and the organizational practices of the old (in this case, the organization of inter-firm relationships).

To bring organizational practices into line with the competitive demands of the new technological and market forces requiring increasing product sophistication and specialization, a new organization model has evolved based on greater functional integration within firms and closer relationships between firms, concepts which owe a great deal to modern Japanese business

structures (Sabel 1986, Ikeda (no date), Hoffman 1989, Perez 1989). Major manufacturing firms are increasingly becoming "sub-system integrators" (Kaplinsky 1990), which requires a closely knit network of buyers and suppliers with long-term, perhaps even exclusive contractual relationships that encourage the pooling of technological resources and know-how, cooperation to improve productivity, and the exchange of detailed design plans and even proprietary information.

Not only do these inter-firm linkages enable finished product and component manufacturers to collectively enhance innovation and competitiveness, they also promote the high level of cooperation necessary for other aspects of the emerging production paradigm, such as JIT, which requires tightly scheduled, frequent deliveries - in precise quantities - between buyers and sellers, and close inter-firm cooperation in the development of specifications and quality assurance procedures. In the developing country context, the emerging inter-firm relationships offer the possibility of far greater technology transfer and other opportunities to improve competitiveness.

Sabel identifies three "basic variants" of the flexible specialization model, each of which have implications for developing country firms. The first is characterized by a horizontal linkage of many small and medium-sized firms specializing in different manufacturing processes, which combine to produce a constantly changing set of products to accommodate changes in demand. This "consortia" model achieves economies of

scale for financing, marketing and research, while preserving some degree of firm-level autonomy. Typical of this variant are the industrial districts found in the Third Italy (see Porter, 1990, for a detailed account of the competitive advantages achieved through this structure among Italian tile producers). In the second variant, large firms achieve flexibility through internal decentralization. The third is the kanban system of intimate collaboration with an extensive supplier network. In the second and third variants, top management provides financial, marketing and research services to semi-autonomous units and cooperative suppliers.

Using this model, it is clear that a CM relationship can take a number of forms. The nature of the CM relationship and the issues it raises for both buyer and supplier will vary considerably depending on its form. However, in all cases, CM essentially involves a linkage between firms. In a forward linkage, the local firm provides value added to the output of the foreign firm, in the form of processing or assembly, distributions or other downstream operations. A backward linkage involves upstream activities by local firms, such as supplying raw materials, parts, components or services as inputs into the foreign firm's operations. The existence of such linkages between firms, particularly the existence of a backward linkage, creates a connection that is one form of what we call a CM relationship.

The existence of such linkages in CM gives it a close relationship to other concepts in the development literature, such

as backward linkages (Hirschman, Thoburn) and reverse integration.[6] Indeed, all of these concepts share many important features, in that they all seek to formulate a framework for the development of programs to increase developing country participation in the global economy through international alliances and export promotion. However, backward linkages and reverse integration approaches are driven primarily by national investment policy. We use the term "contract manufacturing" to refer to buyer/supplier relationships of all kinds and in all places. This perspective places emphasis on firm-level analysis of linkages and permits an examination of CM in industrialized countries and the relevance it has for the developing world.

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[6] "Contract Manufacturing" is conceptually similar to "backward linkages" (Thoburn) and "reverse integration". While these terms all refer to essentially the same category of phenomena, we use "CM" to broaden the concept somewhat. Linkage and integration models are driven primarily by investment policy such as government efforts to develop domestic economies by encouraging foreign business investment through tax incentives, preferential customs treatment, import substitution requirements placed on local MNC affiliates or offshore firms selling in the domestic market. By using the term CM, we intend to include buyer/supplier relationships of all kinds and move the focus from the role of investment policy in economic development to the role played by buyer/supplier relationships in improving the competitiveness of developing country firms to facilitate their greater participation in global markets.

