REPORT

ON

THE COORDINATION AND INTEGRATION BETWEEN LARGE AND SMALL SCALE ENTERPRISES IN METALLIC ENGINEERING INDUSTRIES IN WEST PAKISTAN

MARCH 1965

OVERSEAS TECHNICAL COOPERATION OF JAPAN

P r e f a c e

The present survey was performed at the request of the Government and WPIDC of Pakistan for the purpose of giving advice regarding the development plan of the medium and small scale industries in West Pakistan and especially the co-ordination and integration between large industries and small ones in the field of the metallic engineering industry.

The original intention of the mission was to make investigation and give advice to WPIDC concerning "the organization or methods for bringing about a sound and effective co-ordination and integration of large industries with small industries, with a view to improve the overall efficiency and economics of all the production units in the country". However, as a result of the negotiation between the mission and WPIDC, the object and scope of the investigation were limited to the metallic engineering industry in West Pakistan.

The fact-finding of the mission, starting on October 15th 1964 and coming to an end on November 28th of the same year, extended over forty-five days, during which period the mission inspected about eighty factories and six Small Industries Estates, while vising such leading cities as Karachi, Lahore, Gujrat, Gujranwara, Sialkat, Rawalpindi, Peshawar, Lyallpur, Multan, Quetta, Hyderabad, etc.

This report of the mission was drawn up on the basis of the analysis of the data given to it by the factories and Small Industries Estates together with the data and statistics offered by the authorities concerned of the Government.

The mission takes this opportunity to express its deepest sense of gratitude for the whole-hearted co-operation extended by the Government of Pakistan, WPIDC, proper authorities of the Government and private enterprises concerned.

Nothing would be more gratifying to the mission if this report could make any contribution to the economic development of Pakistan.

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Introduction

1. The task which we have attempted to perform has consisted, for the purpose of developing the metallic engineering industry in West Pakistan, in the investigation of the most desirable conditions of establishing co-ordination and integration between and among the large scale enterprises and medium and small ones together with those between and among the latter themselves. Our investigation involves the statement of our views regarding the effective measures to be taken together with some relevant suggestions.

The direct object of this investigation report has been the metallic engineering industry of the country and especially the co-ordination and integration between and among the large scale types and medium and small scale ones of the industry together with those existing between and among the latter themselves; it is needless to say that we have always been very discreet in taking up this problem so that we might comprehend it relative to the development as a whole of the national economy of the country.

2. The co-ordination and integration we refer to here mean the social division of work in manufacturing industries; it means that not whole of the process of production is completed within the system of an enterprise but some portions of it depend upon other ones; it also involves the relations in which each different enterprise may specialize in its own field of production and sometimes large scale ones may perform their production in cooperation with their subcontractors.

3. The scope and extent of the medium and small enterprises treated in our report will be decided by such standards as considered important for the industrialization of the country; that is, such enterprises as containing not more than 250 employees will be taken up here excluding the so-called

cottage industry from our consideration.

4. Furthermore, our opinions and suggestions which have been stated in this report are meant to cope with the actual situation supposed to come during the several years which will approximately correspond to the period of the third five-year plan of the country.

5. The details of our report which will be stated below consists of three parts: - (A) Summary of report and recommendations, (B) Body of report and (C) Data for reference.

C o n t e n t s

A. Summary of report and recommendations.

1. Grasp of Pakistan economy by way of observation of problem.

In our examination of the above-mentioned question of the co-ordination and integration we understand the nature of the economic situation in West Pakistan as follows:

The industrialization of this country began to be developed after its independence and especially following the first five-year plan which resulted in the increased export of textiles and general merchandise, showing on the other hand a remarkable increase in the import of machinery, metal products and industrial materials accompanied with a conspicuously unfavourable balance of trade (excess of imports over exports).

In order to make up for the deficit in its international trade balance the country gradually came to have recourse to the aid of foreign countries. Thus the national economic policy became to attach importance to the promotion of export as well as encouragement of domestic industry, especially the domestic manufacture of metallic engineering products, for the prevention of increase in import. This tendency has been materialized in the form of making the promotion of its metallic engineering industry a keynote of the problems to be emphasized following the second five-year plan.

