

FLEXIBILITY IN OFFSHORE ASSEMBLY OPERATIONS: ELECTRONICS ASSEMBLY IN THE COMMONWEALTH CARIBBEAN

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I. INTRODUCTION

GIVEN an increasing emphasis on quality, timeliness, and flexibility in United States' manufacturing, many industrial operations previously located in countries peripheral to continental North America have returned home to the mainland. Technological advance, in some cases, has made redundant the need for labor-intensive production, while increasingly, domestic manufacturers require "just in time" servicing and more intensive liaison with their suppliers. These demands often necessitate geographically closer networks of suppliers and producers. This article examines the continued viability of the "offshore" option under these conditions. We look at why particular types of operations are performed in peripheral least developed countries (LDCs) and how they are adapting to compete in a new international business environment.

We take the case of the electronics industry. An industry which has had its own production organization revolutionized through what we term "flexible production methods" and has in turn aided production revolutions in others. The move offshore (to places like Mexico and the Caribbean) by segments of the industry in the late 1970s and the early 1980s was a corporate strategy designed to reduce labor costs. Much of this offshore industry has since been repatriated. Our analysis shows, however, considerable maintenance of activity offshore. Further we find that some operations, under pressure from the mainland, have taken on "flexible" working practices themselves. Finally, we argue that the continued internationalization of what we call flexibilism is likely to enhance the status of less developed countries as production platforms for mainland markets.

In our analysis we examine offshore electronics assembly in the Commonwealth Caribbean. The Commonwealth Caribbean is a significant recipient of transnational money.¹ The Caribbean, as part of the "backyard" stabilization policy initiated by the Reagan administration, became integrated into the North American market via the Caribbean Basin Initiative (CBI) in 1984. CBI gives

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¹ The Commonwealth Caribbean is defined as all islands in the Caribbean that are members of the British Commonwealth. Typically, these islands are ex-colonies of Britain.

direct duty-free access to the U.S. market for manufactured products which have at least 35 per cent of their value added in the region. There is currently more than U.S.\$2 billion invested in U.S. manufacturing subsidiaries in the region [70]. There are also an increasing number of third-party transnationals locating in the Caribbean in order to obtain "back door" access to the U.S. market via CBI. The electronics industry plays a small but growing role in the economies of the Commonwealth Caribbean.

The remainder of this paper is as follows. First, we examine the concept of what we call flexibilism and how it is characterized in U.S. manufacturing. We then trace the movement of U.S. electronics manufacturing activity offshore to the Commonwealth Caribbean. We show that the sections of the industry which continue to reside offshore are indeed those most receptive to inputs of cheap labor. However, in the following sections, using findings from corporate interviews, we argue that a great deal of flexibility has been developed in these operations. Lastly, implications are examined for LDCs previously viewed by transnational enterprises as pools of cheap labor to be exploited then abandoned when necessary.

II. FLEXIBILISM DEFINED

Many observers now agree that the advanced capitalist nations are undergoing a transition from Fordism to flexibilism.² There exists a large and growing literature on flexibilism. This includes literature on flexibilism generally,³ on flexible technologies,⁴ on corresponding flexible management strategies,⁵ and labor relations,⁶ on flexibilist institutions⁷ on culture [30] and on spatial extent.⁸ This same transition is less well documented for the less developed countries of the world.⁹

² In what follows we use the term "flexibilism" to denote the emerging regime of accumulation. This contrasts with "flexibility" which we use as indicative of simply the mode of production.

³ General discussions of flexibilism include [24] [10] [61] [30] [31] [64] [65] [21].

⁴ Discussions of flexible production technology include [54] [68] [11] [32] [3] [14] [1] [46] [33].

⁵ Within this category, we consider management within the firm. Discussions include [2] [36] [62] [67] [5] [34] [66] [58].

⁶ This category includes the use of labor *within* firms. The literature here includes [35] [51] [23] [43] [13] [18] [22].

⁷ The literature on "governance institutions" *within* flexibilism is held (see [64]) to include both interfirm agreements and the intervention of the state in the production relation. Discussion of the former includes [15] [23] [25] [43] [61] [28] [30] [64] [12] [16] [63]. The literature on intervention of the state in the production relation includes [17] [47] [53] [60] [56].

⁸ The literature on the spatial implications of flexibilism includes [52] [9] [61] [28] [65] [49].