A. Issues in Contract Manufacturing

Issues raised by CM revolve around concepts of quality and reliability, intellectual property protection and technology transfer, all of which are of fundamental importance to business in both developing and industrialized countries. A body of literature exists on linkages in developing countries, but it has not been integrated with the much larger number of reports in the U.S. business press on being a good supplier and buyer/supplier relations. Although an examination of both bodies of literature reveals that the issues raised - producing quality products, meeting buyers needs, cooperation to maximize productivity - are essentially the same, the two models (buyer/supplier relations in industrialized countries and those in developing countries) have not been integrated. The perception appears to be that they deal with two distinct phenomena. In fact, the differences between developing and industrialized countries from the standpoint of CM are primarily quantitative. It is the level of skills, technological capability, access to information and equipment, financial resources and the environments in which firms operate that distinguish developing and industrialized countries in terms of competitiveness. While policies based on foreign direct investment (FDI) may be valid approaches to raise the attributes of local firms to the levels that will make them competitive, viewing these issues from the perspective of buyer/supplier relations, that is, from the level of the firm and inter-firm linkages, permits an analysis of proactive, cost-effective measures

an individual developing country supplier firm can undertake on its own to improve its competitiveness in its pursuit of CM relationships with both foreign and domestic firms.

Regarding domestic CM, it is important to note that CM relationships contribute significantly to economic development even when no foreign firms or investment is involved. A network of contract manufacturers that can supply a variety of parts, components and services to other domestic firms can greatly increase the productivity of the buyer firm and the quality of its products. The supplier, by focusing on a limited number of steps in the overall production process required to produce the finished good, can concentrate on skills development, technology acquisition and management strategies that relate only to that limited area. Since these requirements are relatively narrow, the firm can master them to greater depth.[7] The buyer, who sources many parts from a network of such firms, reaps the benefits of this complex of deep capabilities in the quality of its finished products.The absence or inadequacy of local supplier networks in LDCs that can spread

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[7] In developing countries, the tendency has been to pursue vertical integration instead of developing networks of specialized CM relationships (Katz 1986), due primarily to the weakness of the local supplier base. Ernst and O'Connor (1989) cite the development a competitive supplier industry as a major contributor to the rapid enhancement of competitiveness of the Korean electronics and automobile industries. The benefits of a competitive supplier base are explained in part by Porter's (1990) concept of "clusters" of industries within a national economy that are "mutually supporting." The linkages that form within these clusters, Porter says, can be either horizontal (between industries that share common customers or technology channels), or vertical (between buyers and suppliers).

the burden of technological capability development is therefore a central problem. (Katz 1984, Ernst and O'Connor 1989)

B. Foreign Direct Investment (FDI) as a Foundation for Contract Manufacturing

Most of the work on inter-firm linkages in developing countries relates to the integration of FDI under the rubric of backward linkages (Thoburn, ISTI). This work is useful in developing an analysis of policy based on the experiences of countries such as Korea, Mexico, the Dominican Republic, Singapore and Ireland which have extensive programs of FDI integration through backward linkages. These analyses have produced two basic models: an administrative approach that emphasizes import substitution, other protectionist policies and subsidies for domestic suppliers; and a market oriented approach in which the government acts as a facilitator and matchmaker, leaving the formation of linkages to individual firms responding freely to market forces.

C. FDI Policy: Administrative versus Market Approaches

To attract foreign investment, many developing countries have introduced free trade zones that offer tax and customs incentives to foreign affiliates in the hope that this will create jobs and that local firms will benefit through the development of backward linkages with the affiliates.

Multinational national Corporations (MNCs) locate facilities in developing countries for a number of reasons, including favorable tax incentives, low-cost labor, access to local markets, proximity to other major markets, or access to raw materials. Rarely, however, do these firms source supplies beyond basic raw materials unless they are forced to by import substitution requirements. High value added components tend to be imported by the company from a supplier in an industrialized country and are simply assembled in the subsidiary, then exported as finished products. Integration of the foreign direct investment is limited to the creation of assembly jobs, for the most part. Over time, this leads to an "enclave" economy in which the free trade zone firms take advantage of low cost local labor, to which they add components imported from abroad to produce competitive products for the world market. There is little transfer from the free trade zone to local firms of technology or other know-how that would contribute significantly to self-sustaining growth of the domestic economy.

