

University of the Philippines
SCHOOL OF ECONOMICS

Discussion Paper 8112

September 1981

Subcontracting and Technological Diffusion
in Philippine Manufacturing

by

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ABSTRACT

Policy-makers in developing countries, long frustrated with the difficulties, encountered in programs to foster small-scale industry, are giving increased attention to the scope that exists for large firms to assist in the development of small firms. In spite of the large literature on Japan, the nature and extent of inter-firm linkages in developing countries is a relatively unexplored field. This paper presents a preliminary analysis of subcontracting in the Philippine appliance and motorcycle industries, based on a recent survey of firms in the industries. Local content in these industries rose significantly in the 1970s, partly as a result of government policies, but inter-firm linkages remain very weak, and large firms play a minor role in upgrading the technical and managerial capacity of smaller firms. This situation is likely to remain unless there are some fundamental changes in the industries. Government attempts to promote subcontracting *in themselves* are unlikely to contribute to a significant strengthening of inter-firm linkages.

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SUBCONTRACTING AND TECHNOLOGICAL DIFFUSION
IN PHILIPPINE MANUFACTURING

by Hal Hill*

1. Introduction¹

More than twenty years ago, Hirschman (1958, P. 111) observed that developing countries frequently encourage the development of 'last' industries first. Factories are established whose primary tasks are 'conversion, assembly and mixing'; unlike their counterparts in developed countries, which buy most of their intermediate inputs locally, they tend to be highly import-intensive operations with limited local procurement. Although Hirschman's observations were based primarily on the experience of South America, and he was writing before the widespread adoption of international subcontracting, much of his analysis is relevant to Philippine industrialization.

The Philippines has pursued a broadly-based policy of import-substitution (IS) in the manufacturing sector for three decades.² Production of a wide range of consumer goods has increased rapidly from very low levels in the 1950s and 1960s. The initial stage of IS concentrated mainly on the production of finished goods. Yet many of these goods consist of a large number of parts and components and the firms which produce them are primarily assemblers, rather than manufacturers, of the parts and components. Generally the early period of IS for many industries is characterized by the assembly of imported CKD units, and consequently the manufacturing sector remains very import-intensive. Gradually local content can be expected to increase, because pressure

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from the government and local parts and components manufacturers (not the assemblers) for greater localization intensifies, and because the technological and managerial capabilities of the local suppliers improve.

The relationship between the assemblers or contractor firms on the one hand, and the manufacturers or subcontractors on the other hand, lies at the heart of the process of localization.³ In procuring their parts and components, assemblers have a choice between importing, in-house manufacture, and local procurement. Government policies and cost considerations dictate that not all the parts and components will be imported. For various reasons (see Section 2) assemblers rarely manufacture all their intermediate products. Consequently, assemblers require the existence of a network of efficient supplier firms capable of ensuring the continuous delivery of parts and components manufactured to the assembler's specifications.

Initial attempts by the Philippine government to promote backward integration of the assemblers began in earnest in the late 1960s and gathered momentum during the 1970s. In most assembly industries programs for localization have been introduced, in some cases requiring that increased local content be achieved only through 'horizontal integration' (see Section 3). The purpose of this paper is to examine the effects of these policies in the context of the relationship between assembly and manufacturing firms, in the motor cycle and appliance industries. What has the substantial growth in the output (see Table 1) meant for local suppliers of these industries? What is the nature of the relationship that has been forged between the two groups of firms? More specifically,

to what extent and in what way have the assembler firms fostered the growth of the manufacturer firms to which they subcontract, by acting as agents in the diffusion of new technologies to the smaller firms? How have government policies encouraging greater localization impinged on the relationship, and do they require modification? These are some of the issues to be addressed in this paper.

The presentation is organized as follows. Section 2 reviews the literature on subcontracting, focusing especially on the arguments advanced in favor of the practice. Section 3 reviews recent developments in the two industries and government policies which affect the procurement decisions of assemblers. Section 4 presents evidence on the degree of localization of parts and components for major products of the two industries, and discusses the major elements in the make-or-buy choice of firms. Section 5 examines the nature of the relationship between the two groups of firms. Section 6 presents our main conclusions and policy recommendations.

2. The Rationale of Subcontracting

Subcontracting may be defined as a commercial arrangement involving more than simply an off-the-shelf purchase by the assembler. The parts and components manufacturer produces not for the general market but to the assembler's (often unique) specification. Within this broad definition there are a variety of possible arrangements, depending on the strength of the relationship between the two firms. At one extreme, as was frequently the case in Japan, the supplier may be virtually an

extension of the assembler's operations, the latter providing the necessary raw materials, working capital and even machinery.⁴ But for most developing countries this is a restrictive definition of the term. The relationship is unlikely to be as close, except in the case of international subcontracting by a parent firm to its subsidiary.

Various types of subcontracting may be identified. These include, first, 'capacity' and 'specialization-oriented' subcontracting. As the terms imply, the former involves an assembler placing orders with a supplier only during periods of peak demand. But the latter involves greater complementarity between the firms and is more likely to lead to a continuous and stable relationship, and provides more scope for technological spin-off. Hence our main interest is with this type of subcontracting. Secondly, there is commercial and industrial subcontracting. In the case of commercial subcontracting, a firm - or more frequently a trader - supplies raw materials to the manufacturer, who is then responsible for the entire production process. It occurs commonly in the small-scale textile sector, in which textile traders put out orders to small firms. This also is of less interest to our study because it is unlikely to occur in such disaggregated activities as the industries chosen, and because technological linkages are again less likely to be present.

Discussions of subcontracting generally imply that the contracting firm is larger than the subcontractor. While this is a valid generalization, in practice the relationship is more complex. Because assemblers differ in their degree of vertical integration, it is not uncommon for a highly integrated firm to be supplying parts and components to its

competitors. (Examples of this in our survey were observed among motor cycle, television and air conditioner manufacturers.) Moreover, the subcontractor may actually be larger than the contractor - especially in the case of 'dissimilar products' (eg, tires, certain packaging material) - although this is uncommon.

Much has been written regarding the potential for developing mutually beneficial subcontracting arrangements between firms. It will be useful to review this literature before proceeding to the results of our survey. From the assemblers' point of view, their fundamental requirement is a network of reliable, efficient and quality-conscious suppliers. Without this supporting base they will be unable to penetrate export markets, and will require protection against imports in the domestic market. Recent writings by Pack (1980) on the capital-goods sector in developing countries, Oshima (1980) on the assembly industries and Moore (1980) on Korea's efforts to intensify its industrialization efforts all highlight this fact. How, specifically, may assembly firms benefit from subcontracting? There are at least five reasons for assemblers subcontracting, quite apart from deliberate government policies to manipulate firms' choice.