⁹ The literature on offshore flexibility is less extensive (see [56] [48]). Watson [72] notes that flexibility in Caribbean offshore assembly industries might well be predicated by processes occurring in the United States and other Western industrialized nations. However, his approach is more concerned with achieving flexibility through the integration of offshore facilities with their host economies. This is an unlikely prospect for the Caribbean because of the general absence of diversified domestic industrial bases.

Flexibilism is characterized by the ability of firms to rapidly change over between product lines. This rapid transition is made possible by the information handling capabilities of modern computers, worker empowerment, and associated organic management techniques¹⁰ [42] [2] [50] [67] [29]. Flexibilism began to take hold in certain industries in Japan, Germany, and Italy before the global recession of 1979–83. During the recession of 1979–83, however, consumers, faced with overproduction, demanded greater variety and higher quality and firms struggled to differentiate their products.¹¹ This drastically reduced the size of production runs and effectively destroyed the economic rationale of Fordism, which relied on mass production and ever increasing scale economies. Within this new environment, firms producing for niche markets that had lived for some time on the edge of Fordism came to the forefront, while Fordist industry was forced into a period of extensive restructuring.¹²

Under flexibilism the basis for competition is both different and broader than under Fordism. Under Fordism, competition was characterized by an ever deepening investment in mass-production-based, fixed-process technologies. These investments in turn relied on tremendous internal economies of scope afforded by vertical integration and economies of scale resulting from expanding mass markets for highly standardized consumer durables [65]. Investment in fixed-process technologies for mass production engendered an increasing technical, Taylorist division of labor and a corresponding deskilling of the labor force [6]. Thus, competition under Fordism lay primarily in increasing economies of scale and the resultant increasing technical division of labor. Under flexibilism competition rests on external economies of scope and economies of scale that must be maintained in the face of highly differentiated product lines. This imperative engenders an ever decreasing technical division of labor. Price competition, the basis of Fordism, is still important to competition, but only within the overarching context of flexibility and quality. Hence the role of information processing becomes pivotal, since speed of production, rapid changeover between product lines, and high quality are most compatible when in computerized environments. The flexible firm thus competes along dimensions that not only include traditional Fordist concerns such as price, but focus on quality, degree of customization, and timeliness of delivery as well.

Flexibility in this study is therefore taken to mean the attainment of economies of scope. This may require some combination of: supplying a greater variety of products (or supplying a small number of product types with greater differentiation within each type); supplying products quicker, in smaller quantities as and when they are required; or supplying products that conform to higher standards of quality and timeliness. To achieve flexibility there must be a more efficient utilization of factory space and time, minimizing the downtime of machines and inventories, while maximizing the productivity of workers.

¹⁰ See [21] for a discussion of the preconditions for the formation of flexibilism.

¹¹ See [45].

¹² For example, see [39] [27] [37] [44] [29] [52] [4].

External to the factory, flexibility demands other reorganizations in production. Raw material inputs into the factory may now be delivered on a just-in-time (JIT) basis so as to minimize inventory and free-up capital and factory space. To ensure a reliable supply of high-quality raw materials there have also been changes in subcontractual arrangements. During the early 1980s as capital and labor were rationalized, a rise in subcontractual arrangements occurred as the vertical disintegration of industrial corporations took place. This has had an important effect on the geography of manufacturing especially on the location of suppliers.

III. THE ELECTRONICS INDUSTRY

This section examines the implications of the restructuring toward flexible manufacturing affecting U.S. electronics production operation offshore. The electronics industry is studied for several reasons, but fundamentally because electronics is *the* industry where flexible production is integral. Production in this industry has also undergone significant restructuring as a result of flexibilism. It is not our intention to draw conclusions from this industry and generalize to others, especially since electronics is notoriously footloose (because products have such high value per unit weight) and is therefore particularly easily drawn offshore. However, we believe some of the *principals* upon which relocation in the industry is predicated are generalizable.

Here the electronics industry is defined using Cable and Clarke's definition [8]: "those products or systems that use electronic circuits handling small currents which incorporate 'active' components capable of modifying the flow of electricity." This definition covers classifications 772 and 776 of the Annotated Tariff Schedules of the United States which at the level of aggregation used here, is essentially comparable with the revised Standard International Trade Classification [69]. Classification 772 covers: electrical apparatus for making, breaking, or protecting electrical circuits or making connections to or in electrical circuits; fixed or variable resistors; printed circuits; switch boards (except telephone) and control panels; and parts of the foregoing not specially provided for. Classification 776 covers: electronic tubes; diodes; transistors and other semiconductor devices; integrated circuits; mounted piezoelectric crystals; and parts not elsewhere specified.