For example, in the Dominican Republic, 15 trade zones have been established since the 1960s. They now include 290 firms, mostly U.S. subsidiaries, which employ 110,000 workers and account for more than 30% of all Dominican imports. Yet, virtually all production inputs to free trade zone firms are imported. Integration into the domestic economy is limited almost entirely to providing jobs (ISTI). While employment is a significant

benefit, it merely increases the dependence of the Dominican economy on foreign companies.

To gain additional leverage on FDI, many governments in developing countries resorted to import substitution, tariff barriers and limits on foreign ownership to force the development of backward linkages with domestic firms.

The prohibition of imported parts can stimulate local industrial development in the short run, but in recent years several reports have pointed out that in the long run these policies lead to inefficiency and technological stagnation at the firm level and top-heavy, inefficient, inflexible bureaucracies at the governmental level (Perez 1989).

Protectionist regimes create a national business environment that does not reflect the international environment. To the extent that protection allows domestic industries to grow, that growth is based on subsidies and import substitution requirements that are not available to firms involved in international trade.

Further, local content requirements motivate firms to localize their production, whether or not it is economically justified. In a period of increasing globalization, this type of incentive structure causes local firms to look inward in terms of markets, production and supply. Rather than integrating the national economy into the world economy, these policies encourage isolation and deter the flow of technology and new management thinking in and out of the country.

For example, in Mexico before 1897, local content requirements placed on MNC subsidiaries led to initial growth in firms that were forced on the subsidiary as suppliers. The Mexican government believed this would develop local industrial and technological capabilities and help to reduce its balance of payments deficit. The primary incentive for foreign firms locating in Mexico was to circumvent high tariff barriers by establishing production facilities in-country.

Mexican law limited foreign ownership to 49% in most cases and the government, not the markets, sanctioned specific foreign dir ct investments based on the perceived degree to which the investment would increase the demand for domestic capital and intermediate goods. Local content requirements created a captive market of foreign firms for locally produced goods such as automobile and computer parts. The local metalworking industry grew rapidly by supplying local subsidiaries of foreign automakers, but the growth was based not on competitiveness but on a captive market for metal products. Inefficient firms thrived even though production costs were chronically higher and product quality lower than the international marketplace would tolerate. Protection led to further distortions in the local CM environment because it increased the costs of the finished goods produced by the foreign subsidiary which reduced their export potential and therefore limited the contribution of FDI to domestic growth.

Since 1987, Mexico has liberalized its investment policy by removing many tariff barriers and local content requirements,

stimulating domestic industry to increase productivity and quality while giving foreign investment a larger role in transferring technology and developing domestic and export markets for Mexican production. While it is too soon to tell whether this policy shift will achieve the desired result, there are indicators that FDI in Mexico is increasing.

D. Market-oriented Approaches

The market oriented approach is based on mutually beneficial business agreements, not regulatory requirements. Deals are struck on a firm-by-firm basis, which is more likely to result in deals that best suit individual firms than a legislative approach that tends to treat all firms, at least all firms of a given size in the same sector, the same way.

Often, the development literature treats all developing countries as if they are more similar than they actually are. The protectionist economic policies that many of them employed during the sixties, seventies, and eighties actually tended to make them more different. The insulation that resulted from these policies led to development along parochial lines, with each country focusing its resources on the development of its own natural resource base, using cheap labor to compensate for their lack of technological sophistication.