(i) Cost-saving factor: Small sub-contracting firms may be able to achieve cost savings not available to larger firms, especially in the production of simple items where a high degree of precision is not critical. Lower wage rates is the most frequently cited factor. In the presence of segmented labor markets, small firms are better able to evade the institutional pressures (government regulations, trade unions, etc.) on wages. However, lower wage rates do not necessarily mean lower labor costs,

owing to differences in labor quality and productivity between large and small firms. Small firms may also be able to achieve savings in overheads (factory premises, location of factory, office overheads), and the burden of taxation may be lighter - either by government regulation (eg, the Philippine government's cottage industry authority, NACIDA, grants five-year tax exemptions) or simply because taxation authorities may pay greater attention to modern sector firms.

(ii) Scarcity of capital factor: The primary function of contractor firms is to assemble the myriad parts and components into the final product. To the extent that these firms experience difficulty in obtaining capital, they will be forced to concentrate scarce funds in the core production process, putting out as much as possible to subcontractors. This is especially so if the market is expanding rapidly.⁵

(iii) Specialization factor: Manufacturers of parts and components are able to reap the benefits of economies of scale and specialization. If they are supplying the whole market (or a greater part than the production of one firm), longer production runs should result in lower unit costs. Producing a small range of products justifies the purchase of specialist machinery, leads to greater familiarity with existing technologies, and places the firm at the forefront of technological advance. Related to this, subcontracting permits the assembler to maintain a diversified product range without necessarily sacrificing economies of scale, because the significant scale economies generally occur on the manufacturing rather than the assembly side.

(iv) Organization factor: Motor cycles and most appliances usually consist of hundreds of parts and components. Co-ordinating the procurement and assembly of all of these severely taxes the purchasing and production divisions of most firms. If instead the firm were to attempt to manufacture in-house, these problems would be greatly magnified. The final product consists a wide range of dissimilar parts and components (eg, in audio-visual products, there are metal, plastic, rubber, wood and glass products, in addition to the high precision items). Consequently, a very wide range of skills, equipment and raw materials would be required for a fully integrated production unit, creating enormous organizational difficulties. Subcontracting greatly simplifies these problems.

(v) Flexibility factor: Subcontracting allows greater flexibility for the assembler in two ways. First, it enables the firm to adjust more quickly to fluctuations in demand - suppliers can be dropped during a downturn and sought out during a sudden upswing. Secondly, the assembler can change its product composition more quickly in the face of sudden switches in demand than in the case of in-house manufacture. Subcontracting therefore cushions the effect of sudden changes in market conditions for the assembler.

How may small manufacturers benefit from subcontracting? A United Nations report (UNIDO, 1974, P. 32) argued that

"a basic condition for carrying on subcontracting ... is an efficient, modern small-industry sector in lines of production corresponding to the requirements of the large firms".

This is a more appropriate observation for developed, industrialized

economies for, as Baranson (1969, P. 26) observes:

"The manufacturer-supplier relationship in developing economies is the exact reverse of what is typical of industrialized areas, where the manufacturer relies upon supplier know-how even to design required components and parts. In developing areas, it is the other way around; licensors have a very heavy responsibility to help develop the supplier industry, which ... typically lacks engineering capacity and foreign contacts".

Where the design of parts and components are frequently firm-specific, the need for 'extra-market direct linkages' (to use the term of Lall, 1980) - that is, a subcontracting relationship - arises before manufacturers will supply the assemblers. Subcontracting also assists manufacturers because it provides a continuity of orders and may enable the owner to concentrate solely on the production side of his business. But, as Baranson implies, potentially the more important contribution is the role that assemblers can play in upgrading the financial, technical and managerial capability of small supplier firms. The main purpose of this study is to examine the extent to which this potential has been realized in the industries under investigation.

3. The Industries: Recent Developments and Government Policies

3.1 Industry Structure

The industries chosen are well suited to a study of subcontracting because of the highly disintegrated nature of the production process. Baranson (1969, P. 22) has estimated that a small passenger car comprises 2,500 major parts and assemblies, and that approximately 15,000 separate machining and treatment processes are required in the manufacture of the

engine. In the motor cycle and appliance industries the number is much smaller but still very significant. Firms in these industries rely on supplier firms for a wide range of parts and components.

The industries are all relative newcomers to the Philippines, a fact which has important implications for the development of subcontracting networks. During the 1950s and 1960s the products were imported on a CKD basis and assembled locally. It is only in the last decade, and more particularly the last six years, that a substantial local production capacity has developed, at the instigation of government localization programs. Prior to the mid 1970s these assembly operations had virtually no local spin-off.⁶ Consequently, as Ishikawa and Odaka (1979, P. 3) observe, in the Philippines and elsewhere in Southeast Asia, "the machine-building industry still remains to be one of the weakest branches of manufacturing".

Production statistics on the industries are scanty. Central Bank and NEDA statistics provide estimates of production only at fairly aggregated levels. The figures in Table 1 are on the basis of estimates made by the Ministry of Industry, Trade and Investment, and the Manufacturers' Associations. There has been strong growth in the production of television sets and refrigerators, these two products especially benefiting from the government's program of rural electrification. However, the performance of other industries has been indifferent. Motor cycle production has declined since 1978, because of restrictions placed on the use of tri-cycles (motor cycles with a cabin attached at the side for carrying passengers), which previously accounted for 80 per cent of the industry's

sales. The production of audio units has been severely affected by smuggling and legal importation by Filipinos returning from abroad.⁷ Demand for air conditioners has declined owing to big increases in the price of electricity in the late 1970s.

Three additional characteristics of the industries are relevant to our study. First, foreign influence is very considerable. There is hardly a firm in the industry which does not have either a foreign partner or a licensing agreement with a foreign firm. In motor cycles three out of the four firms are joint ventures, the fourth is a licensee; in air conditioners three are joint ventures and four licensees; in television sets there are six joint ventures and seven licensees. This situation is not surprising in view of the limited domestic technological capacity present at the time that the government encouraged local assembly. Clearly the industries could not have developed initially without some type of overseas technical tie-ups. It is important to bear in mind this strong foreign influence in any discussion aimed at rationalizing the industry (see Section 6).

