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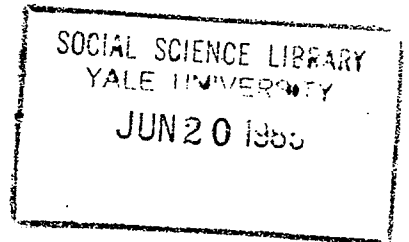
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CENTER DISCUSSION PAPER NO. 481

SUBCONTRACTING AND INDUSTRIALIZATION IN DEVELOPING COUNTRIES

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Abstract

The widespread subcontracting arrangements in the engineering industry in Pakistan are examined from the perspective of both 'vendor' and 'parent' firms. The nature of the contract is presented and reasons for subcontracting are explored including credit arrangements and technological innovation facilitated by the contract. Cost and price mark-ups in subcontracting and methods of contract enforcement such as various 'tying' arrangements are reviewed. It is concluded that subcontracting results in process rather than product specialization to achieve division of labour and thus enables small and large firms to coexist in the industry.

1. Introduction

Subcontracting as a form of industrial organization is widespread in the engineering industry in Pakistan. In agricultural machinery manufacturing, which is an important component of Pakistan's engineering sector, the incidence of subcontracting is striking and was noted in the course of a field survey undertaken to study that sector (Nabi, 1984a). This follow-up study is an attempt to present a detailed discussion of the nature of subcontracting and its importance in beginning industrialization. The study is based on a survey of parent (firms that subcontract work out) and vendor firms (who subcontract work in, also known as ancilliary firms in the literature) conducted in the Punjab province of Pakistan in spring 1984.

Historically, subcontracting has been important in economic development. In Japan, in 1966, about 310,000 enterprises (53.6 percent of all medium and small enterprises in manufacturing) were subcontractors and they employed 3.6 million workers or more than one quarter of the total manufacturing labour force (Watanabe 1971). Subcontracting has also been important in industrialized countries such as the U.S., France and Sweden. In the U.S., as recently as the 1960's, primary government contractors were legally required to contract out work to small subcontractors (Small Business Administration, 1969). In France subcontractors' cooperatives were active in the early 1960's in devising schemes to help small entrepreneurs to overcome

problems of the prevailing recession (Levy, 1964). The success of Swedish Association of Metalworking Industries contributed to promoting subcontracting in all four Nordic countries (Sverges Mekanforbund, 1967). More recent examples of successful subcontracting are Taiwan and South Korea. In Pakistan the beginning of automotive industry in cities like Karachi and Lahore has resulted in rapid growth of subcontracting.

Subcontracting takes place in commercial construction as well as in manufacturing activities. In this discussion, we are concerned with subcontracting in manufacturing. We focus on situations where a large parent firm contracts out part of the production process to small vendor firms with both contributing importantly to the final product. The parent firm does not merely purchase ready made parts and components from vendor firms but actually has a contract, formal or informal, with the vendor firm regarding quality of work and the schedules of delivery. Such subcontracting enables us to examine the generally held view (elaborated in Hamid and Nabi, 1984) that small and large scale production arrangements are competing strategies in economic development. Our discussion will show that, on the contrary, subcontracting reflects important complementarities between small and large scale manufacturing. This suggests a special role for subcontracting in development strategies.

Our examination of subcontracting arrangements allows us to focus on several important economic issues. One is, what determines the decision of the firm regarding the number of processes it integrates to produce the final product? This is related to the question of process specialization which will be taken up in our discussion. Another issue concerns inter-sectoral linkages

in the economy. The usual argument is that for balanced growth a development strategy that forges and exploits linkages between agricultural and industrial sectors of the economy is to be preferred to one that does not foster such interlinkages (one important reason being that linkages allow maximum multiplier effects of investment and consumption). Subcontracting arrangements that we examine in this study forge intra-sectoral linkages and thus contribute importantly in realizing balanced growth. For subcontracting to exploit such linkages successfully, communications between parent and vendor firms and thus firm location is important and will be examined in this study.

Recent discussions of tenancy in agriculture have emphasized that because of market imperfections landlord-tenant relationship often extends to credit and product markets in addition to the land market. Such market interlinkages affect tenant behaviour and influence the outcome of policies aimed at increasing agricultural productivity. We find that in subcontracting arrangements, parent firms often extend credit and technological know-how to vendor firms. We examine how such inter-linkages in subcontracting are likely to influence pricing decisions and the spread of technological innovation.

The study is structured as follows. In section 2 we describe the sample of parent and vendor firms that were interviewed to obtain information on subcontracting. In section 3 we examine the following issues in detail:

- (i) Nature of the contract
- (ii) Reasons for subcontracting.

(iii) Communications between vendor and parent firms.

(iv) Subcontracting and the credit market.

(v) Technological innovation in subcontracting.

(vi) 'Tying' in subcontracting.

(vii) Costs and price mark up in subcontracting.

(viii) Contract enforcement.

In section 4 some economic implications of subcontracting are discussed and some policy issues considered.

Section 2 Data

We examine the issues enumerated in section 1 using two sets of data. First we report the extent of subcontracting in the agricultural machinery industry on the basis of data collected in the field survey conducted in the spring of 1982 for a major study of the industry (the survey is described in Nabi 1984a). The evidence as to which processes and components are subcontracted is also taken from that survey. The evidence on details of the

contract was collected in a subsequent survey conducted in spring 1984. In this section we briefly describe this survey. Firms were selected in Lahore, Gujranwala, Faisalabad and Sheikhpura districts, the three districts of Pakistan's Punjab where subcontracting is common.