Judging, however, from the existing state of things in Pakistan it is advisable to endeavour to increase the production of such products as textiles, sundries, jute, rice, wool, hide, etc., all of which holding comparatively advantageous positions in the field of international competition, while it is still premature to plan the domestic manufacture of all machineries and metal products, if it is to be promoted on a large scale except in the sphere which will be

made clear later. The forceful promotion plan of such articles will not only result in the high cost of exports but also have an adverse effect on the growth of national economy as a whole. In view of the present economic situation of the country we have to point out the necessity of a deliberate consideration with regard to the conditions of attaining the domestic supply of metallic engineering products in connection with their lines and fields of manufacture.

2. Metallic engineering industry in the economy of Pakistan.

The points of issue we take up out of the present conditions as well as the future prospects of the metallic engineering industry of the country are derived from the analysis of the demand, that is, market by means of the statistics of the import, domestic production and export of metallic engineering products, which will enable us to anticipate the future sphere of the industry which will be made possible to develop economically, taking at the same time into account the market, technical and labour conditions corresponding to the present stage of development of the country.

Our analysis leads us to the conceivable lines of manufacturing industry favourable to the development of the medium and small scale enterprises of this country; they are approximately twenty in number as the following:- (1) Re-rolling and wiredrawing, (2) Forging, (3) Iron casting, (4) Non-ferrous casting, (5) Hardware for building and construction work, (6) Sheet metal working, (7) Electroplating, (8) Secondary products of steel bar and wire rod (bolts, nuts, rivets, screws, woodscrews, wire nets, etc.), (9) Diesel engines (medium or small size with medium or low speed), (10) Agricultural machinery and implements, (11) Textile machinery and spare parts, (12) Water pumps,

(13) Air compressors, (14) Valves and pipes, (15) Electric illuminating instruments, (16) Wiring appliances and accessories, (17) Gas and water gauges, (18) Bodies of buses and trucks, (19) Bicycles, spare parts and attachments, (20) Sewing machines and spare parts.

However, the number of possible lines of manufacture may not be limited to the items enumerated here. If it is possible to place our hope on the future development of subcontract relationship between such small industries and their orderers or large industries, the field of production for the former will be enlarged to the production of such parts as necessary for automotive vehicles, electric communicating machines, radio apparatuses and rolling-stock.

Now we should like to draw your attention to the lack of "Integration" between large scale enterprises and small ones, which is one of the structural characteristics of the metallic engineering industry of the country.

(a) Small enterprises as well as large ones, that is, whatever their scale may be, are so strongly inclined to complete their production beginning with the processing of raw materials to the finishing of final products that cooperative relations between enterprises are rarely found, as a result of which the development of social division and specialization of work is being hampered.

(b) Competition and concurrence in the same type and field of production carried on by large and small enterprises are so prevalent everywhere that no motive is cognizable of bringing about the social division and specialization of work.

(c) Even within the framework of production system of the large industries themselves cooperation and division of work between different departments are rarely found. Their unit of production

in each individual department is often little greater than that of small enterprieses. This means that the big enterprises are not enjoying the benefit of large scale production which makes it almost hopeless to utilize the outside minor factories of auxiliary character on the basis of cooperation.

(d) On the other hand most of the technical level of manufacture as specialized mills is so low in small enterprises that it can hardly meet the order of other factories. This accounts for the stagnancy of the development of social division and specialization.

(e) Another factor which is retarding the above-mentioned development is the market condition of this country, which is, generally speaking, a kind of a sellers' market, due to the relative shortage of industrial products. Under such circumstances manufacture of finished products brings more profits than that of intermediary ones, which leads to the evil of vertical work on the part of the manufacturers.

(f) Lack of the spirit of cooperation among enterprises is one of the causes of tardy progress of the social division and specialization.

The characteristic stagnancy above-stated is due to the various conditions brought about by the existing stage of the industrial development of this country and naturally has its own reasons. However, we believe that it is possible to improve the situation, and therefore, hope that efficient measures will be taken to overcome the immense disadvantages caused by the lack of "Integration".