Secondly, there is a general lack of standardization in the industries, mainly because of these overseas tie-ups. Very few parts are interchangeable. Product specifications are developed by the foreign partner or foreign licensor and passed on to the local assembler. The result is that parts and components, both major and minor, differ between the firms. Standardization is not such an important factor in industrialized countries with large domestic markets, or even in industrializing countries which export a large proportion of their output. But in the Philippines, where the domestic market is limited and exports minimal, it

is a major constraint on the development of efficient parts and components industries.

Thirdly, although the Philippines is the third most populous country in developing East and Southeast Asia, the domestic market is still relatively small.⁸ Moreover the market is highly fragmented because there are many producers (13 in case of television, 12 in audio sets, 7 in air conditioners), many of whom are producing a wide range of models. It is not uncommon for air conditioner and television manufacturers to have as many as 20 different models, with an annual production of about 5,000 and 20,000 units respectively. While there is often a good deal of interchangeability of parts and components between these models, the inevitable result is that the market for suppliers becomes even further fragmented. These factors combined - a relatively small market, a large number of firms, lack of standardization, and model proliferation - inevitably mean that, for parts and components with significant economies of scale in their production, local suppliers are not competitive. It is essential for policy-makers to come to grips with this fundamental fact in charting the future course of the industries.

3.2 The Impact of Government Policies

A wide range of government policies impinge on the sourcing decisions of assemblers and hence on the development of subcontracting relationships. It is important to outline these because they are central to a proper understanding of firms' motivation in the choice between buy, make or import.

The drive towards localization began in earnest in the 1970s, but some initiatives were introduced in the 1960s. Republic Act (R.A.) No. 3029 (1961) specified differential sales taxes on refrigerators, air conditioners and beverage coolers according to the degree of local content.⁹ No reference was made to subcontracting, as in later regulations. Indeed in discussing localization of parts and components, it specified that a firm "must manufacture [them] within its premises". Thus, the initial attempt to increase local content in the Philippines also provided a strong incentive for in-house manufacture. A similar regulation (R.A. No. 4122, 1964) was introduced for audio-visual appliances, wherein the sales tax on certain locally manufactured parts and components was 7 per cent, as compared with 40 per cent for imported items. Another indirect influence during the 1960s was periodic balance of payments difficulties, the most serious being in 1969 (Baldwin, 1975), and consequent moves by the Central Bank to discourage imports. But the most concerted attempts to increase local content occurred in the 1970s, and our attention focuses on these.

3.2.1 Policies to Increase Local Content

These include policies to achieve a certain percentage of local content in parts and components, and those which in effect force assemblers to buy certain parts and components locally.

3.2.1.1 Progressive Motor Cycle Manufacturing Program (PMMP)

The PMMP, introduced in 1973, follows closely the Progressive Car Manufacturing Program (PCMP), and for its origins and rationale we may refer to the latter program. The PCMP arose out of the belief by policy

makers that the automotive assembly industry, established in 1951, had had a minimal effect in stimulating parts and component manufacturers. Aiming to rationalize the industry, its objectives (like those of the PMMP) were, first, to save foreign exchange, through increased local production; secondly, to generate exports, especially in the context of the ASEAN complementation program; and thirdly, to foster the development of small and medium suppliers. The program is quite specific on the latter point, stating that:

"The end-product assemblers/manufacturers would serve as the focal points through which engineering, management and financial assistance would be extended by international companies to domestic parts makers to enable the latter's products to comply with international quality standards." (Philippines, Board of Investments, 1971).

To this end, the Board of Investment (BOI) introduced a program of progressively increasing local content for the five participating assemblers, the incentive for compliance being that foreign exchange allocations for remaining imports may be withheld if the targets are not attained.

The difficulties encountered by the PCMP have been discussed elsewhere (Watanabe (1979), APO (1978, Pp. 53-59), Tolentino and Ybañez (1980)).

Two important points need to be emphasized regarding both the PCMP and the PMMP.¹⁰ First, although the programs aim to develop small and medium manufacturers, and specify that "horizontal integration ... shall be preferred to vertical integration", they draw no distinction between in-house manufacture and subcontracting. In fact, because of distortions in the tariff structure (see Section 3.2.4) and because the BOI incentives are made available only to program participants and not subcontractors,

the programs in reality encourage greater in-house manufacture. Secondly, the formula used to estimate the local content ratio substantially overstates the effective level. This is because locally manufactured parts and components are valued at replacement-parts prices, which are always substantially higher than original-parts prices (in a CKD kit).

Despite these limitations, the PCMP and the PMMP have undoubtedly fostered the development of some local manufacturers. Table 2 shows the prescribed and actual local content for the four manufacturers under the PMMP. After rapid growth during the first five years, the last four years have witnessed slower progress. Some of the reasons for this will be discussed in Section 4.

3.2.1.2 The Electronic Local Content Program (ELCP)

The ELCP, also administered by the BOI, has adopted a different approach to localization. Introduced in 1975 in response to pressure from the manufacturers of electronic parts and components, it applies to audio-visual appliances (television sets, stereos, cassette recorders, transistor radios). Whereas the PMMP prescribed certain local content levels and left the assemblers to choose between making or buying, the ELCP drew up a list of parts and components to be procured locally (see Table 3 for those included in the first two program years). Moreover, it states explicitly that "horizontal integration shall be a guiding policy in the implementation of the Program", and that assemblers are required to buy these parts and components from local suppliers. There are, however, several exemptions. First, if the assembler is already manufacturing these parts and components in-house, he may continue to do so. This is

an important consideration because the assemblers were very influential in deciding which parts and components were to be included and most already possessed substantial in-house operations. Secondly, proprietary items may still be imported or manufactured in-house. The definition of 'proprietary', however, has not been resolved satisfactorily, and it is a contentious issue in current negotiations on the ELCP's third program year. Thirdly, the price of locally supplied items must be competitive with imports and in-house manufacture. Here, also, there are no clear guidelines and implementation has not been consistent. Finally, if assemblers are affected unduly by widespread smuggling - as has been the case in audio products and color television sets - the localization provisions may be waived by the BOI. This is allowed on a case-to-case basis and, again, no clear guidelines have emerged.