The widespread incidence of subcontracting in Faisalabad and Lahore corresponds well with the experience in other countries. Both cities have a sizeable industrial base (these being two of the most industrialized cities in the country). The skilled labour force is large because of the presence of substantial engineering industry such as textile machinery manufacturing and household durables (gas cooking ranges, water heaters, washing machines, fans and water coolers) apart from agricultural machinery. Many of the subcontracting firms have been started by skilled workers in the engineering industry who have managed to save or borrow capital to start their own operations.

In the main field survey conducted in 1982, 54 firms had reported that they subcontract out processes and components (ie. they are parent firms) while 40 had reported that they subcontract components in (i.e. they are vendor firms). In the follow-up survey we interviewed all 40 vendor firms and 31 of the parent firms. Thus we hope to discuss the subcontracting arrangements from the twin perspective of parent and vendor firms.

The citywise distribution of parent and vendor firms is given in table 1 below:

Table 1: Citywise Distribution of Subcontracting Firms in the Sample.

<u>Cities</u>	<u>Vendor Firms</u>	<u>Parent Firms</u>	<u>Total</u>
Lahore	11	10	21
Sheikhupura	8	8	16
Gujranwala	2	2	4
Faisalabd	19	11	30
<u>Total</u>	<u>40</u>	<u>31</u>	<u>71</u>

The firms in Sheikhupura are in that district for administrative reasons. They are located on Sheikhupura road on the outskirts of Lahore so that really the firms are part of Lahore's light engineering industry. In Gujranwala we interviewed 4 subcontracting firms. These represent only the agriculture machinery industry. Gujranwala is an important centre of the light engineering sector in Pakistan and subcontracting in this sector is common. We encountered several firms that subcontract work from large Lahore firms manufacturing household durables. We did not include these firms in the sample.

Section 3.1: Subcontracting firms and the processes subcontracted.

The main field survey revealed that 104 firms (out of the 119 interviewed) manufacturing agricultural machinery are involved in subcontracting. Fifty-four of these are pure parent firms while 40 are pure vendor firms. Ten firms reported that they both subcontract in as well as subcontract out, in other words they are parent-cum-vendor firms. In table 2 we

present evidence on variables that indicate the relative size of the firms involved in subcontracting and their key technical ratios.

Table 2; Mean Values of Economic Accounting Variables of Subcontracting Firms.

	Parent Firms	Vendor Firms	Parent-cum-Vendors
Value Added	4,39,300	1,55,363	2,98,500
Value of Machinery	2,46,613	96,765	1,06,314
Value of 'Sophisticated' Machinery to			
Total Machinery	0.295	0.444	0.381
Total Labour	21.42	5.43	11.69
Skilled/Total Labours	0.31	0.52	0.41
Value Added/Labour	20,508	28,612	25,535
Value Added/Capital	1.78	1.605	2.807
Capital/labour	11,513	17,820	9,094

Notes: a:

b: The total value of machinery owned by the firm evaluated at 1982 prices. For details see Nabi (1984b).

It can be seen that vendor firms are smaller compared to parent firms while the parent-cum-vendor firms fall between the two. Also, vendor firms are more capital and skill intensive compared to parent firms.

In table 3 we report the processes and components subcontracted by the parent firms in the industry.

Table 3: Processes/Components Subcontracted by Parent Firms

	Tubewell Firms	Thresher Firms
Total firms subcontracting	16	38
<u>Subcontracted Activity</u>		
Casting	14	11
Sheet metal cutting	0	23
Machining	8	12
Complete components	12	14
Painting	4	6

Tubewell firms in our sample sell the package of diesel engines and pumps. The most important processes for these firms are casting and machining. Casting is a specialized skill and most firms do not undertake it themselves. Firms may choose to specialize in the manufacture of pump sets or diesel engines in which case the other component is subcontracted. Twelve of the 16 tubewell firms report subcontracting either diesel engine or pump sets. There is no sheet metal cutting activity in the tubewell industry. On the other hand, for threshers this is the most important process requiring specialized equipment and most firms subcontract out this process. The component most frequently subcontracted out is the thresher fan.

In the sections that follow we examine subcontracting arrangements more closely using evidence collected in the second field survey.

Section 3.2 Nature of the Contract.

The interviews reveal that none of the vendor firms produce for a single parent firm. Most vendor firms subcontract from 3 or more parent firms. However, 70 percent of the vendors in our sample responded that one parent firm dominates others in the sense that between 60-70 percent of the output is manufactured for a single parent firm. In sections 3.6 and 3.9 we examine how this influences negotiations regarding technical innovation and prices.

The contract between vendor and parent firms is arrived at by direct negotiations. Only one vendor firm, located in Faisalabad, reported that it had subcontracted work from a firm which, in turn, had subcontracted from a parent firm. This, however, is the only vendor firm out of the 29 interviewed in Faisalabad that reported this so that we cannot generalize regarding the tier trend in subcontracting relationship even in a city that has a large engineering industry base. Also none of the vendor firms reported subcontracting work to secondary vendor firms. Further, only 2 firms (1 in Lahore out of 10 interviewed and 1 in Sheikhpura out of 8 interviewed) reported that they had obtained the contract through commission agents. Thus the classic putting out system in which the commission agent plays an important role does not appear to be at work in the subcontracting arrangements in agricultural machinery industry of Pakistan.