We use U.S. trade data as a surrogate for the value of offshore investment here. The value of imports of electronic goods into the United States from the Caribbean is assumed to reflect activities of manufacturers located offshore in the region. This assumption is tenable because the Caribbean has an extremely small domestic market for electronics. It is also worth noting that, while foreign-based electronics industry within the Caribbean is growing because of CBI, it remains small in comparison to U.S.-based investment.

As the "profit squeeze" began to suffocate industry during the late 1970s and early 1980s industrialists faced limited choices; they could either restructure to compete with the new technological ensemble offered by international com-

petition, or they could try to move production to a cheaper-cost environment in terms of direct and indirect (non-unionized) labor costs. It was at this point that sections of industry which could not restructure in situ to compete with technically more advanced foreign industry moved offshore to LDCs offering cheap non-unionized labor. From 1978 on, therefore, we see a rise in offshore activity in the Caribbean so that by 1984 total imports of electronic goods had reached an all time high of almost U.S.\$200 million that year. Both product classifications exhibit strong growth patterns during this time (see Figure 1).

The restructuring process began in earnest after 1983 [30]. Those electronics companies on the leading edge of flexibilism in the United States began to overcome the technical limitations which they had encountered and which had forced them offshore. As these limits were overcome production operations were repatriated. This is clearly evident in the decline of trade activity from 1984 onwards.

There is, however, a relatively small but nonetheless significant increase in classification 772 goods between 1986 and 1987. This increase, when decomposed by exporting country (see Figure 2), is evidently an extension of trends that have been occurring in two of the three main exporters since the late 1970s. For the Leewards and Windwards¹³ and Jamaica, the extensive repatriation of productive facilities never occurred. For Barbados, there was a very great cut-back between 1984 and 1986; the decline then halted and a small increase was registered between 1986 and 1987.

The difference in trends between classifications 772 and 776 imports can be explained by the different levels of product development exhibited by the two classes. The latter class includes within it the most technologically advanced of all electronic products—semiconductors. It is in this area that U.S. manufacturers have dedicated enormous funds to compete against international competitors [7] [19] [71] [41] [57]. Semiconductors, especially integrated circuits (micro-processors) are also of great strategic value to the U.S. economy as the number of chip makers has fallen drastically over the last decade. Once the need for cheap labor was made redundant by automating production processes, the production of semiconductors was repatriated. It appears however, that there still exist considerable cost savings from the use of relatively cheap semi-skilled labor in the assembly of 772 imports such as printed circuit boards. For this portion of the industry there is no readily available (and competitively priced) technology for automated production.

IV. OFFSHORE PRODUCTION AND FLEXIBILITY

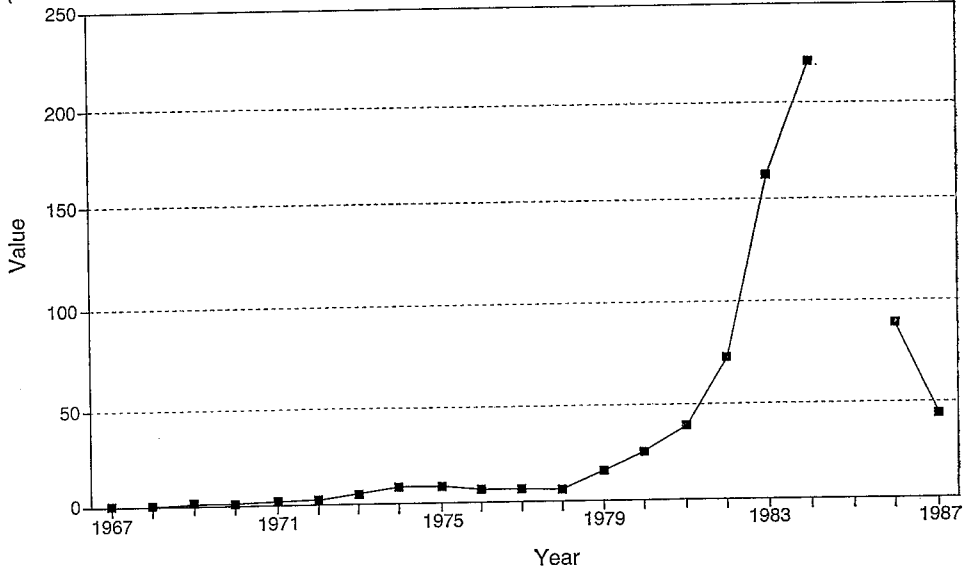
In this section we examine the continued production of 772 electronic devices by U.S. producers in the Commonwealth Caribbean using four case studies. A total of twelve factories involved in the manufacture of 772 components were