Like the PMMP, the ELCP clearly has contributed to the development of parts and components manufacturers, but it is difficult to gauge its full impact. In theory it should have been considerable, because it is the first (and only) regulation requiring that specific items be procured from local firms. There have, however, been allegations that the ELCP is not being fully implemented. The establishment of 'sister companies', while complying with the ELCP, is not in accord with the spirit of the regulations. The BOI, charged with annual inspection and approval of each assembler, does not have the resources (especially the technical manpower) to carefully monitor the program. Moreover, especially in the audio field, where smuggling is a major problem, there is little doubt that some assemblers are virtually importing their parts and components on a CKD basis. Implementation was pursued quite vigorously in its earlier years,

but more recently appears to have slackened off. Naturally the question arises of whether the first two program years should be thoroughly implemented before a third program year is attempted.

3.2.1.3 Other Localization Programs

The BOI has two additional localization programs, both of which make no stipulation regarding in-house manufacture or local procurement. In the case of refrigerators and air conditioners, which were previously subject to differential rates of sales tax according to the level of local content, the BOI now requires that 50 per cent of the total number (not value) of parts and components be locally manufactured. Further, seven major assembly processes are identified, and 50 per cent of the items within each category must be localized. In practice, this has little effect on the sourcing decisions of assemblers. It is possible to achieve the requirement with low levels of local content (for example, the local content for air conditioner firms is on average below 50 per cent - see Table 5), because of the wide range in prices of parts and components. Secondly, the government's push to encourage localization for refrigerators in the 1960s means that these firms easily exceed the requirement. Periodic attempts have been made to enforce localization of certain key parts and components (for example, compressors for air conditioners in the mid 1970s) but these have not been sustained.

Secondly, the BOI has a local content requirement for electric fans and cooking appliances, that 80 per cent of their parts and components be locally produced. Here also, the figure refers to the number, not the value, of items.

3.4.2 The Tariff Structure

The Philippine tariff structure exerts a crucial influence over sourcing decisions of firms. Its effects have been extensively documented elsewhere (Bautista, Power and Associates (1979), Baldwin (1975)) and it is currently the subject of a major review, so our comments will be brief. There is a wide variation in nominal tariffs which becomes wider still in terms of effective rates of protection (EPR), according to the most recent calculations (Tan, 1979, using 1974 data). In the mechanical engineering sector differential rates of protection constitute a major distortion, which encourages assemblers to import their parts and components wherever possible. EPRs on final consumer goods in the industries being considered are very high - in some cases over 200 per cent - whereas those on most parts and components are moderate (see Table 4).¹² This problem is compounded by quite high prices for certain raw materials. In comparison with Taiwan, perhaps the major overseas supplier of parts and components to the Philippines, domestic prices for Ferro Silicon, Resin, Sand and Ferro Manganese are approximately double the corresponding price in Taiwan. The nominal tariff on tinplate and rods and bars is 50 per cent and, moreover, domestic prices are set by the relevant government agency. In recent years, in order to compensate for losses incurred by the government steel plant in Illigan, domestic prices have been maintained at high levels. According to a recent World Bank estimate, for example, the price of rods and bars is 23 per cent above 'international prices'.¹³ Thus, it is not uncommon for the landed price of certain imported metal parts and components to exceed the local cost of raw materials for the similar items produced domestically. Clearly this provides a powerful incentive for

assemblers to important these parts and components wherever possible.

3.2.3 Policies to Upgrade Subcontractors

Policies to increase local content operate on the demand side, that is, they force assemblers to place more orders with local manufacturers. The government has also attempted to work on the supply side, through upgrading the capability of small and medium subcontractors. Many schemes have been introduced, so much so that it is not always easy to discern the overall thrust of government initiatives.

The body established (in 1978) to co-ordinate government efforts to promote subcontracting is the Manufacturers Subcontracting Development Office (MSDO), a small group within the Commission of Small and Medium Industry. The MSDO has drawn up a list of certified subcontractors - to be computerized - which is made available to interested domestic and international assemblers (the latter in conjunction with the Bureau of Export Promotion). The MSDO is also to be consulted in the implementation of the programs by government agencies which have direct implications for subcontractors.

One example of this type is an imaginative financing scheme developed jointly by the MSDO and the government's Development Bank of the Philippines (DBP). Under the scheme, MSDO-registered subcontractors receiving purchase orders from assemblers could present the order to the MSDO who, acting as the agent for DBP, would verify the authenticity of the application and then request DBP to release the funds. Processing of the scheme was to take just three days, with an upper limit of P500,000. This would have

been a major contribution to one of the most pressing needs of subcontractors - obtaining working capital quickly - but unfortunately the scheme has been shelved and is unlikely to become operational. Thus the potentially useful role of MSDO is being circumscribed by its very limited staff resources and its dependence on other more powerful government agencies.

A recent World Bank report observed that

"there is an urgent need for strengthening vocational training, apprenticeship and technical training throughout the Philippines ... The lack of skilled workers will soon become a major bottleneck to industrial development". (IBRD, 1980, P. 47 [Main Report])

As we shall see below, poor quality and low technical levels are major constraints on the development of subcontracting in the Philippines. Faced with the need to upgrade the technical and managerial skills of small and medium firms, the government has embarked on a number of programs. This is not the place to evaluate their contribution, which has in any case been examined by two recent World Bank reports (Anderson and Khambata (1980), IBRD (1980)). But two observations are pertinent here. First, the programs appear to have mushroomed at an astonishing pace and to operate in a somewhat unco-ordinated manner. The list of government bodies (there are also some private institutions) with some technical or training function to assist small and medium firms is now so great that these businessmen appear rather confused as to which is the appropriate agency to approach for assistance.¹⁴ Secondly, given the limitations of funds and skilled manpower, it is inevitable that resources on the ground will be stretched very thin and moreover that some duplication will occur.

3.2.4 Other Policies

3.2.4.1 Sales Tax

A frequent deterrent to subcontracting is the cascading effect of the sales tax structure, whereby purchased intermediate inputs are subject to a sales tax whereas those manufactured in-house are not.¹⁵ This is not a factor in the Philippines because the Bureau of Internal Revenue (BIR) operates a draw-back scheme, wherein sales tax paid on purchased inputs may be deducted from the payment of sales tax on the final product. However, the scheme is not completely neutral in practice, and two minor factors impinge. First, in the case where an assembler provides raw materials to a subcontractor when placing an order, the sales tax is reduced from the usual 10 per cent to three per cent, but the latter is not deductible from the assembler's final sales tax payment. Although the effect is minimal it does provide a slight inducement not to provide subcontractors with raw materials. Secondly, the sales tax component is usually itemized in orders for raw materials and parts and components. However, this procedure is not always adopted in the case of smaller traders, the usual source of raw materials for parts and components manufacturers. The consequent uncertainty (regarding the amount of sales tax paid) necessitates the assembler having to negotiate with the BIR, which may be to the former's advantage.