The parent firms usually have more than one subcontractor. This is partly because more than one component of the machines is subcontracted. The other reason is that firms prefer to subcontract the same component to more

than one vendor to ensure bargaining strength regarding price mark-up over costs. The citywise breakdown of 31 parent firms in our sample along with number of their vendors is reported in table 4.

Table 4: Breakdown of Parent Firms by Number of Vendors and by City.

<u>City</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>Total</u>
Lahore	2		5	1	1	1	10
Sheikhupura	2	2	1		2	1	8
Gujranwala			1		1		2
Faisalabad	3	6	2				11
Total	7	8	9	1	4	2	31

The number of components subcontracted by parent firms is reported in table 5.

Table 5: Number of Components Subcontracted by Parent Firms by City

<u>City</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>Total</u>
Lahore		1	1	3	3	2	10
Sheikhupura			2	1	2	3	8
Gujranwala				1	1		2
Faisalabad		1	2	5	1	2	11
Total		2	5	10	7	7	31

Table 5 read in conjunction with table 4 reveals an interesting picture. It appears that parent firms subcontract more than one component to

one vendor firm. Also they subcontract more than one vendor for the same component. There seems to be little pricing advantage in subcontracting different components to the same vendor firm. This arrangement is undertaken in circumstances when the parent firm is very large compared to the vendor firm and when vendor firms have diverse engineering skills. Thus this practice is most widespread in Lahore and its outskirts (Sheikhupura firms) where access to firms with diverse engineering skills located in Lahore is easy.

The importance of subcontracting in agricultural machinery manufacturing can be gauged by examining the proportion of the value of output subcontracted by the parent firm. This is reported in table 6.

Table 6: Value of Output Subcontracted Out by Parent Firms.

City	½ 10%	10-19%	20-29%	30-39%	40-49%	50-59%	60-80%	Total
Lahore	1		1	2	2	3	1	10
Sheikhupura	1	2	1	2	2			8
Gujranwala						1	1	2
Faisalabad	2	1		1	2	1	4	11
Total	4	3	2	5	6	5	6	31

More than half the firms in our sample subcontract out between 40-80 percent of the gross value of the output they produce. Thus subcontracting arrangements constitute a significant proportion of the manufacturing activity in the industry.

Earlier we stated that most vendor firms negotiate directly with parent firms without intermediaries. This is confirmed by parent firms. Only 1 out of 31 firms interviewed reported secondary subcontracting. The parent firm involved here is located in Sheikhpura and manufactures relatively sophisticated agricultural machinery such as mechanical reapers which lends itself to secondary subcontracting because of the large number of components involved.

Our survey reveals some interesting features regarding the choice of vendor firms by parent firms. Only one parent firm reported that it invites bids by vendors before awarding the contract. The remaining 30 firms choose their vendors through references and through personal knowledge of the vendor firm. Further insights into the selection procedure were obtained by asking the vendor firms how they obtained the contract. Their answers are reproduced in table 7 below:

Table 7: Breakdown of Vendor Firms by Method of Approaching Parent Firms.

City	A	B	C	Total
Lahore		5	3	11
Sheikhpura	5	2	1	8
Gujranwala	1	1		2
Faisalabad	7	11	1	19
Total	16	19	5	40

A: owner of vendor firm previously employed by parent firm.

B: Owner of vendor firm previously employed by a firm manufacturing machines similar to parent firm machines.

C: Vendor firm owner's relative employed in the parent firm.

Sixteen out of 40 vendor firms (40 percent) reported that they had obtained the contract from the parent firm because the owner was previously employed in the parent firm. Nineteen vendor firms (48 percent) reported that they had previously been employed by firms manufacturing machinery similar to that being manufactured by the parent firm and thus had the necessary expertise to manufacture the components. The parent firms were aware of this. Only 5 firms reported that they had obtained the contract through relatives who worked for the parent firms. It is interesting that 'nepotism' is unimportant in an industry dominated by a single (lohar) 'bradri'. The relative importance of personal contacts in awarding contracts, compared to bidding, as revealed by both vendor as well as parent firms, may be important at this early phase of subcontracting. As the practice becomes more widespread and the machinery manufactured becomes more sophisticated requiring specialized and standardized engineering skills, parent firms are more likely to adopt formal bidding procedures. This is likely to happen also because with greater standardization risk associated with the manufacturing process undertaken by the vendor firms is likely to decline.

Typically, vendor firms are small firms both regarding labour employed (10 workers or less) as well as value of machinery owned and are considerably smaller than parent firms (see section 3.1). There are some exceptions to this. Two parent firms in Sheikhpura and Lahore reported that vendor firms were larger than they were both in terms of workers employed as well as value of machinery. The vendor firms in these two cases are large, diversified, engineering firms of Lahore that perform specialized tasks for firms in the engineering sector.

Section 3.3 Why Subcontract?

There are several reasons why subcontracting may come to exist. As we have seen, agricultural machinery manufacturing is a good example of an industry where the production cycle is not continuous. Components can be manufactured separately and then assembled together in the final stage. The parent firm that assembles the components to produce agricultural machinery (assuming responsibility for its performance to the buyer) may choose to subcontract for the following reasons:

(i) To save capital, i.e. it may not wish to purchase machinery that requires specialized operations if these operations use up only a part of the machine capacity. Under these circumstances it may be beneficial to subcontract these operations to firms that specialize in that activity and perform similar operations for other engineering firms.