¹³ The Leewards and Windwards are defined as Antigua, Barbuda, St. Kitts-Nevis, Anguilla, Montserrat, the British Virgin Islands, St. Vincent and the Grenadines, St. Lucia, Grenada, and Dominica.

Fig. 1. U.S. Imports of Electronic Goods from Commonwealth Caribbean

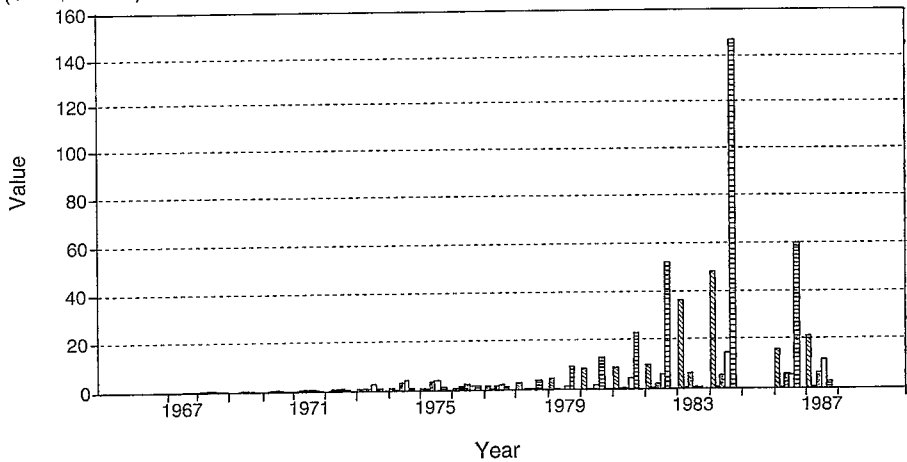
A. Total

(U.S. \$ million)



B. By Product Classification

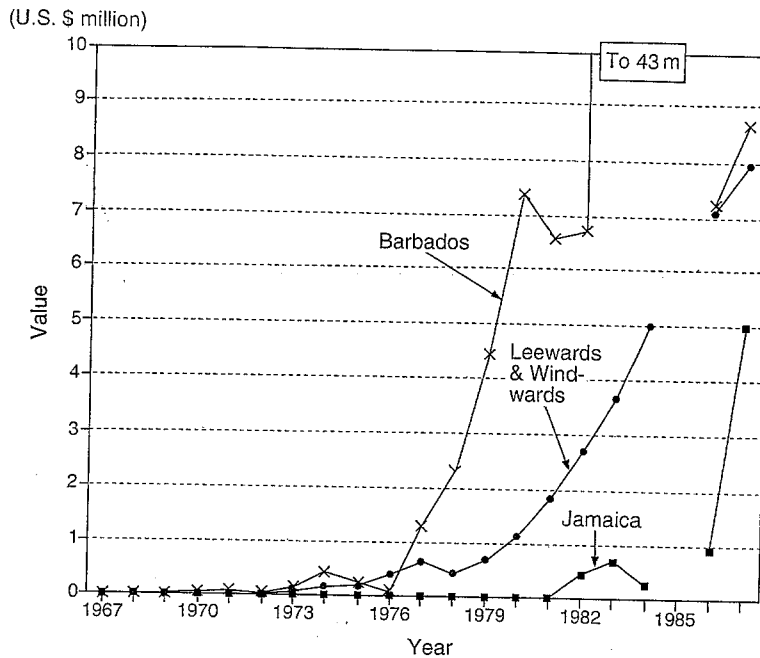
(U.S. \$ million)



- Electronic circuit equip.
 - Telecom. equip.
 - Electronic equip.
- Distribution equip.
 - Misc. electronic equip.

Source: [70].