3.2.4.2 Prohibited Imports

The government regulates the flow of imports not only through its tariff structure, but also through outright prohibition of the import of

certain items. These are mainly final consumer goods, but a few parts and components in the industries under study are also included. In certain cases, however, exemptions are provided on application to the Central Bank.

3.2.4.3 ASEAN Complementation Programs

ASEAN complementation programs and the ASEAN Preferential Tariff Agreement (PTA) have a potentially significant impact on assemblers' sourcing decisions. Discussions on complementation programs for several industries have been proceeding since 1977, but in the industries under examination major break throughs have yet to occur. Philippine officials and business associations have proposed a number of components, none of which has yet been adopted. These include picture tubes (1977), compressors for refrigerators and air conditioners (1979) and motor cycle engines. The pace at which negotiations have been proceeding in the automobile complementation program, the first major project to be tackled, suggests that it may be some time yet before real progress will be achieved in other industries. Apart from Singapore, each of the four ASEAN countries have undertaken, or are about to undertake, comprehensive import substitution programs which renders the achievement of complementation schemes more difficult. Frequent allegations are also made that multinational corporations, which dominate many industries, are less than enthusiastic about the schemes. Progress with the PTA has been very slow (Naya, 1980) and it also has had a minimal effect in encouraging increased regional procurement.

3.2.4.4 Technology Transfer Board (TTB)

The TTB, established in 1978 as a unit within the then BOI, has been assigned the task of scrutinizing technology agreements between overseas firms and local licensees. Its operations could potentially extend to an examination of the appropriateness of the technology to be adopted in light of the capacity of local parts and components suppliers, and the scope that exists for standardization. As yet, it has not extended into these areas, which have important implications for local subcontractors. Moreover, most firms in the industries were established before 1978, and hence do not come under the TTBs purview.

3.2.4.5 Smuggling

Smuggling has assumed major dimensions in the case of relatively small, high value products like television sets, transistors and stereos. As already noted, it has led to a sharp decline in production of audio products and discouraged local production of color television sets. By their very nature, most other products in the two industries are largely unaffected. Smuggling affects sourcing decisions in two ways. First, it provides assemblers with a powerful incentive to import CKD kits if at all practicable. Secondly, in products where smuggling is blatant and widespread, the BOI is unlikely to implement localization programs as vigorously as might otherwise be the case. Thus exemptions are frequently provided in the case of color television sets and audio products.

4. The Sourcing Decision: Make, Buy or Import

4.1 Introduction

There has been surprisingly little discussion in the industrial economics literature regarding factors determining the sourcing decisions of assemblers, especially in developing countries.¹⁶ In his well-known article, Stigler (1951) argued that certain trends in the degree of vertical integration are discernible in most industries. Young industries, he maintained, are likely to exhibit greater vertical integration because they may require new types of intermediate inputs. But, gradually, specialist manufacturers emerge, and a trend towards vertical disintegration becomes evident as assemblers hand over these functions to the former. While much of this is relevant to developing countries also, Stigler's analysis may have to be modified because of the high import-intensity of many assemblers. The first consideration for firms is not whether to make or buy (locally). Rather it is whether to import or source locally. And, especially in the early stages of import substitution, assemblers are unlikely to localize substantially in the absence of government pressure. We will be arguing that sourcing decisions in the Philippines have depended primarily on three factors. First, and most important, government policies. Secondly, the state of parts and components manufacturers, their technological and managerial capacities. Thirdly, the nature and size of the market, including factors such as the number of assemblers, the degree of standardization and the type of products produced.

4.2 Sourcing: Empirical Evidence

Table 5 shows the composition of parts and components for each of the products assembled by firms in our survey. Several points need to be made regarding the data. First, the sum of the number of firms in column 1 exceeds that in our survey (20 firms) because several firms produce more than one product. Secondly, the import and local content ratios (columns 3 and 6) are not the same as those for the industries as a whole because they are unweighted and because not all firms in the industries were surveyed. However in most cases they are a reasonable guide to the overall composition.¹⁷

Finally, the meaning of local content ratios, and their interpretation, should be clarified. First, they indicate the percentage of the total value of parts and components in the final product which are manufactured locally. As such, they say nothing about economic efficiency. They are an economic indicator only to the extent that increased localization is adopted as a development objective.¹⁸ Secondly, local content ratios say little about the degree of effective localization, unless account is also taken of this ratio in the manufacture of parts and components. Frequently, major intermediate inputs are highly import-intensive, some involving little more than the assembly of imported CKD units. For example, in the television manufacturing industry, a major component is the picture tube. In its manufacture in the Philippines, approximately 90 per cent of the total value of parts and components are imported. Thirdly, there are substantial measurement and definitional problems in calculating local content ratios. Some firms value in-house

manufacture at cost, others at some equivalent of 'market price'; the price of imported units may be distorted by transfer pricing, in the case of intra-firm transactions; it is not always easy to distinguish between assembly and manufacturing operations, and the former should not be included (but in practice frequently is) in determining the value of intermediate inputs.¹⁹

With these considerations in mind, what are the main findings from Table 5? The range in import-intensity is very great among the nine products: imported parts and components constitute almost 90 per cent of the cost of color television sets, but as little as 13 per cent in the assembly of electric fans. In fact, three broad categories of products may be identified. First, those with high import intensity (imports greater than 60 per cent), which include color television and audio products. These industries are basically assembling imported CKD units, supplemented by limited local procurements. Local content ratios of 10 to 15 per cent can be achieved very easily, through sourcing packaging and other sundry items locally, and undertaking minimal processing in conjunction with local assembly. The local content figure for audios is higher than color television because cabinets and some parts of speakers may also be obtained locally. Secondly, at the other extreme are industries with low import-intensity (imports less than 30 per cent), including electric fans, refrigerators and gas stoves. Here, imports are restricted to a relatively small number of critical parts and components which are not produced locally, or where local products do not meet the required quality standards. The third category, including sewing machines, air conditioners, black and white television sets and motor cycles, are industries in which significant

localization has occurred, but some major parts and components continue to be imported.