(ii) To save labour particularly in terms of the specialized skills that are required to perform operations such as those discussed above. Again it may be feasible for a vendor firm to specialize in such operations given that it can perform these operations for other firms in the engineering industry.

(iii) To take advantage of lower wages for similar tasks prevailing amongst vendor firms because vendor firms rely on family labour and the labour market may be characterized by a dual wage structure (family labour is paid lower wages compared to labour hired in the market).

(iv) To avoid problems of labour management. Vendor firms specializing in a few operations under the close supervision of the mechanic/owner may realize greater effort from workers who, in any case, may be related to each other and thus may work in a congenial environment which may contribute to higher productivity.

(v) To save capital costs of structures and other overheads. Vendor firms may have lower overhead costs because they are located in owners' dwellings. Subcontracting may thus lead to better utilization of resources tied up in such dwellings and underemployed family labour.

(vi) As a buffer against business fluctuations. When business is poor parent firms can pass on the effects to vendor firms rather than bear all the costs of excess capacity. This is socially desirable in view of the fact that vendor firms take orders from many firms manufacturing different types of machinery so that loss of orders from one section of the industry does not result in severe financial burden to the vendor firm.

In the survey we interviewed parent firms to elicit the importance of these reasons for subcontracting. In table 8 we reproduce their responses.

Table 8: Frequency of the Stated Reasons for Subcontracting by Parent firms.

City	A	B	C	D	E	F
Lahore	10	10	10	7	2	3
Sheikhupura	8	8	6	8	1	2
Gujranwala	2	2		2		
Faisalabad	11	10	8	7	4	2
Total	31	30	24	24	7	7

Notes: A: To save capital (machinery) D: To avoid labour problems.
 B: To save labour E: To save capital (structures).
 C: Lower wage advantage F: Buffer against business fluctuations

The most frequently stated reason for subcontracting is saving on capital followed by saving on labour. Taking advantage of lower wages in vendor firms and avoiding labour problems tie for the third important stated reason. Saving on costs of structures is not frequently stated as an important reason. This is surprising given that many firms are obviously short of space. Machinery, raw material and semifinished components clutter the shop floor. Thus it would make sense if components are subcontracted for this reason also. However, agricultural machinery manufacturing is seasonal so that for several months in the year shop floor space appears to be adequate. Thus it may not always be perceived as a binding constraint. Only 7 firms stated that subcontracting is important as a buffer against business fluctuation. Several of the firms who stated this reason cited the seasonality factor in the business and were aware that overheads are reduced as a result of subcontracting. It is worth noting also that agricultural machinery manufacturing (excluding diesel engines) is going through a period of high growth associated with the early phases of farm mechanization. Expectations regarding growth in the future are high so that, as yet, there is a lack of awareness that this can also be an important reason for subcontracting.

The household character of vendor firms is confirmed in our survey. Except for 2 firms with diverse engineering skills, firms have 10 or less workers most of whom are related to firm owners. Several of the apprentices we interviewed said that they are willing to work for less wages in their relative's firm compared to what they would accept in another firm because there is no 'nokar-hakim' (servant-boss) relationship in the relative's firm. Also they expected to get better training in the relative's firm. In another

firm they would be asked to do mostly unskilled work, better skills being reserved for their own kith and kin. Thus it appears that dual labour market features associated with the nature of firm organization may be at work and this facilitates subcontracting.

Section 3.4: Location of Firms.

For successful subcontracting firm location is important. Firms located in Lahore and Faisalabad subcontract a larger proportion of their components compared to other firms. The reason, of course, is that vendor firms are more likely to locate themselves in towns with a large and diverse industrial base. The large industrial base facilitates specialization and thus allows subcontracting. All the parent firms we interviewed responded that their vendor firms were within 2 mile radius (18 firms had their vendors within 1 mile radius). Distance is important, specially in the early phases of the subcontracting relationship, since close supervision of the vendor firm operations may be necessary to ensure that specifications are met. Although all the parent firms we interviewed had telephone connections, only 9 reported that they were connected by telephone to their vendor firms. Thus personal visits are essential. In any case, we were informed that such visits are extremely important for direct discussions on specifications since drawings and written instructions concerning engineering specifications are almost never used. Under these circumstances physical examination of the components and visual impressions is what counts. For all these reasons it is important to be located near vendor firms.

In Lahore many of the vendor firms are located in Sarai Sultan which is adjacent to the market for scrap and pig iron. These constitute the major raw material and a substantial proportion of the total cost of production of vendor firms. The material is bulky and has high transportation costs. These costs are lowered by locating the firm near the source of supply. Another attraction of this location is the feeling of being in the market and having easy access to information regarding demand for their product, sources of raw material supply and technological innovation. Also there is considerable informal exchange of machine time and engineering advice. This location specificity of vendor firms and the need for close supervision makes parent firms location specific as well. This may explain the concentration of light engineering industry in Pakistan in cities like Lahore, Faisalabad, Gujranwala, and Sialkot.