Fig. 2. U.S. Imports of Classification 776 Electronics



Source: [70].

visited in three islands, Barbados, St. Lucia, and St. Kitts. The four presented here illustrate the spectrum represented by all of the factories visited. The investigation was carried out using the "corporate interview" methodology [59] as distinct from the closed-ended or fixed survey. Predominantly open-ended questions were asked of managers (and in the case of Plant B, the assistant manager) from a structured list developed from an earlier preparatory investigation [40]. In each case plant tours and a careful examination of plant systems were undertaken.

Finally it should be noted that the time of the interviews, February 1991, was a time of spiraling economic recession for the United States and order books were slack in several cases. The accuracy, validity, and reliability of our corporate interview cases may thus have been tainted by an overly pessimistic outlook taken by management.

A. Plant A

Established in Barbados in 1984, Plant A is an operation which assembles completed printed circuit boards for use in high-technology microwave products (772 components). The plant is owned by a Canadian corporation with its inter-

national headquarters in Ontario and subsidiaries in Europe, North America, and the Caribbean. Like most electronics assembly plants in the Caribbean, the operation is relatively small, employing ninety-five workers at the time of research with an output of 6,000-7,000 units per week.

According to the manager, the location decision was made more on the package of incentives which the corporation was offered by the government than on the cheapness of labor. These fiscal incentives include a fifteen-year tax holiday and duty-free importation of raw materials and plant equipment. Plant A is a "twin plant," i.e., it is integrated with a Puerto Rican 936 plant. The 936 scheme allows U.S. offshore plants in Puerto Rico to repatriate profits earned in that country tax free. Rulings under 936 have also been extended to cover second plants located in other Caribbean countries which remain linked to the Puerto Rican end through material transfers.

The production process is based on the "kitting" system. The "kit" is a small number of brightly colored trays each filled with a specific component; the assembly of all the components in the trays making up the kit produces a single order or part of an order. Accompanying each set of trays are instructional diagrams showing which operations they must pass through and how the components in each operation are to be assembled. Also attached is a "travel sheet" on which each operator records quantity completed and time taken for a given operation. The whole production process is carefully controlled by the materials supervisor who controls what is on the floor and what stage in production it reaches (about thirty minutes of work goes into each unit). Production supervisors take the kits to the factory floor and it is their responsibility to move them from operation to operation. Orders can thus be taken on and off the floor with a minimum of complication. This allows a great deal of flexibility allowing production to switch between product lines. Quality control is built into the operation because each operator must check the previous operator's work. If it is substandard it is returned to that worker to be completed properly. Each unit is also electronically tested near the end of the production process by a technician. Again, if there is a fault, the travel sheet indicates who is responsible and the unit is returned to be rectified. The plant has surpassed all quality standards set by headquarters (HQ).

Ninety per cent of employees are female and the average operator receives U.S.\$60.00 per week at a fixed hourly rate. This is on a par with other electronics manufacturers on the island. There is no piecework because workers apparently become more concerned with quantity as opposed to quality under that system. There are incentives though. Each worker is given a daily target for completions. If she surpasses it, she can go home early or accrue bonus time. During times of low orders workers may be laid off for a period of thirteen weeks, after which they receive severance pay. Management therefore has a pool of labor available which it can utilize to accommodate fluctuations in the volume of business. It is rarely stretched above capacity however because HQ regulates orders sent down to the factory. Skill acquisition and "versatility" is very important according to management. Each operator is therefore cross-trained during her

thirteen-week training period. This training time is invested in the operator so that deadlines can be met on time if there are bottlenecks or absentees. It also allows production switches between different products to be achieved quickly and effectively.

External coordination is achieved through monthly reports to HQ and quarterly managers meetings. Work schedules, instructions, and feedback on quality and other concerns are achieved through weekly faxes and via the telephone. Raw materials are globally sourced by HQ from Japan, Taiwan, and Brazil, among other countries. They are then flown to Barbados via Puerto Rico. Transit from Canada to Barbados is achieved over the weekend. Finished subassemblies are then flown from Barbados to Puerto Rico by overnight or next-day delivery. Raw materials are acquired on a JIT basis, and since nothing is made for stock, total inventories are minimized.

The need for flexibility was stressed by management. Cognizant of the fact that their products have increasingly short life cycles, the plant's ability to switch between products is a central concern in the short term as order specifications constantly change, and in the longer term as the products themselves change. Flexibility is manifested in (i) the use of "kits," (ii) the cross-training of operators, (iii) JIT sourcing and shipping, (iv) the use of rapid air transport, and (v) the overall coordination and control of the operation by HQ.