3. Lack of co-ordination and integration, its disadvantages and reasons

We point out the disadvantages caused by the lack of "Integration",

which we have already stated, as follows:-

(a) Absence of economy of scale based on concentrated mass production giving rise to unfavourable effects on cost and quality of products.

(b) Absence of advantages resulting from blanket purchase of raw materials and sale by bulk of products.

(c) Absence of concentrated production always resulting in inefficiency of productive equipments of each individual enterprise.

(d) Excessive or double investment of social capital causing waste of valuable foreign currency of the country.

The reasons for such lack of "Integration" may be accounted for from the viewpoints of both demand and supply; and especially important one is the strong protective measures of the Government in the forms of import prohibition and raised import duties, which have resulted in the creation of sellers' markets, easily securing a wide margin of profit for manufacturers on the one hand and on the other adversely taking effect on the development of "Integration". As other reasons we can point out such factors as the inadequate demand for industrial products, which is not large enough to necessitate the realization of the social division of work, the low stage of industrial development in which the country is placed, the scarcity of specialized manufacturers whose level of technique is high enough and the immaturity of cooperative customs among enterprises.

4. Direct measures to expedite co-ordination and integration.

We recommend five direct measures to be immediately taken either by the government or W.P.I.D.C. as follows:

(a) At the present moment there are only a very small number of large

scale enterprises in the metallic engineering industry, which makes it difficult to immediately bring up such subcontractors of medium and small scale ones as capable of meeting the orders of the former. For the time being, therefore, horizontal social division of work among different lines belonging to the industry must be promoted in order to expedite the specialization of each individual line; that means, the specialization of the following lines of work is considered most important:- iron casting, nonferrous casting, forging, electroplating, sheet metal working, precision rivets and screws, cold forged rivets and screws, cold forged rivets and screws, hot processed rivets and screws, machining of metals, etc. It must be added, from the viewpoint of co-ordination and integration between large industries and small ones that the adjustment of their fields of production is also important.

(b) In order to expedite the promotion of the social division of work in metallic engineering industry it is desirable to establish some model plants as private enterprises either under the direct management of W.P.I.D.C. or by its aid. A double selling price system of the products of such model plants should be adopted by W.P.I.D.C., which will be able to pave the way for the introduction of specialized work to this industry.

(c) The majority of the demand for the products of metallic engineering industry comes from the Public Sector. In order to bring up specialized plants necessary technical guidance must be also performed in such manners as making the order from such specialized plants as large as possible, clearly demonstrating the specifications and standards for the order, practising the inspection of delivered products, etc.

(d) Unification and standardization of industrial products have been already practised, but it has not yet pervaded in the metal engineering industry, especially in the field of medium and small scale plants. Standards of industrial materials and common parts which remain still unstipulated should be instituted as soon as possible and the measures for their diffusion should be taken. As regards the system of weights and measurements adoption of the Metric System which is now becoming an international standard, is recommended for the future advantage of the country.

(e) The majority of the metallic engineering industry of this country is concentrated in the districts of Lahore and Karachi. However, adequate consideration from the view point of their future development must be given not to lose the advantages of the local concentration and accumulation of the industry centering around these districts. For the condition of the location of metallic engineering industry greatly depends on the factor of concentration and accumulation. As things stand we are afraid that licensed enterprises, which are paying in spite of unsuitable sites of their plants, will help towards the building-up of uneconomical location of industry.

Problems of medium and small scale enterpries in relation to co-ordination and integration together with measures to be taken.

Besides the direct measures above-stated we propose five indirect measures which are, in a sense, a kind of general measures but important for the promotion of co-ordination and integration among enterprises; they are as follows:

(a) First of all we take up the question of business funds. The existing state of things shows that the manufacturers of this country

are, more or less, in need of foreign exchange for the import of machine apparatuses, raw materials and some portions of machine parts, while the allocation of foreign currency, which is conducted through banks, is inclined to lay stress on large scale enterprises which get the larger share. This leads to the difference of growth in the development pace between the large and small types of enterprises. Furthermore, a high degree of dependence of the latter enterprises on Bonus Vouchers System is another cause of high cost, which is a great obstacle on the way of their specialization. In order to remove this bottleneck such positive steps must be taken as special consideration for the allocation of foreign exchange to them, introduction of foreign investment by means of joint venture and use of payment on credit.