3.5 Subcontracting and the credit market.

We have already seen (Nabi, 1984b) that the credit markets serving the light engineering sector are far from perfect. Basically, there are four broad sources of credit. These are: government sponsored credit institutions such as development banks and cooperatives that subsidize credit resorting to rationing to clear the excess demand; commercial banks that charge the government fixed lending rate plus a service charge - they also resort to rationing; back street capital markets that charge the market clearing interest rates but borrowers have a high probability of default; and finally, friends/relatives and self-

generated funds. We discussed how each of these arrangements work and how they influence investment decisions and choice of technology. Another borrowing arrangement that we discussed was suppliers' credit and advances on machine orders. In subcontracting it is this last arrangement that is most commonly observed. We recorded many instances where parent firms extend loans to vendors both for working capital and for purchasing fixed assets such as machinery. In this section we present the evidence on vendor-parent firm relationship in the credit market.

Our present discussion focuses on issues that have much in common with recent developments in the economics of agriculture in developing countries. In that literature it is argued that landlord-tenant relations are complex in that they interact in credit, product, land and labour markets simultaneously. This market interlocking arises from imperfections in markets for inputs and output. For example, a household may find it difficult to get credit or sell family labour, so it rents land from a landowner who often also supplies credit. Another example is that of the rural town middleman who ties up credit availability with sale of the crop. We shall see in this section and those that follow that similar interlocking may exist in the parent-vendor firm relationship as well.

In table 9 we present the response of vendor firms to our questions about their most important sources for financing fixed investment (where fixed investment mainly covers additions to capital stock through purchase of machinery).

Table 9: Most Important Sources For Financing Fixed Investments Of VendorFirms:

City	A	B	C	D	E	F	Total
Lahore	1	4	3	2		1	11
Sheikhupura		3	3			2	8
Gujranwala			1			1	2
Faisalabad	1	7	4	2	1	4	19
Total	2	14	11	4	1	8	40

Notes: A: Parent Firms B: Friends/relatives C: Self-generated funds

D: Commercial Banks E: Government credit banks F: Informal street markets.

Only 2 of the 40 firms we interviewed reported that parent firms are the most important source for financing fixed investment. In most cases such investment is undertaken by borrowing from friends/relatives and through self-generated funds. Interestingly, informal street capital markets are as important as parent firms for financing fixed investment. This shows that such markets may work well in that they enable relatively long term borrowing. Unfortunately, we did not get reliable information on terms of borrowing in these markets. From our experience in the main field survey we know that real interest rates can be as high as 30 percent per annum which is more than twice the commercial bank rate. Formal credit institutions such as commercial banks and specialized government credit institutions are relatively unimportant in financing the purchase of capital stock. This is consistent with our earlier findings reported in Nabi (1984b).

In section 3.3 we stated that an important reason for subcontracting is that parent firms can save on capital. Thus it is hardly surprising that they do not lend to vendor firms to finance the purchase of machinery. To do so would tie up their capital precisely in the manner which they attempt to avoid through subcontracting. Owners of 2 vendor firms that had been thus financed by their parent firms were unhappy about the arrangements whereby parent firms not only expect to jump the delivery queue but also dictate the choice of other parent firms particularly when rivals are involved. One of the vendors felt that his owner always "drags him down" when his business is bad by not allowing him to seek out other customers. This sounds implausible since the parent financier can always share the returns with vendors by allowing them to take orders from others.

The parent firm is an important financier of working capital. This can be seen in table 10 where parent firms are listed as the most important source of borrowing by a majority of vendor firms.

Table 10: Most Important Sources of Working Capital of Vendor Firms.

<u>City</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>Total</u>
Lahore	6	2	2			1	11
Sheikhupura	5	2	1				8
Gujranwala	1	1					2
Faisalabad	7	4	3	1		4	19
<u>Total</u>	19	9	6	1		5	40

Note: See table 7 for definition.

Nearly half the vendor firms interviewed reported that the most important source of borrowing is the parent firm. Three vendors, 1 in Lahore and 2 in Faisalabad, reported that parent firms arrange direct supplies of raw material needed to manufacture the components. Most vendors felt that it was best to have own resources (this includes friends and relatives) but if borrowing is essential, they prefer to borrow from parent firms since their terms are best. Such borrowing does not involve the payment of interest. Also, demand is less uncertain since parent firms are committed to buying. The advantage to parent firms of such lending is that it enables them to work closely with vendor firms to improve the quality of subcontracted components and to ensure that delivery schedules are met. In the next section we shall say more on this when we examine the technological relationship between parent and vendor firms.

3.6 Subcontracting and Technology:

Accounts of the Japanese subcontracting experience, and the more recent studies of subcontracting in Taiwan and Korea, suggest that this industrial organization has played an important role in technological innovation. Broadly speaking, the process of technological innovation can be thought to consist of three important dimensions. One is the perceived need for the innovation which may depend on the relative prices of capital and labor and expectations regarding returns to the innovation. Another (or the second) is the nature of engineering skills required for innovating and whether these are easily accessible. The third is whether capital markets function well and

enable the financing of innovation. Clearly, risks are associated with all three dimensions and together they may have a compound effect on the riskiness of the innovation. Subcontracting arrangements may encourage technological innovation by allowing innovating parent firms to share the risk with vendor firms by sharing their working capital. We have already seen that many parent firms lend working capital to vendor firms. At least in the case of one large parent firm (Millat tractors, to be discussed in section 4, which is a leading innovating firm) we know that its vendors are able to raise working capital with its assistance. In return for this assistance, which implies a subsidy by the parent firm, vendors undertake to manufacture the new components.