B. *Plant B*

Plant B was established in St. Lucia in 1979 and assembles delay lines for telecommunications equipment. The operation is a subsidiary of a New Jersey company which is a subcontractor making delay lines for U.S. electronics companies such as IBM. The operation employs 200 people with an output of around 11,000 units per week at the time of survey. The factory turns out more than one hundred types of delay lines.

The location decision was based on the cheapness of labor and proximity to the United States. The quality of infrastructure on the island was also cited as a positive factor in the decision. The production process involves seven basic assembly steps including two stages of quality control. A basic kitting system is used but there are no travel cards. Quality control is carried out first by electronic testing of each unit before it is encased in resin and then by a final testing in a "clean room" before packaging. Achieving quality is a significant problem for this plant. The testing equipment, being very delicate, is subject to failure because of the heat and dust of the area. Although there is "in-process" inspection of operators' work, the lack of travel sheets makes it very difficult to trace where problems occur. Management also complained that approximately 6 per cent of materials are damaged in-process (it used to be more) and that large volumes of materials are simply "lost" during assembly. Because of this disorganization, management has little recourse with those producing substandard work. The whole operation is set up so that the inventory supervisor has little grasp of what is occurring on the factory floor and is in a poor position to control the flow of materials. The factory constantly receives faxes from head office on the substandard quality of its work.

Ninety-eight per cent of employees are women who are paid either on the "incentive" scale which pays U.S.\$30.00 per week plus piecework up to U.S.\$75.00 per week or U.S.\$37.00 per week for non-piecework jobs. Works are trained for six to ten weeks on a separate production line where they learn a variety of operations.

Over and above every day communication, external coordination is achieved through occasional visits from the firm's president. Raw materials arrive every week having left New Jersey a week before, via Puerto Rico on a routine cargo flight. Exports take the same time on the return journey.

Plant B maintains a more rigid mode of production than most other plants visited. The plant used to get raw materials and assemble as much or as little as they liked for stock except when special orders came in and regular work was pushed aside. Order schedules were introduced about four or five years ago. However, the factory still makes for stock. The plant also keeps large raw material stocks because of the significant proportion of work that is lost or damaged in the manufacturing process. The turnaround time for an order is roughly one month, one week's transportation time before and after two weeks' production time. This is unusually long and again points towards a less flexible method of manufacture.

C. *Plant C*

Plant C was established in St. Lucia in 1979. A subsidiary of a New Hampshire electronics components subcontractor, the St. Lucian operation produces wire-wound long resistors for the U.S. market and customers such as Ford Motor Company, IBM, and Hewlett Packard. The factory has a work force of 238 and produces several thousand units a week.

The location decision was made on the basis of labor costs on the island. Access to the international air and sea ports were also cited as being important. Before the location decision was taken the company examined several other low-wage regions. St. Lucia measured up well against Mexico where even though labor was cheaper, the quality of workmanship was poor by comparison. Quality production is a major goal of this operation.

The production process is again based on the kitting system; there are eight stages in assembly. Quality control (QC) is built into the process. Early in the assembly process the resistance of each unit is tested and adjusted if slightly off. At the next stage each operator's work is logged and tested on a statistical sample basis. If one out of fifty (or more) do not meet specifications then all work is tested. If there are four or five defective units in the work, there is an investigation with the worker, the supervisor, and the manager to ascertain why this problem is occurring. There is also "in-process" inspection by the eleven QC supervisors who check how each individual is performing her task in terms of technique used, problems encountered, and numbers of rejects. The supervisors check each operator every hour or as frequently as every quarter of an hour. There is also a quality awareness campaign which tries to build quality into the product as opposed to merely relying on the QC points to catch sub-standard work. The in-process inspection is part of this campaign, and there

are posters underlining the importance of quality hanging in the factory. The pay scheme is also designed to encourage quality. The parent company at one time demanded an acceptable quality level (AQL) of 95 per cent. This tolerance level has actually been decreased now to 90 per cent because it gives the plant greater ability to improve production methods through experimentation. However, the tightening of quality control procedures and the use of repeat jobs (i.e., the travel sheet shows who committed an error and the defective piece is taken back to that person and the job is redone) means the factory has achieved an absolute zero defect situation.