(b) Labour is sufficient in quantity but very inferior in quality. In order to improve the technical level and labour efficiency such steps should be taken as the renewal of machine apparatuses together with the establishment of training facilities of workmen for their bettered craftsmanship and the insititution of proper wage system for stabilized employment.

Re-training of workmen should be given in connection with such specialized types of manufacture based on the social division of work as stated above for at least six months, during which period their ability of reading mechanical drawings should be improved and their skill in operating up-to-date apparatuses acquired. Institution of wage systems should be encouraged in which the longer the employment is the higher the income in order to stabilize the employment and prevent the deterioration in craftsmanship.

(c) Like machinery the majority of raw materials consist of imported goods; the prices of which are comparatively high due to foreign loans and like reasons, and especially the medium and small scale plants are obliged to purchase very dear materials due to the Bonus Voucher system. This accounts for the very high price of manufactured products in general. Special consideration of the allocation of foreign currency and import of materials at moderate international prices should be given at least to those metallic engineering plants which are manufacturing producer's goods.

(d) Other probelems are found also in the fields of the technique of design and manufacture, and the capacity of machines and apparatuses. It is advisable in such cases to introduce foreign technique which should be looked with utmost favour together with the opportune replacement of obsolete equipments with renewed ones. As regards the former willing cooperation of foreign technique must be secured by virtue of such preparedness for its acceptance as adequate compensations for foreign technical know-how, patents, designs and consulting services. In the case of the latter such encouragement measures should be taken as granting to the renewal of obsolate machines subsidies, exemption from taxation, special financial arrangements, allocation of necessary materials in preference to other plants, etc., and sometimes determination to import excellent machines of foreign make is necessary for the improvement of capacity of home-made ones when they are found inefficient.

(e) The immaturity of the custom of cooperation and harmonization between the plants of the same line of business is hampering to a great extent the progress of the metallic engineering industry. For this reason the organization and utilization of trade associations are desirable.

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6. Problems concerning Small Industries Estate and countermeasures.

It has been another task imposed upon us to consider the use of the small industries estate together with the way of dealing with it. Here we discuss the matter from three viewpoints: the role of such estates in expediting the co-ordination and integration: the existing estates in West Pakistan and the situation around them: the construction of such estates aiming at the establishment of co-ordination and integration of metallic engineering industry.

(1) Regarding the above-mentioned role we point out the necessity, from experience in Japan as well as in other countries, of introducing efficient common facilities to be brought about by means of co-operation and concentration of plants, especially because cooperation in manufacture is realized between different plants belonging to the same or related lines of work, we emphasize, such plants as built in the estates must be limited to the ones belonging to some specific or closely related lines of business. As will be stated later, the construction of such estates designed to promote the co-ordination and integration must be materialized in conformity with the conditions stated here.

(2) In connection with the existing estates and the situation around them we have inspected six of the nine estates now under construction. First of all we point out the following features which are common to all of them:- a) we can expect their function of concentrating plants but, for the time being, cannot place much hope in bringing about the promotion of cooperation; b) promotion of co-operation is being commenced not by the medium and small scale

plants themselves but by W.P.I.D.C.; c) the construction of plants is being delayed by the insufficiency of imported machines and of foreign currency. Items a) and b) are unavoidable at this stage of the industrilization of the country, but regarding item c) we admit that there is some room for its improvement. We add to our recommendations the desirability of constructing the small industries estates designed to introduce positive cooperative character in the third five-year plan.

We now express our views on some of the problems peculiar to each estate.

(a) Sialkot. This estate centers around the plants of conventional production, in which neither any move for mechanization is seen nor can be expected any easy shift to it; the estate will be useful only in the case of newly built plants. It can be made use of also as an efficient means of giving technical guidance as well as promoting the cooperation of plants.