In the previous section we saw that 19 vendor firms reported that parent firms are the most important source for working capital. We also asked these firms about the number of innovated components they had manufactured for parent firms in the previous three years. The responses are recorded in table 11.

Table 11: Number of Innovated Components Manufactured by Vendors In the Previous Three Years By whether or Not Parent Firms Lend Working Capital

	Total Vendors	None	One	Two	Three	Four or More
Parent Firm	19	5	3	4	4	3
Lends						
Parent Firm	11	6	4	1		
Does Not Lend						

It can be seen in the table that vendor firms that have borrowing arrangements with parent firms carry out innovations more frequently compared to vendors that do not have such arrangements. We now examine the technological relationship between subcontracting firms and comment on the method by which parent firms encourage vendor firms to innovate.

Component design.

Technical drawings are almost never used by parent firms to explain the component design to vendor firms. The usual practice is to hand over the prototype, which may be imported or designed by a rival firm, to the vendor requiring little modification. While the component is being manufactured for the first time the parent firm actively supervises the process to ensure that specifications are met. This usually requires frequent visits by the skilled machinists of parent firms. Once the newly manufactured component is deemed satisfactory, such visits become rare.

Material and equipment selection.

There is active involvement of the parent firm regarding material selection throughout the parent-vendor firm relationship since the quality of material, as much as vendor craftsmanship, determines the life and quality of the component. Although parent firms rarely get directly involved in equipment selection by vendors, they investigate thoroughly the equipment available with vendors before awarding the contract. Vendors having a wide range of machining equipment have a greater chance of being selected. For vendor firms that cast components, the range of dies and furnaces is important.

Skills training.

We observed only one parent firm which has an active program of training vendor firm workers in skills required to manufacture new components. This firm, Millat Tractors, is exceptional and not really representative of the industry. The firm is an important component of the publicly owned Automobile Corporation of Pakistan. Until 1972, when it was nationalised, it imported Massey-Ferguson tractors in knocked-down condition and assembled them in its plant in Lahore. It had a capacity of assembling two to three thousand tractors every year. In 1980 it began a program of progressive domestic manufacturing. Starting with 19 percent, it increased the domestically produced components to 27 percent in 1981, 38 percent in 1982 and 55 percent in 1983. This involved 160 components in 1980 and had gone up to 410 in 1983. The firm has a large section which deals with vendors with departments specializing in component design, marketing and supervision. It organizes frequent conferences of vendors to resolve engineering and financial problems. This firm is not included in our sample of 40 parent firms being discussed in this section.

Vendor firm grouping.

Although all the vendor firms we interviewed expressed a keen interest in formal trade groupings to exchange information on new methods and skills, as yet no such grouping exists formally. Informal exchanges, as mentioned earlier, are common but they do not always work. Some firm owners complained bitterly of severe competition and the associated secrecy "even among people who belong to the same lohar bradri".

Section 3.7 'Tying' in Subcontracting:

In our discussion of the relationship between parent and vendor firms we saw that parent firms provide both credit for working capital as well as technological advice to vendor firms. We shall now examine whether this relationship results in the vendor firm getting 'tied' to the parent firm in the sense that it is unable to perform similar tasks for other firms in the industry. If such tying is widespread, it is likely to effect the vendor firms' ability to use its capital stock (machinery) intensively and thus one of the benefits of subcontracting mentioned in section 3.3 will be lost.

In Table 12 we report parent-vendor firm tying arrangements. Only 9

Table 12: Vendor Firm Tying Arrangements.

<u>City</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
Lahore	11	3	2	1	1
Sheikhupura	8	2	1	1	
Gujranwala	2				
Faisalabad	19	4	3	3	
<u>Total</u>	<u>40</u>	<u>9</u>	<u>6</u>	<u>5</u>	<u>1</u>

Notes: A: Total Number of Firms. B: Number of Vendor Firms reporting tying.

C: Number of firms reporting tying only when new process introduced.

D: Duration of tying: 1 year, 2 years, 3 years.

vendors out of the 40 we interviewed reported tying. Tying is a verbal pledge by the vendor firm to the parent firm that, for a specified period, it will not perform similar work for another firm. Of the 9 firms reporting tying, 6 responded that tying takes place only when the parent firm introduces, or actively participates, in the development of a new component. In most cases such tying is only for one production season when the parent firm introduces the new component. Patents are non-existent in the industry so that rival firms can, and often do, enter the market the following year by copying the models developed by one firm. Thus the 'free rider' problem exists and may inhibit technological innovation in the industry. Further evidence of the free rider problem is indicated by the response by both parent as well as vendor firms that it is hard to police such tying and that if the price is right, vendor firms are quite likely to make the innovated component available to rival firms. However, it appears that such "copying" of innovations has at least one year lag. Few parent firms expect the innovation to be kept hidden from rivals for more than one year. This, to some extent, may explain why only small, gradual, modifications are made in the designs of agricultural machinery. The other side of such loose tying arrangements is that vendor firms are relatively free of the production constraints of one parent firm and thus they can avoid excess capacity in their capital stock when business is bad for one parent firm.

Section 3.8 Costs and Price Mark-up in Subcontracting.