Indeed, it is the most industrialized countries that tended to become more similar during this period, as these countries became integrated into a globalizing economy. From high-tech

computers and diagnostic equipment to low-tech casual clothing, fundamental design specifications and quality standards have become more international as a result of the increasing integration of national markets among developed countries. For developing countries, integration into this global economy offers the best hope of sustainable, long term growth. The market-oriented approach to development, with emphasis on increasing backward linkages, is more likely than protectionist strategies to lead to improvements in quality and productivity that are in line with the expectations of the international marketplace.

The backward linkages strategy is therefore essentially an export promotion program, except that it allows developing country firms to work most closely with multinational subsidiaries in their own country, rather than attempting to market themselves to the whole world at once. Subsidiaries of MNCs that locate in a developing country provide that country with a "window" to the global economy. In the absence of protectionist distortion, the standards they require of their subcontractors will be essentially global standards. When a subcontracting relationship is established, the local firm receives specific requirements of product performance, volume and delivery. For purposes of global market integration, the specificity of these design, reliability and delivery standards offer local contract manufacturers an advantage over local producers of finished products in that there is far less need, at least initially, for the supplier to conduct

market research or educate itself about the standards and specifications required in overseas markets.

The strategies the supplier firm must adopt are therefore not based on amorphous goals of producing "better" or "more" products, but products that have exact characteristics that will satisfy the contract, and de facto, bring the firm into line with world-class standards. A program of backward linkages is therefore, for all intents and purposes, a program of export promotion as a strategy for insertion into the global economy.

V. TOWARD A FRAMEWORK OF BUYER/SUPPLIER RELATIONSHIPS

These administrative and market oriented approaches and their implications for developing countries are unquestionably a valuable contribution to the development literature, but they do not permit an analysis of buyer/supplier relationships themselves. Regardless of whether linkages are formed as a result of national investment policy, import substitution or free market forces, or whether they involve foreign firms or only domestic ones, the long term success of CM is determined by the extent to which it contributes to meaningful economic growth, which will ultimately depend on the quality and sustainability of the CM relationships themselves. If these linkages provide mutually beneficial results for the buyers and suppliers, the number of linkages will increase. If either party (or both parties) find that the relationships are not competitive with the available alternatives (e.g., vertical

integration downward by the buyer or upward by the supplier, or equivalent CM relationships with other firms), their number will either decrease or be maintained only by legal requirements that contribute little to improved competitiveness. Understanding the nature of these relationships and the factors at work in them requires a framework for examining CM relationships at the firm level that accounts for variations in the relationships, accounts for the compatibility of the interests and capabilities of the parties on the relationships, and addresses firm level concerns as well as investment policy concerns.

To build such a framework, it is necessary to expand the analysis beyond the literature on linkages and FDI to incorporate concepts such as technological change, the new global context and productivity and competitiveness in the new TEP. Since the care capability of FMS is to produce custom products in relatively small lots, suppliers with expertise in flexible production will best serve their interests by seeking CM relationships with buyers that need custom parts. This suggests that CM relationships under the new TEP will require closer cooperation and greater exchange of information between firms than relationships geared to supplying standard parts. The viability of these collaborative CM relationships will relate, in our view, to three central factors:

1) Time horizon - or the duration of the CM relationship.
2) Exclusivity and technology transfer - by exclusivity we mean the degree to which a supplier dedicates its productive capabilities, or a subset thereof, to serving a single buyer.

On the buyer side, exclusivity of the relationship relates directly to the willingness of the buyer to transfer technology and know-how to a supplier to enable the supplier to better serve its needs.

3) Integration - Refers to the value of the part or component provided by the supplier to the buyer's finished product.