The coefficient of variation for imports (column 7) for most products is low, indicating considerable uniformity among firms in their decision to source locally or overseas. Part of the explanation for this is government localization programs. Indeed the two industries with the highest coefficients are those where the localization requirement is very relaxed (refrigerators) or loosely defined (electric fans), permitting firms a greater degree of flexibility.

Regarding locally manufactured inputs, there is no clear pattern in the make-or-buy choice, but the data in columns 4 and 5 suggest a general preference towards in-house manufacture. In six of the nine industries the value of items manufactured in-house exceeds that of subcontracted items. Significantly, of the three industries for which it is the reverse, two of them (black and white television, and audio) have been the only industries where the localization program has specifically included a requirement regarding local procurement. This suggests that, here at least, government policies have had some impact.

To elaborate on Table 5 and facilitate our analysis of factors underlying the sourcing decision, it will be useful to list for each product the major parts and components being imported. These are as follows:

(i) Sewing machines: Major component parts (all high precision parts) of the motor, plus certain high precision metal hardware.

(ii) Air conditioners: Critical items in the operation of the unit, including the compressor (for most firms), the fan motor, and the thermostat, plus some plastic controls and switches.

(iii) Color television: Virtually the entire product, apart from packaging, small plastic and metal parts, and the cabinet (in one case).

(iv) Black and white television: Electronic components (resistors, capacitors, transistors), yoke and flyback.

(v) Audio: Printed circuit board, turntable and parts, and speakers (in most cases).

(vi) Electric fans: Condensor, switches and control knobs.

(vii) Refrigerators: Compressor and fan motor (in some cases), thermostats certain metal hardware.

(viii) Gas stoves: Gas valve, thermostat and burner.

(ix) Motor cycles: Major component parts of the engine, unassembled frame, wheels, some electrical parts.

4.3 Factors Determining Sourcing

What are the major factors determining the choice between the three sources of parts and components? We have already discussed government policies, and clearly they have an impact on local content ratios and, in the two products mentioned, on the decision to buy locally or manufacture in-house. While very important, however, it would be a mistake to exaggerate their impact. For sewing machines there are virtually no restric-

tions on sourcing. In motor cycles the prescribed local content ratios overstate the effect local content which is required, as can be seen by comparing Tables 2 and 5. Originally, air conditioner and refrigerator producers had a strong incentive to localize, but the current requirements are quite limited. Similarly, in the case of electric fans and gas stoves the regulations are fairly liberal because they are based on the number of items rather than their value. Finally, the audio-visual sector is not heavily regulated now, except in the case of black and white television sets.

There is, therefore, a substantial degree of freedom in firm's sourcing decisions. The purpose of this section is to identify some of the principal economic factors which impinge on these decisions, both as between local and import and, within the former, between make and buy.

(i) Economies of scale in the manufacture of certain parts and components: While precise estimates of the optimal scales of production are not available, it is clear that this is an overriding factor for some items. These include, for example, the electronic components in television sets, major parts in motor cycle and sewing machine motors, the condensor in electric fans, and certain plastic parts requiring very expensive molds. For these and other products the minimum efficient scale probably exceeds the entire local market. Thus, the relatively small domestic market plus the inability to penetrate export markets effectively precludes economic local manufacture. There is no option but for firms to import these items, unless the government forces high cost local production.

(ii) The type of product: Aside from the issue of economies of scale, the type of product has an important bearing on the choice between local manufacture and imports, because it determines the ease with which local producers may be located and developed. 'High technology' products, comprising a significant proportion of high precision items requiring sophisticated machinery and technical expertise, will be much more difficult to localize. This also applies to products which undergo frequent and rapid design changes and technological modifications. The implication is that governments should aim for selective rather than across-the-board localization. Conversely, the parts and components of many products are such that they are within the capabilities of local manufacturers, even in their present relatively underdeveloped state, and Philippine comparative advantage clearly lies in the production of these simpler items.

(iii) The extent of market fragmentation: The scope for exploiting economies of scale depends not only on total market size, but also on the fragmentation within the market. Important variables here include the number of producers and the number of models produced in an industry, the degree of interchangeability among models, and the extent of standardization among producers. It was argued earlier that the industries in our survey are highly fragmented - not only are there many producers and models, but there is a general lack of standardization in items used. This further limits the ability of parts and components manufacturers to achieve economic production runs, and hence increases domestic costs relative to import prices.

(iv) The attitude of foreign partner or licensor: This is an important consideration, because virtually every firm in the industries

is either a joint venture with or a licensee of a foreign firm. It is difficult to generalize regarding the influence of foreign partners and licensees. Presumably both local and foreign firms have broadly similar economic objectives and comply equally with government regulations. But there are grounds for believing that foreign influence may impart a bias - perhaps only slight - towards higher import intensity. Before sourcing locally, licensees must obtain approval from the licensor that local items are of suitable quality. Moreover if they source from the licensor's country, which is generally the case, they are usually required to buy through the licensor. In the case of joint ventures, the influence is probably greater. Plant managers, who are generally expatriate personnel, have an understandable predisposition towards sourcing from the parent company. (Initially quality considerations may dictate this choice, but the preference often continues even after local supplier have improved.) Transfer pricing probably also plays a role in the choice, but it is very difficult to determine its exact impact.

The first four factors have been concerned mainly with the choice between importing and local sourcing. There are in addition a number of factors which relate more to make-or-buy choice in the local market.

(v) Desire for secrecy: Most firms have certain proprietary items, involving firm-specific technology, which they are reluctant to divulge to their competitors. In the industries surveyed, this applied mainly to the audio-visual products - it is one of the reasons why these firms are objecting vigorously to certain items being included for consideration in the ELCP's third program year - and to a lesser extent air conditioners. Firms insist on these items being manufactured under close supervision,

either in-house or by an exclusive subcontractor. Since in the Philippines their orders would not generally be of sufficient volume for a firm to rely solely on one firm, in practice the only alternative to importing is in-house manufacture. This is not a major factor in the sourcing decision, however, as these items rarely constitute more than 20 per cent of the total value of parts and components, and in most products they are considerably less.

(vi) Age of the firm: Modifying Stigler's hypothesis, we might expect older firms to subcontract a higher percentage of their parts and components.²⁰ This is not apparent from our survey; in fact the reverse is more likely to be true. Our finding does not invalidate Stigler's notion, however, because it reflects mainly the impact of localization programs. When initial attempts to encourage greater local content were introduced, local suppliers were very weak. The programs in effect encouraged greater in-house manufacture, because the assemblers were technologically more developed, and because incentives were generally available to the assemblers and not the small parts and components manufacturers. Moreover, in the case of the ELCP, where specific subcontracting provisions were introduced, older firms already possessing in-house manufacturing capacity were exempt from its provisions. Thus it is generally the newer firms which engage in greater subcontracting. But, overall, the industries are probably too recent to be able to reach definite conclusions on the impact of age on sourcing decisions.