We have argued that an important advantage of subcontracting is that parent firms can avoid excess capacity in the off-peak season (and the

organizational costs of obtaining and fulfilling contracts) and thereby achieve lower costs of production compared to what they would be in the absence of subcontracting. This requires a careful analysis to determine whether, in fact, the cost of producing similar components under subcontracting arrangements are different compared to the firm undertaking production of all components itself. To carry out such an analysis, detailed data on costs of vendor firms, including imputed value of equipment time used in the production process, should be collected and compared with similar cost data for firms that manufacture their own components. Such comparisons, in themselves, will not be sufficient to establish the superiority or otherwise of own production over subcontracting. There may be important externalities of undertaking the entire production process by the parent firm which the previously outlined analysis ignores. For example, parent firms' skilled workers and supervisory labour may become thinly spread causing inefficiencies. Also, the shop floor may become cluttered and congested, seriously hampering the work flow and contributing to costs. All these reasons would also make subcontracting attractive.

We do not have detailed data needed to examine the cost advantage of subcontracting as discussed above. We do, however, have information on pricing decisions in subcontracting. A discussion of this information will indicate the relative bargaining strengths of parent and vendor firms in arriving at contracted component prices and will shed some light on the decision to subcontract.

In table 13 we report firms' responses to our questions regarding their perception of the adequacy of prices they receive or pay for the

subcontracted components. After discussions with firms, we defined prices to be adequate if they were 15-20 percent above the cost of manufacturing components, too high if they were 20-30 percent above costs and too low if they were 10-15 percent above costs. Thirty out of the 40 firms we interviewed replied that prices paid by parent firms are adequate while 10 felt that prices are too low. On the other hand, 18 parent firms out of 31 interviewed thought that prices they paid are adequate while 13 thought prices are too high. Thus more vendor firms (75 percent) believe that prices are adequate compared to parent firms (58 percent). We interpret this to imply that vendor firms are more frequently satisfied with subcontracted component prices compared to parent firms who may feel that they are driven to this arrangement by the high organizational costs of undertaking production themselves.

Table 13: Price-Cost Perceptions of Parent and Vendor Firms.

	A	B	C	Total Firms
Vendor Firms		30 (75%)	10 (25%)	40
Parent Firms	13 (42%)	18 (58%)		31

Notes: A: Prices too high (20-30%) above costs. B: Prices adequate (15-20% above costs) C: Prices too low (10-15% above costs).

Table 14: Price Perceptions of Parent Firms Compared to Own Manufacture and Vendor Firms Compared To Market Prices.

	Higher	The Same	Lower	Total Firms
Vendor Firms	4 (10%)	24 (60%)	12 (30%)	40
Parent Firms	4 (13%)	18 (58%)	9 (29%)	31

An alternative view of pricing in subcontracting is presented in Table 14. Here we record the response of vendor firms to our question: Are the prices you receive for the subcontracted components higher, the same or lower than what you would receive without subcontracting (transacting in the ironmongers' market)? The corresponding question to the parent firm was: Are the prices you pay for subcontracting components higher, the same, or lower than the imputed value of components had you manufactured them yourself? A majority (70 percent) of vendor firms reported that subcontracting prices are either adequate or higher while a majority (87%) of parent firms believed that subcontracting prices are the same or lower. The vendors reporting that prices are lower under subcontracting are, in most cases, those that have 'tying' relationship with parent firms. As we saw in section 3.7, such tying is not very widespread. The conclusion that we draw from this evidence is that, by and large, vendor and parent firms are better off under subcontracting since both feel that they can do no better under alternative arrangements.

Section 3.9. Contract Enforcement.

The success of subcontracting for the parent firm lies in ensuring that product specifications and delivery schedules are met by vendor firms. This is determined, in part, by the material and moral incentives for fulfilling contracts, such as goodwill in the industry, prompt payment on delivery and advance payments on orders. Equally important are the penalties associated with nonfulfillment. In this regard we attempted to examine the legality of contracts in the course of the survey. We came across only one

parent firm (Millat Tractors, discussed in 3.6) that had anything resembling a written contract with vendors. Even this was quite informal. The 'contract' was a letter from the parent firm indicating the number of components to be supplied. There was nothing on delivery schedules and component specifications.

Verbal contracts, of course, exist and are taken very seriously since, in a small business, goodwill and reputation are very important. Besides, as we have seen earlier, vendor and parent firms belong to the same 'lohar' bradri. This is also important in contract fulfillment. Informal escape clauses exist and come into effect when circumstances leading to contract non-fulfillment are obvious, such as illness or death or bottlenecks in the supply of essential raw material. When this happens, no legal machinery is activated. The parent firm knows of the circumstances, since personal supervision ensures close contact with vendor firms, and makes appropriate arrangements depending on whether or not it believes that the vendor did not willfully break the contract. Only 2 parent firms in our sample reported breach of the verbal contract. The vendor firms had absconded with advance payments on components. In both cases vendor firms were new to the locality.

Delays in delivery of components were reported frequently but there were no reported penalties associated with such delays - except the threat that no work would be subcontracted in the following season. This threat is rarely carried out since the average duration of the contract with vendors is between 5 and 8 years. It is worth noting, however, that parent firms that lend credit and provide technical know-how to their vendors are more likely to succeed in contract enforcement compared to others. We grouped firms according to whether

they provided such assistance and report their responses regarding contract fulfillment in table 15.