A. Time Horizon

Time horizon can vary from a single purchase order to a contract lasting many years. Short term relationships have, until recently, characterized most CM in the U.S. and Europe. The buyer usually selects the contractor through a competitive bidding process, with price being the paramount criterion. To keep the bidding competitive, the buyer needs to have several potential suppliers for each part or material. The relationship between buyer and supplier remains tenuous and the supplier has little incentive to invest in process or skill development that will increase the quality of a given output, unless the market for that output includes many potential buyers. The need of the buyer to source parts that are tailored to its final product can conflict with the need of the supplier to produce parts that are standardized and will meet the specifications of the largest number of potential buyers with the least possible modifications.

However, in most industrialized economies, particularly Japan, buyer-supplier relations are becoming increasingly close. Some writers have suggested that the difference in productivity and the

rate of innovation in the U.S. and Japan is due to a significant degree to differences in buyer-supplier relationships in the manufacturing sectors of the two countries (Ikeda, no date). Japanese manufacturers develop long-term relationships with relatively few suppliers, which gives the supplier the incentive to invest in equipment and research to provide the buyer with high-quality products tailored specifically to the buyer's needs. This reduces the capital investment burden on the buyer (compared to vertical integration) and stabilizes cash flow for the supplier.

In addition, the closeness of these relationships encourages cooperation between the two firms to increase quality and reduce costs, and, perhaps most importantly for our purposes, encourages the exchange of detailed information on technological know-how, production methods and management practices.

The most significant impact of time horizon on the CM relationship is therefore in the areas of investment within the supplier organization to acquire and utilize equipment and personnel needed to meet the special needs of a specific customer, and the flow of information between the buyer and the supplier.

The economic success of Japan has led other industrialized nations to borrow or adapt many Japanese organizational and managerial techniques, including closer buyer-supplier relationships (such as the supplier certification programs implemented by Xerox and other U.S. MNCs). As the companies from these countries locate subsidiaries in the developing countries, they bring many of these concepts with them. If more

buyer-supplier relations of this sort could be established between foreign subsidiaries and local suppliers in developing countries, perhaps the impact of FDI would penetrate much more deeply into the local economy, producing gains in productivity, reliability, delivery systems, marketing, management and technological capability as well as more and better jobs.

Schonberger (1986) cites examples from Polaroid's Zero Based Pricing (ZBP) approach to illustrate the productivity improvements that accrue to both the buyer and the supplier as a result of this type of relationship. In one case, a chemical filter supplier agreed to reorganize production to cut costs if Polaroid would agree to commit to the company for a full year, rather than offering the company only occasional orders. By replacing purchase orders with a contract, the supplier was able to keep its price steady for the full term of the agreement.

Also, under its ZBP policy, Polaroid does not accept cost increase to the supplier as justification for price increases. Instead, Polaroid sends its own people to visit the suppliers plant to offer suggestions on controlling costs. When buyers source components from fewer suppliers, and suppliers serve fewer, larger customers, each is able to "get to know" the other better. Schonberger points out that, in contrast to ZBP, the traditional relationships between buyers and suppliers that have prevailed under the mass production TEP would make a supplier leery of having a customer, even an important one, come into the plant to comb over production processes and cost data.

But the closeness necessary in long-term relationships also raises some red flags of which developing country firms need to be aware.

1) While major world-class manufacturers are reducing the number of suppliers they deal with, they are at the same time globalizing their supplier base. In other words, they are looking in more places for fewer suppliers. It is therefore more difficult for a supplier to attract the attention of an MNC. Most contractors, especially those in developing countries, tend to be of small or medium size. Their ability to market themselves effectively on a worldwide basis is therefore likely to become a matter of increasing concern.

2) These firms must be careful to ensure that they get a maximum share of the value added chain. Attracting contracts by offering low cost labor has historically not led to the economic development these countries are seeking. Buyers that enter into subcontracting agreements simply to acquire the cost benefits of cheap labor will not have an incentive to improve the technological capability or productivity of the CM firms.

3) While more of the value-added is occurring at the suppler stage in the emerging TEP, the bulk of the profits are still going to the large, finished product manufacturers. Accounting procedures and guidelines to achieve an efficient and equitable cost sharing relationship between firms that

operate in close buyer-supplier cooperation has yet to be fully developed in any country. Tax laws and treatments also have significant impacts on the viability of buyer-supplier relationships.