(b) Lahore This is considered to be a mono-purpose estate of sewing machine industry. However, there is also a tardy progress in the division and specialization of work in this line of manufacture. It is quite appropriate therefore, that a system of cooperation is going to be established in this estate between the assemblers and makers of parts. Furthermore, it is desirable that the role which W.P.I.D.C. is going to play in the process of attaining the above purpose will be limited to the purchase of the parts and sale of the products considering simultaneously the promotion of business with outside plants in general the same line together with refraining from exerting undue oppression on the existing manufacturers.

(c) Gujranwala It is planned that a number of plants belonging to various lines of manufacture will be built in this estate, but in view of its effective use it is advisable that the lines will be limited to light engineering and textile ones which are not only the leading industries of this country but also suitable kinds for the construction of such estate as designed to introduce mass production and division of work.

(d) Peshawar As the industrilization of this district has just been begun, no kind of noteworthy industry is found here. We cannot expect, different from the other estates, any co-operative relations to be established. It is advisable to accommodate, whatever the lines may be, the plants to be newly built as many as possible.

(e) Regarding the remaining two estates of Gujrat and Quetta what we have stated in connection with Sialkat applies to Gujrat and the case of Peshawar is similar with Quetta.

(3) We are going to state our measures regarding the small industries estates. These measures have been derived from the core of our investigations which directly concern the establishment of co-ordination and integration in metallic engineering industry. Our idea consists in the construction in Karachi and Lahore of estates of industry centering around several model plants in which will be performed the production of such nine specialized kinds of goods as we have selected in preference to the others for the promotion of social division of work.

If any of the existing plants which belongs to any one of the nine lines is found capable enough, it is to be selected a model plant aided by W.P.I.D.C. In the absence of such plants W.P.I.D.C.

itself should establish new model plants and furnish them with its special aid. By so doing we expect that the specialization and division of work in medium and small scale plants will be strongly pushed forward.

Summary of recommendations.

The summary of our recommendations is as follows, though there are some repetitions of what we have already stated above:-

(1) It is needless to say that careful examination of the fields, which will prove profitable in national economy, of manufacture in metallic engineering industry is indispensable before planning the promotion of this industry and its development on national basis. From this standpoint we have selected about twenty lines of manufacture, the development of which is desirable and also promissing in the production field of medium and small scale plants. We have pointed out that the development itself of such plants forms the important prerequisites to the co-ordination and integration in the industry.

Direct measures to expedite the co-ordination and integration are as follows:-

(2) For the time being it is desirable to attach more importance to the promotion of social division of work in accordance with different lines of manufacture than to the bringing-up of such subcontractors as capable of meeting the orders of large scale plants. For this purpose we have selected nine lines of manufacture, namely, iron casting, nonferrous casting, forging, electroplating, sheet metal working, precision rivets and screws, cold forged rivets and screws, hot processed rivets and screws and machining of metal.

(3) In view of the existing stage of development in the metallic engineering industry of this country the growth of specialized plants of their own accord can hardly be expected. Therefore, we propose the establishment of model plants sponsored either by the Government or W.P.I.D.C.

(4) Most of the demand for the products of metallic engineering industry come from the Public Sector which have a weight with the industry. In order to bring up specialized plants measures should be taken to increase the amount of orders from such plants.

(5) Standards of industrial materials and common parts must be stipulated. The importance of standardization must be realized and popularized.

(6) Considering the advantages of concentration and accumulation of plants it is advisable to plan the construction of industrial zones of metallic engineering industry centering around Lahore and Karachi districts.

Indirect measures to promote the co-ordination and integration are as follows:-

(7) Special consideration regarding the allocation of foreign exchange should be given to specialized plants and those steps should be taken which will facilitate the introduction of foreign investment to individual plants as well as their payment on credit.

(8) In order to improve the quality of labour training centres must be established for re-training workmen. Such wage systems should be instituted and popularized as useful for the stabilization of employment.

(9) As regards the materials measures should be taken so that they may be procurable for each individual enterprise at reasonable

international prices. Present prices of materials which are excessively high are hampering the reasonable management of enterprises.

(10) For the improvement of industrial technique, machinery and apparatus measures should be taken to extend a favour to foreign know-how and grant subsidies to the replacement of obsolete machines.