Ninety per cent of employees are females between the ages of eighteen and thirty years old who receive a minimum of U.S.\$35.00 per week. There are two pay scales, piecework for some operations, as well as an hourly wage. Operators can earn up to several hundred Eastern Caribbean dollars per week (2.70 EC dollars to U.S.\$1.00). Workers are cross-trained on several different tasks. There are several bonus systems in place as incentives for operators to perform better. Worker of the month, travel compensations, team productivity competitions, T-shirts, and company picnics are all devised to make the factory a productive factory. There are weekly worker-management meetings to air grievances and make suggestions, the minutes of which are sent to New Hampshire. Management stated that these minutes had "a powerful impact" on the running of the factory.

External coordination is achieved through faxes and the telephone. The manager occasionally goes to headquarters in New Hampshire and is asked for his "critical input" (along with managers from sister plants around the world). The corporation therefore demands a two-way flow of information in developing offshore production systems. The corporation's president as well as customers and engineers regularly visit the St. Lucian operation.

Raw materials take one month to arrive from Taiwan by shipping container. They are imported each month. Other raw materials are flown in from New Hampshire which takes forty-eight hours. The finished product is also flown back. Because U.S. customers wish to minimize their own inventories and many expect JIT delivery of components, Plant C's inventories have had to remain sizable. Also the lead time on an order has had to be drastically reduced (from six to eight weeks in 1980 to two weeks currently), and indeed customers are beginning to contact the operation directly to see if priority orders can be placed to be completed in only a few days. Management hopes that if reliable and accurate testing equipment can be obtained and utilized successfully, Plant C can ship straight to customers.

Much of the flexibility acquired by the plant is dependent on the system used for turning the schedule of orders into a work schedule. The simultaneous production of more-than-one-product type on the floor has been achieved through the use of the kitting system because more-than-one-kit type can be issued to the floor at the same time and, providing the supervisors can move the materials around the different operations (which is not too difficult), some flexibility can be achieved. Kitting can also optimize the use of workers around bottlenecks.

Flexibility and total quality management (TQM) has also been introduced by the use of motivational techniques by management: bonus systems, the appeal to values other than monetary remuneration (i.e., intergroup competition), management-worker integration, and employee participation in decision making. Together these foster a quality work force which can react swiftly and effectively to production needs. Cross-training is also crucial and results in the elimination of bottlenecks, the facilitation of fast and effective switching between products, and the elimination of potential problems due to absentees. The minimization of lead times and the maintenance of substantial inventories enables prompt JIT delivery even for unexpected orders. Also constant feedback orientated communication with headquarters enables the maximization of performance through experimentation and synergistic learning.

D. *Plant D*

Plant D's parent company, a subcontractor to the North American telecommunications industry, is located in New York and has subsidiaries in California, Taiwan, and St. Kitts. Established in St. Kitts in 1983, Plant D assembles minute circuit boards for telecommunications equipment. These are exported either to New York or California. Only a single product is assembled and there are merely twenty different values for it. The work force is made up of 150 women and has an output of 70,000 units per week when running at maximum capacity.

The location decision was made on the basis of the cheap labor available and the fifteen-year tax holiday offered by the government. The production process involves sixteen stages including three quality-control points and uses the kitting system. Quality control is achieved through electrical testing on a 10 to 20 per cent sample basis at the last two checkpoints (the first checkpoint is merely a visual inspection of all units).

Employees earn on average U.S.\$45.00 per week plus travel expenses which can be up to an additional U.S.\$0.27 per person per hour. This travel allowance is very costly for the company. There is on top of these a bonus system, and daily targets for individuals are set. If the daily targets are met the operator may go home or she may stay and work on bonus time. One skill is taught and there is no cross-training. According to the manager absenteeism, at about 4 to 5 per cent, is a problem. Changes in production volumes are managed through the hiring and firing of workers, and indeed in January there was a materials shortage and everyone was laid off for three weeks. The opposite condition does not occur often because headquarters sends only just enough work to St. Kitts.

External coordination is achieved through weekly faxes and telephone conversations. The chief executive officer and U.S. technicians and engineers visit the plant several times a year to iron out production problems. Raw materials arrive from the Republic of Korea once every three or four months. This results in very large inventories of both raw materials and final products (subassemblies) numerous shut downs due to materials shortages. Plant D is now trying to implement once-a-month shipping from Korea. Lead time on an order is theoretically two weeks: one week production, plus one week in transit. However, actual

lead time is likely to be longer because production is on a "first in first out" basis and if there are orders in the system new orders must wait, raw material shortages are common and finished products are exported only once a week. Finished goods travel by plane to Miami (two days) and then by road to New York or California (three or four days). The manager also stated that they try to keep a backlog of work orders to keep workers busy. They also build to replace inventory in California.