4) A close, long-term buyer-supplier arrangement makes each party more dependent on the other. If either firm fails, the other is more at risk.

B. Exclusivity and Technology Transfer

The criteria by which a supplier allocates resources is directly related to the structure of the market in which it operates. The close cooperation between buyers and suppliers with long term contracts encourages the supplier to invest in skills and technological development to better meet the suppliers needs. The buyer also has an incentive to assist the supplier in these efforts by offering technical and managerial assistance, so long as the cost to the buyer of providing this help is less than the cost of vertical integration.

In the modern, technologically driven, global economy, product and technology life cycles have become much shorter than in the past. When CM relationships are short term, there is pressure on suppliers to continuously upgrade their capabilities along the technological trajectory (Dosi 1986) of their customers. Buyers will abandon those suppliers that fail to do so and source parts elsewhere. Under a flexible specialization regime, the continuous process of innovation and redesign is

carried out cooperatively by the two firms under a long-term agreement. The mutual trust and interdependence that characterizes these relationships permits a bilateral flow of new technology and other innovations between the firms to facilitate this process.

The types of technologies and the ease with which they are transferred depends on several factors, many of which are embedded in the CM relationship. Assuming, for the moment, that the level of intellectual property and proprietary information protection is acceptable to both parties and that local content requirements are not an issue, technology transfer will be most significantly affected by the firm-to-firm relationship itself, in terms of the degree of exclusivity.[8] By this we mean the

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[8] Excluding factors of intellectual property and proprietary information from the present analysis should not be taken to mean that these are not central issues. Teece (1986) has demonstrated the importance of these factors in firm strategies relating to new product development, including the pursuit of CM. The degree of "appropriability" will significantly impact the degree of technology transfer between buyer and supplier. Appropriability refers to "environmental factors, excluding firm and market structure," that govern an innovator's ability to capture the profits generated by an innovation using such legal instruments as patents and copyrights or by keeping the innovation a trade secret. The efficacy of these instruments is therefore crucial in determining what might be called the "controlled transferability" of the technology - that is, the possibility of limiting the spread of the technology once it has left the firm. If, however, the technology to be transferred is not an innovation developed exclusively by the buyer, Teece suggests that transfer may be more influenced by the "tacitness" (Dosi 1982) of the technology, meaning the extent to which the effective use of the technology requires specialized knowledge. A high degree of tacitness enables the technology to be protected either by protecting the technology itself or by protecting the know-how required to exploit it. From the standpoint of transferability, tacitness is also valuable as a measure of the amount of training and other commitments the buyer must make to the supplier.

concentration of the supplier's market. If the supplier produces a given part or component for a single customer, the flow of technologies and skills related to the production of that part are likely to be smooth. The extent of investment by either party will be determined by volume, complexity and other similar factors. However, if the supplier sells the part to more than one buyer, the technology transfer flow will be impeded by a variety of proprietary concerns. In developing countries where diffusion of technological know-how is of major importance, the exclusivity of the market of supplier firms becomes a central consideration when balancing the needs of the supplier firm to market its products as broadly as possible against the need to maximize technology transfer from the buyer (particularly if that buyer is an MNC with many relevant technologies at its disposal).

Further, the closeness of the emerging buyer-supplier relationship model is particularly important for firms in developing countries that provide only weak protection for intellectual property or proprietary information. When buyers and suppliers do not know one another well, and when both sides seek to use the relationship to maximize their own unilateral advantage, the laws governing intellectual property and trademark protection in the supplier's country become the limits that define the relationship. But when the relationship between the firms is closer and long lasting, and each firm has invested in equipment and manpower to better accommodate the other, there is the possibility that trust will develop between the two firms to protect techniques and information to an extent that goes beyond the limits of the law. The assumption that each party will abuse the other to the extent allowed by law is no longer operative.