Table 15: Contract Fulfillment for Parent Firms Providing Assistance

	A	B		C		D	E		
		(i)	(ii)	(i)	(ii)		(i)	(ii)	(iii)
Assisting Firms	13	10	3	11	2		2	7	4
Other Parents	18	12	6	13	5	2	5	10	3

Notes: A: Number of Firms. B: Delivery Schedules (i) satisfactory, (ii) unsatisfactory. C: Specification Schedules (i) satisfactory (ii) unsatisfactory. D: Average contract duration (i) 1-5 years (ii) 5-8 years (iii) 8 years or more.

The vendor firm story of subcontracting is relatively more straightforward. We came across no cases where a contract was broken prematurely. The main issue, from vendor perspective, is payment schedules of parent firms. Vendor firms reporting tying arrangements are, in general, more satisfied than others regarding payment schedules. In Faisalabad 2 vendors reported that they had stopped working for parent firms because of exceptional delays (6 months in one case and 4 months in the other) in payments on delivered components.

Unrecognized (by the government) 'federations' of agricultural machinery manufacturers exist in all towns that we visited. Membership is open to both vendor and parent firms. However, separate groupings of vendor firms do not exist. All the vendors we interviewed expressed a keen desire to form such

groups to exchange technical information and for financial cooperation. A common perception is that such groups can ensure better working relations with parent firms particularly with regards to parent firms' payment schedules. Vendors were unanimous that this is one area where the government ought to intervene and promote such groups.

Section 4: Some Economic Implications of Subcontracting.

Earlier studies of Agricultural machinery in Pakistan, by Falcon (1967) and Child and Kenada (1975), report that large and small firms coexist producing a homogenous product. This view of the industry implies that there are no scale related barriers to entry. The existence of widespread subcontracting arrangements that we have observed suggest, however, that there is process (or component) specialization rather than product homogeneity in the industry. This is consistent with Adam Smith's view that with expansion in the size of the market, process specialization (division of labour), follows. In a growing agricultural machinery industry, which does not require a continuous production process, large firms find it attractive to subcontract processes (or components) to small firms.

Subcontracting is also implied in the classic paper by Coase (1937) on the nature of the firm. He examines the factors that discourage firms from vertically integrating until the entire production process is carried out under one organization. In the context of our discussion, when the net benefits of contracting in additional services to carry out production under one firm

organization become negative, subcontracting takes place. Thus we agree with Aftab and Rahim (1983) that process specialization, which subcontracting enables, is a more satisfactory explanation for the coexistence of small and large firms in the industry compared to the alternative explanation that scale economies do not exist as suggested by Child and Kenada.

In our discussion of subcontracting arrangements we have focussed on the interlinkages, and complementarities that exist between the small vendor firms and the large parent firms. These inter-linkages operate primarily in the credit market and in the exchange of technical know-how. The main complementarity, of course, is in terms of process or skill specialization. All of these are important but in many ways the most important is that forged in the credit market. It is quite certain that many of the vendor firms would be unable to continue operations, given that the credit market functions so poorly, without the credit arrangements with their parent firms. The advantage to parent firms, of course, is that it enables them to contract out processes - thus saving labour, capital and organizational costs - to firms that they can supervise closely and thus ensure that contract specifications and delivery schedules are met. This is important in the absence of a formal legal machinery for enforcing contracts. Thus sub-contracting arrangements suggest that both small and large firms co-exist in the industrialization strategies of developing countries. Seen in this light the debate that sees the emergence of small and large firms as competing strategies for industrialization ignores important dimensions of the underlying issues.

The inter-linkages in subcontracting arrangements imply that parent and vendor firms must be located within easily reachable distance of each

other. Historically, vendor firms in the engineering industry were located near supplies of raw material to avoid the transportation costs of the bulky material. This resulted in the concentration of such firms in specific locations to exchange engineering skills and information on prices of input and sources of demand for their output. Parent firms that wish to subcontract must, therefore, seek out firms thus located. This explains the continued growth of small, specialized industrial towns like Daska and Mianchannu in Pakistan.

One adverse effect of complementarities between vendor and parent firms is that they may result in 'tying' and thus may inhibit the diffusion of innovations. There are at least three ways in which a carefully devised government policy may help here. One is to introduce, and vigorously police, a patent system. The other is to make more capital available to vendors from sources other than parent firms to avoid the creation of monopolies. Thirdly, programs can be initiated that encourage R & D by selected vendor firms through financial and technical assistance. This should be followed up with frequent conventions of parent and vendor firms to exchange innovated processes (this was common in Japanese subcontracting in the first half of this century).

As we have argued, subcontracting forges important intra-sectoral linkages, thus enabling maximum multiplier effects of demand and investment expansion. For this to happen it is important that expansion in demand takes place for goods which the domestic engineering skills are capable of manufacturing. Thus an import policy that makes combine harvesters cheaply available domestically will result in much of the domestic engineering industry, and the subcontracting links that it forges, being by-passed.

Finally, the benefits of subcontracting must not be the only consideration in promoting import-substitution. Thus the success in promoting subcontracting by Pakistan Automobile Corporation in the manufacture of cars, trucks and tractors must not be allowed to detract from a careful analysis of international competitiveness of the import-substituted vehicles. Watanabe (1974) has catalogued in detail the economic losses to the society of such 'forced' subcontracting in India.

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