(vii) The state of factor markets: In section 2 it was observed that much of the Japanese literature on subcontracting alludes to this factor. Without a thorough examination of factor markets in the

Philippines, our analysis here is at best exploratory. During our interviews, however, several firms indicated that recent changes in the state of factor markets constitute a strong inducement to increase subcontracting. Many of the assemblers were established in early 1970s when credit for firms in the 'promoted' sector was relatively easily obtained, and at low or even negative real interest rates (ILO, 1974). Access to loan funds on favorable terms meant that these firms were not forced to concentrate their resources only on the core assembly processes, but could also extend into in-house manufacture. In the case of the labor market, available evidence suggests that real wages in the formal sector declined in the first half of the 1970s (Lal, 1979). Thus, two factors which allegedly provided a strong incentive to subcontract in Japan - capital shortage and marked wage differentials between large and small firms - may not have been operative to the same degree in the Philippines during the initial stages of backward integration.

By the late 1970s, however, many firms argued that the situation had been reversed to some extent. Credit was much more difficult to obtain, even for joint venture firms, because of Central Bank restrictions on the foreign partner's equity contribution. Real wages were rising again, although not perhaps to the level of 1970. Moreover, wages rose less in small firms, which could avoid paying the additional allowances, or even the increase itself. Many of the firms surveyed stated that these changes were affecting their sourcing decisions, both for new items and those currently produced in-house where the machinery was due for replacement. 18 of the 20 firms interviewed indicated that, if they were commencing in the 1980, the share of subcontracting in local content would be higher

than it was when they originally established. Improved state of suppliers and factor market conditions were given as the two principal reasons.

(viii) The composition of parts and components: A further explanation of sourcing decisions is the nature of parts and components which comprise the final product. Here the distinction drawn by Lall (1980, P. 206) between technologically similar and dissimilar activities is useful. The former he defines as "those that are based on common scientific, engineering and production experience", whereas the latter are "those drawing on different technological specializations". While it is not easy to draw precise distinctions, those products which draw on a wide range of specialized technology (for example, in the manufacture of electronic, glass, wood, rubber and plastic parts) in addition to basic metal work processes, would generally be expected to subcontract a greater proportion of their parts and components. This is one explanation of why, for example, in-house manufacture is lower in audio-visual products than it is in refrigerators and sewing machines. The former consist of many specialized parts and components, whereas much of the value of the latter is in the basic frame and casing.

(ix) Degree of export-orientation: The industries surveyed are basically import substituting. Only one firm in our sample of 20 was exporting significant quantities of finished products, another three had done so intermittently, while four had exported parts and components on an irregular basis. But owing to the sluggish domestic market and government policies designed to encourage firms to become internationally competitive, increasingly assemblers are examining export prospects. There is evidence to suggest that, as firms become more export-oriented, changes

occur in both the sourcing decision and the nature of the subcontracting relationship. The export market is far more demanding than the domestic one, particularly as regards quality and delivery schedules. The experience of firms attempting to penetrate overseas markets was that their operations initially became more import-intensive, that is, they were forced to import more parts and components, primarily for reasons of quality. However, many of these items were not necessarily beyond the technological capability of local suppliers. It simply required greater attention to quality. To avoid unnecessarily high imports - imports require greater inventory levels - the longer term effect appears to be (it is still too early to be sure) that assemblers pay more attention to suppliers, to upgrade their quality and skills, and local content eventually increases. By contrast, firms producing only for the less demanding domestic market pay less attention to the need for quality improvements, which is reflected in the nature of the relationship with their suppliers. (This issue is relevant to our discussion in the following section.)

(x) Management preferences: So far we have been assuming that firms in an industry respond in a similar fashion to factors influencing the sourcing decision. There are, however, inter-firm differences (see columns 7 and 8 in Table 5), based on the background and experience of company management. Some companies exhibit a very strong preference for direct control, especially in the case of critical items or those subject to warranty, and they believe that the only way to ensure adequate quality and prompt delivery of these is to manufacture them in-house. Several factors are important here.

The first of these is the background of the owners and the general manager. As a generalization those firms which, prior to backward integration, were engaged in distribution or assembly of imported CKD units and had very little manufacturing experience tend to have greater in-house manufacture. Localization occurred through a series of discrete investments in in-house manufacturing capacity, with the foreign partner or licensor usually playing a very significant role. By contrast, those firms whose management has had extensive manufacturing experience generally resort to greater local subcontracting.

Seeking out, developing and co-ordinating a reliable network of subcontractors is an expensive, time-consuming task. As a recent survey of the capital-goods sector in developing countries observed, managerial weaknesses in the assembly firms can be such that "organizational costs of subcontracting may currently exceed the cost reductions to be derived from it" (Pack, 1980, P. 21).²¹ For managers with a sound knowledge of the local manufacturing sector, this cost impediment is likely to much reduced. In this context, the purchasing or procurement managers play a crucial role, since they are the focal point of suppliers' contact with the assemblers. Even though they are subordinate to the general manager, they frequently exert an independent influence on a firm's sourcing decisions. An 'activist' purchasing manager who develops strong personal relationships with suppliers is likely to constitute an important factor in the make-or-buy choice (especially in the Philippines where inter-personal relations perhaps play a greater role than in western industrialized economies).

(xi) Existing state of suppliers: The strength of local suppliers has been implicit in much of our discussion regarding sourcing decisions. Good local manufacturers are a strong incentive to increase local content, and to subcontract a greater percentage of parts and components. As was observed earlier, ancillary firms in Southeast Asia are a lagging sector, especially compared to those in newly industrializing countries of North-east Asia.²² Nevertheless, Philippine supplier industries have improved in the last decade, partly because of government policies, and this will encourage increased local procurement in the future.

4.4 Factors Determining Sourcing: A Summary

Many factors determine the sourcing decisions of firms and in particular the development of subcontracting relationships. Of those discussed, which may be regarded as the key factors? This is a difficult question to answer, as clearly many of them are interrelated. Moreover, it is not possible to develop a rigorous explanatory model, because many of the factors are not easily quantifiable.