C. Integration

Closely related to the concept of exclusivity is that of integration, which refers the extent to which the products the buyer outsources contribute to the finished product. The spectrum of integration can run from a single molded plastic or metal part to a finished OEM product. For example, a supplier may provide a single type of screw for an automobile carburetor, or an assembled valve or a complete carburetor. Generally speaking the more complex the supplier's component is, the higher up the firm will climb on the "value added ladder." Mechanisms that will enable developing country supplier firms to reach higher rungs on the ladder would have a major impact on the economic development potential of many countries. Not only would it make the supplier a more valued and profitable partner for finished product manufacturing, it would also stimulate growth in domestic second and third tier suppliers that would provide the parts lower down on the ladder.

To move up to higher value added output, supplier firms must improve their capabilities, in terms of both technology and management. Recruiting top management personnel is therefore a major challenge for the subcontracting sector of developing economies. R&D skills, at both the technical and managerial levels, must also be improved. Increasing integration means increased responsibility for the quality of the buyer's finished product.

Meeting the standards that world-class producers of finished manufactured products require of suppliers integrates the supplier (regardless of the country in which they are located) into the global marketplace. In most cases, the nature of these standards, regardless of the specific industry, fall into two very general categories: technical design specifications of the components themselves; and price capacity and reliability in terms of low defect rates, delivery, etc.

Technical design specifications include those that require the acquisition, adaptation and skilled use of hardware such as machine tools and flexible manufacturing systems to produce components of the proper dimensions and durability. The second category, however, is based more on the reliability of the firm itself and its ability to control costs and inventories, provide adequate training and organize the workforce in a way that produces maximum efficiency.

These categories suggest that DC firm integration into the global marketplace through backward linkage has both "hard" and "soft" aspects. The hard aspects can be addressed, to some extent, through the use of Technology Sourcing and Intelligence strategies that allow the firm to define it's technological needs (based on "targets" determined by the contract specifications of the components) and acquire and make use of the needed equipment most cost-effectively; as well as the implementation of reverse engineering and similar strategies. The soft side relates essentially to the adoption of the new best practice management

techniques such as Total Quality Control, Just in Time, skills integration and employee empowerment, which characterize the emerging TEP.

VI. CONCLUSION AND RECOMMENDATIONS

While this rudimentary categorization is perhaps useful for the analysis of productivity and quality problems faced by contract manufacturers in developing countries, it is not intended to suggest that the hard and soft factors are mutually exclusive. Rather, the development of FMS allows firms to produce more specialized products in smaller lots, to reduce inventories and to organize manufacturing as a set of multi-disciplinary work stations, rather than as a single, large production line. The new production organization principles have a direct, even symbiotic connection to these technological developments (Hoffman 1989).

The diffusion of the hard technologies, however, is likely to be less equitable than the spread of the new management paradigm. It will probably be some time before most developing country firms acquire the skills and financial resources needed to fully integrate FMS, although the prospects for such integration are brighter than they ever were for mass production There is perhaps particularly strong grounds for optimism in the area of managerial reform, which will enable LDC firms to squeez every available ounce of competitiveness out of their FMS

investments. Hoffman further suggests that a "sizable" share of productivity gains achieved by a developing country firm's investment in flexible technology often comes from organizational changes, and that these gains may in fact reduce the firms' need for complex hardware.

While significant training is required to execute the full range of organizational reforms needed to convert a mass production-based organization to the new management paradigm, it is nonetheless, in its essence, a "frame of mind," a new perspective on the challenges posed by the need to increase quality and productivity for the purpose of penetrating global markets. As such, it requires very little capital relative to the possible returns. The core advantages of new management are organizational principles available in journals and books or directly from the individuals involved in developing them.