Flexibility in operations is not a priority for this offshore plant. The reason for this may lie in the demand for the product itself which is likely to be reasonably steady and fairly easily calculated in advance. The production system is extremely simple using a straight-forward assembly line down which the kits pass. There is little cross-training of workers (and little need for it according to management), inventories are large and the number of different products made is low. There is little evidence of worker motivation techniques and the high absenteeism rate may well indicate some discontent.

E. *Summary*

Flexibilism has already influenced production systems offshore in the Caribbean. Reliability, promptness, and quality in production are increasingly becoming the most important aspects in electronics manufacturing. Several of the firms interviewed indicated that they have been "flexibly orientated" since their establishment and that they continue to experience "moderate" change annually in their production process.

Electronics firms in the Caribbean typically are involved in mixed-mode electronics assembly operations for onshore partners. The most successful plants all utilize the kitting system, and labor control centered on this system. Plant A indeed had the most efficient arrangement for the handling and tracking of kit trays. Plant B, on the other hand, did not even track trays via travel sheets. It was consequently the most disorganized plant. There is no doubt that this is due not only to the inadequacy of the system, but also to problems in management. The supervision of labor and the instillation of values concerning quality and productivity, as well as the cross-training of labor, are all at the heart of successful offshore operation for these plants. It appears that total quality management through in-process inspection and rigorous quality-control stages, is well advanced in these cases and that employees can exceed expectations handed down from the mainland. While the majority of the plants visited consequently appear to have secure futures, Plant B, which has continued to have trouble meeting the new world standard, appears to face an uncertain future.

V. CONCLUSIONS

It has been argued elsewhere that firms that are unable to technologically innovate against competition are most likely to move offshore [38] [20] [26]. This research would seem to indicate that this is true, but that such a statement underemphasizes the rapidity with which restructuring of the production process

becomes a global phenomenon. Indeed, the continued internationalization of what we call flexibilism could possibly enhance the status of less developed countries as production platforms for mainland markets.

This occurs because, unlike Fordism which is based on price competition and ever enlarging economies of scale, competition under flexibilism is based on customization, quality, and price. Under this larger definition of competition, enlarging economies of scope while providing higher quality at lower price is paramount. Achieving enlarged economies of scale requires greater capital intensity, and marshalling capital is particularly difficult for less developed countries. Achieving enlarged economies of scope, however, is possible either through increasing capital intensity, i.e., the technology approach to flexibility, or through reorganizing the definition of labor and management tasks within the firm, i.e., the organizational approach to flexibility [39]. While the former pathway remains problematic for less developed countries, the latter pathway to flexibility in production is not particularly capital-intensive. Thus the organizational approach to flexibility provides a realistic strategy for increasing the global competitiveness of less developed countries. This strategy becomes especially advantageous if the organizational approach to flexibility can be maintained in concert with high quality and low labor costs. This is precisely the situation of electronics manufacturing in the Commonwealth Caribbean.

Within the Commonwealth Caribbean, the initial impetus for industries to move offshore may have been an inability to compete with foreign, already flexible competition. While such firms tended to move offshore thereby achieving cost savings in the most wage-sensitive portion of their manufacturing process (e.g., assembly), they initially did not restructure and therefore continued to compete at a disadvantage. As restructuring of the industry within the Caribbean occurred, some segments of the industry proved to be more amenable to technology approaches to flexibility than others and were repatriated. However, those segments of the industry that proved amenable to organizational flexibility remained in the Caribbean, since given flexibility and the maintenance of high quality, low wages still provide a significant competitive advantage to firms.

Importantly, however, because competition under flexibilism is not entirely focused on price, but includes considerations of customization and quality, cost minimization is less of an imperative. As a result the competitive advantage and hence development potential of less developed countries, such as those within the Commonwealth Caribbean, is less centered on the issue of wages. Despite wage increases of about 5 per cent per annum for the last five years in both St. Lucia and Barbados, and even higher wage inflation in the enclave estates where the electronics factories are situated (all pay at least twice government-legislated minimum wages), management spoke of the wish to expand operations. This contrasts with the islands' textile industry which is almost exclusively concerned with wage minimization and which has been slowly leaving the islands as wages rise.

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