From our analysis, four factors emerge as being of major importance. First, government policies. This is an exogenous variable, whose exact influence is difficult to predict. Its power depends on the precise nature of localization policies adopted, and the degree of implementation. Secondly, the type of product, its technological requirements, and industry structure. High technology items, product proliferation and a lack of interchangeability and standardization among firms and products in the context of a small domestic market all militate against the development of viable local subcontracting relationships. Thirdly, the ability of

local suppliers to manufacture parts and components at internationally competitive prices, of suitable (and uniform) quality, and to maintain reliable delivery schedules. (This factor is heavily dependent on the first two factors.) Fourthly, the state of factor markets. A highly segmented labor market (implying wage differentials between small and large firms which exceed productivity differences for workers in the two sectors) and a capital market which allocates loan funds according to the viability of investment projects rather than the status of the firm (so that firms in the modern, organized sector do not receive special treatment from financial institutions) both provide strong incentives towards increased subcontracting.

To generalize for the Philippines, the first factor has encouraged the development of subcontracting, although only to a limited extent; the second and third factors have been impediments; and the fourth has not exerted a great influence, but it may become more important in the future.

5. Technological Diffusion and the Nature of Subcontracting Relationships

The previous section has examined factors in the procurement decision of assemblers and the development of subcontracting relationships. Much of the subcontracting literature has emphasized the complementary nature of the relationship between assemblers and manufacturers, and the technological and other linkages between the two groups of firms. The Japanese experience, in particular, suggests that assemblers may play a very positive role - purely through self-interest - in upgrading the capacities of their suppliers. After more than a decade of backward integration in Philippine manufacturing, to what extent and in what manner

have local assemblers performed a similar role? This question can be answered by examining the strength and closeness of the relationship between the two groups of firms, and the extent and nature of inter-firm linkages.

5.1 The Subcontracting Relationship

There are several indicators of the strength of subcontracting relationships. Our survey suggests that ties are generally weak and shallow.

5.1.1 Single Suppliers

Consider, first, assemblers' preferences regarding the number of supplier firms. Japanese assembly firms concentrated on developing a relatively small number of reliable suppliers. The reverse is generally the case in the Philippines. It is not uncommon for quite small assemblers to have as many as 80 supplier firms. In particular, they exhibit a strong preference for having at least two and, in some cases, as many as four or five suppliers of the same item. The main reason is that assemblers do not have sufficient confidence in suppliers being able to meet delivery schedules consistently and to maintain quality standards. An additional consideration is the need to ensure competitive pricing among suppliers.

Examples of single supplier firms are comparatively rare (see Table 6), especially when it is remembered that most firms are producing more than one product and typically would be procuring more than 50 different items locally. (The two firms with more than eight single

suppliers are both Filipino - Japanese joint ventures, in which the Japanese partner has adopted a policy of close co-operation with suppliers.) Moreover, in many of these cases the assemblers have little choice but to select only one supplier. This applies to sister companies (firms owned by one of the assembler's owners, or a close relative), products where there are only one or two local manufacturers, and items which require the provision of molds or dies by the assembler, thus making more than one supplier uneconomic.²³ Instances in which assemblers freely choose to have a single supplier because of a close and trusting relationship are very rare.

The preference of assemblers for more than one supplier has important economic implications for the development of local manufacturers. It results in the small, fragmented local market being even further subdivided and firms receiving orders for small, high cost production runs. The scope for achieving economies of scale is therefore even less, rendering local suppliers less competitive with imports and in-house manufacture. There is little doubt that this has inhibited the development of local subcontractors. It also makes the assemblers more reluctant to subcontract, because the administrative problems (and costs) of handling many small orders are considerable. There is no obvious solution to this problem, which may become less serious as subcontracting networks develop. One indirect solution would be to make importing easier. Current procedures are such that it takes three to six months, from the time of placing the order to its arrival, and a letter of credit (worth 50 per cent of the order) must be opened immediately. Assemblers may be less reluctant to rely on single suppliers if they could quickly resort

to imports in case of difficulty.

5.1.2 Exclusive Suppliers

The other element of the 1:1 relationship found in other countries is component manufacturers which supply one assembler exclusively. This is especially the case in proprietary items, where assemblers wish to maintain secrecy. It is also an important element conditioning the nature of the relationship between the assembler and the supplier. Assemblers are reluctant to assist in upgrading suppliers if they do not obtain the full benefit of their effort, the more so if their subcontractor is also supplying rival assembly firms. Exclusivity is a key factor in the development of close relationships.

Not surprisingly, exclusive suppliers are rare in the Philippines. The small domestic market and a proliferation of producers means that suppliers cannot usually survive on the orders of just one firm. In our survey just seven of the 20 assemblers interviewed had one exclusive supplier, and one had two exclusive suppliers. And, not infrequently, the exclusive supplier was a sister company, and a source of a good deal of tension in the assembler firm. This arose in the case of joint ventures, where the sister company was a supplier only because it was owned by a relative of a Filipino partner. The majority of these firms were poor suppliers, but the foreign partner was unable to remove them.²⁴

Exclusivity in the Philippines will become more widespread only as the market expands, especially the export market - penetration of which itself partly requires stronger subcontracting networks - thus making it

economically viable for a supplier to depend solely on one assembler. (It is significant that the firm in our survey which exported the greatest percentage of its output is now moving towards the adoption of exclusive suppliers, to justify its investment in improving their quality.) Market size is not the only barrier, however; there is a tendency among suppliers to view 1:1 relationships with assemblers as 'feudalistic' and some sense excessively paternalistic. Some see the Japanese system as undesirable because it would restrict their business freedom. Hence, there are also attitudinal obstacles to be overcome.

5.1.3 Duration of the Relationship

To the question "what percentage of your suppliers have been supplying you more or less continuously since 1975?", 16 out of the 20 suppliers replied more than 50 per cent, of which a further eight replied more than 75 per cent. The fact that almost half the assemblers had had a continuous relationship with the great majority of their suppliers suggests ties in the industries must be fairly strong. This conclusion is, however, misleading.

The 'durability' of the relationships says nothing about their strength; it arises because in many cases assemblers have rather limited choice. First, there are the parts and components requiring the provision of molds or dies by the assembler. These are either loaned by the assembler, or sold to the supplier and amortized over the supply contract. In either case, this will reduce the assembler's ability to switch suppliers frequently. Secondly, for precision parts and components whose manufacture requires sophisticated technology or substantial capital