Hoffman (1989) has provided an excellent preliminary study of the applicability of new management techniques in the developing country context. He suggests that firms in developing countries, which tend to be relatively small, labor intensive and characterized by simple product flows, may in fact be more fertile ground for new managerial and organizational approaches (which achieve productivity gains from simplicity and cooperation, than Western firms, which tend to be larger, more complex organizations with irretrievable investments in expensive, "elaborate" machinery.

CM firms in industrialized countries have been wedded to a management paradigm based on mass production, but developing country firms have for the most part lacked the capital and know-how to fully "buy in" to the mass production approach. Indeed, the financial and training deficits that these firms have suffered relative to the industrialized world have left them far less grounded in this approach to production. Industrialized country firms, therefore, are forced to suffer the full force of the wrenching Kuhnian shift of abandoning principles that were instrumental in their achievement of industrial preeminence. In developing countries, far less must be "sacrificed" to the new management paradigm. These firms have, perhaps, been nascent "new management" organizations without knowing it. Hoffman puts it thus:

> "In the absence of a mass production tradition, and with only limited Fordist relations in production, might it not be easier to introduce the new relations into what are essentially greenfield sites?" (Hoffman, 1989).

The points we have attempted to raise in this paper have implications for policy development at both national and firm levels. We therefore offer the following tentative recommendations as a basis for further discussion.

A. Policy

1) National development policies in LDCs can not simply mirror the steps taken by the Southeast Asian NICs. Policies that were effective for Korea or Taiwan in the 60s and 70s will

not necessarily have application in the global economy of today. Light manufacturing industries, the foundation of previous NIC development, are far more competitive than they once were, and the growth of export markets for these products has slowed to a crawl. In addition, the increasing ease with which manufacturers in the industrialized world can dissect low-value added steps in the production process for export to developing countries with low wage rates makes many of these industries bad investments for LDC policy-makers. Rather than concentrating on industries and processes that the industrialized world has de-emphasized, future industrial development will perhaps be more a matter of skills development in frontier areas within the new TEP, which the industrialized nations can not penetrate without massive retooling costs.

2) Our research suggests that a greater emphasis on FMS production is advisable. These systems require much smaller initial investment in equipment than mass production. Economies of scale can be achieved at production levels that are less likely to outstrip domestic markets, reducing the reliance on exports as a sine quae non for development.

3) The promotion of specialized supplier networks may well offer greater returns on a national scale than the development of a few large, subsidized manufacturing firms. Small, competitive supplier firms could enhance the integration of FDI into the local economy and may increase

the aggregate of technology transfer from the industrialized world.

Also, a well coordinated supplier network will spread the burden of increasing technological capabilities among a larger number of firms. The development of enhanced capabilities in a supplier firm will facilitate the formation of interfirm linkages that offer the possibility of greater integration into the global economy. Similar improvements in a large firm, on the other hand, may actually reduce the number of linkages because the firm will have less need for external capabilities.

B. Firm-Level

1) The primary objective of attracting FDI should not be to create low-wage, insecure jobs, but to leverage this investment into CM relationships for domestic suppliers. When domestic suppliers enter into relationships with foreign firms, contracts that include precise specifications and delivery dates in effect become templates for what is required to compete globally. Strategies the supplier develops to fulfill such contracts can later be implemented as the firm moves beyond relationships based on FDI to relationships with domestic firms or foreign firms that have no domestic presence. In negotiating with local affiliates of foreign firms, it is therefore important for suppliers to capture a maximum share of the value added chain.

Agreements of this type are the most likely to lead to significant technology transfer.

2) As an initial step in the development of strategies for increasing technological capability, firms must assess their existing capabilities, giving adequate attention to both "hard" and "soft" assets. The assessment of the "hard" assets includes an analysis of existing in-house technology and the extent to which it fits the firm's objectives for new product development and new market penetration; the soft assets relate to the current state of management practices and their applicability to the management requirements of the new TEP.

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