(11) It is desirable for the promotion of cooperation between plants to establish trade associations which will be positively utilized.

The last but not the least measures in connection with the small industries estates are as follows:-

(12) Such estates as qualified now for the institution of co-operative system of production are limited in number, but it is hoped that the system will be practised at the time of the third five-year plan.

(13) As a new plan of the estate we propose the construction of estates in the two districts of Lahore and Karachi which will be designed to practise the co-ordination and integration in metallic engineering industry; these estates will be constructed laying stress on the specialized model plants of priority lines of production. We are confident that such measures will contribute much to the promotion of social division of work.

B. Text of report

1. Grasp of Pakistan economy by way of observation of problems.

At the beginning we make clear how we understand the Pakistan economy in general and from what viewpoint we approach the problem. This will make the background of our dealing with the question of integration and cooperation in the engineering and metallic industry of the country.

According to the interim report(1) of the National Income Committee which was set up in April 1963 the economy of Pakistan has been making a remarkable progress in recent years; during the four years from 1959 - 60 to 1963 - 64 the total G.N.P. has shown a real increase by 22.9% and the G.N.P. per capita has recorded an increase by 11.0%. These percentages, if converted into yearly ones, are 5.3% and 2.6% respectively, and we can appraise the growth percetage of 2.6% to be showing a favourable development of economy in spite of a considerable increase in population.

If classified by industries (Table 2), the growth of manufacturing industry is conspicuous, being by 38.7% (yearly 8.5%), that of the other sectors by 29.3% (yearly 6.7%) and that of agriculture by 15.6% (yearly 3.7%). As a result the distribution ratio of the G.N.P. classified by industries shows that the relative share of agriculture has decreased from 53.3% of 1959 - 60 to 50.1% of 1963 - 64, while that of the other sectors has increased from 37.4% to 39.4% and that of manufacturing industries from 9.3% to 10.5% respectively during the same period.

Table 1. Increase rate of G.N.P.

	Actual amount		Index	
	Total amount of G.N.P.	Per capita amount of G.N.P.	Total amount of G.N.P.	Per capita amount of G.N.P.
1959 - 60	3,143.9*	318	100.0	100.0
60 - 61	3,294.6	325	104.8	102.2
61 - 62	3,474.4	334	110.5	105.0
62 - 63	3,863.7	353	122.9	111.0
63 - 64	3,863 7	353	122.9	111.0

* Unit: Rs. 10 million

** Provisional value

Table 2. G.N.P. classified by industries and its rate of increase

Sector	Relative share in 1963-4	Index (1959-60 = 100)
I Agriculture	50.1	115.6
(a) Major Crops	29.8	117.6
(b) Other Subsectors	20.3	110.1
II Manufacturing	10.5	138.7
(a) Large Scale	6.6	162.9
(b) Small Scale	3.9	111.0
III Other Sectors	39.4	129.3
(a) Mining	0.3	157.1
(b) Construction	3.9	232.0
(c) Electricity, Gas, etc.	0.6	217.8
(d) Transport and Communications	6.0	124.3
(e) Wholesale and Retail Trade	12.2	128.2
(f) Ownership of dwellings	5.1	112.0
(g) Public Admn. and Defence	4.3	126.0
(h) Services	6.3	116.1
(i) Banking and Insurance	0.8	145.1
Net Factor Income		
IV From abroad	(-)0.2	

A glimpse of Table 2 shows us a noteworthy fact that the growth of the large scale enterprises of manufacturing industries is conspicuous and the construction, electrical, gas and other industries have recorded growth ratio of over 100% during the past four years, all of which are the indicators of the recent progress of the industrialization of the country.

So far as West Pakistan alone is concerned, the indices of 1963 - 64, letting those of 1959 - 60 be 100, are 121.0 in the total G.D.P. (Gross Domestic Product) and 109.3 in G.D.P. per capita which are expressed in the yearly increase ratios of 4.9% and 2.3% respectively. Yearly increase percentages classified by industries consisted of 3.0% of agriculture, 7.5% of manufacturing industry and 6.3% of the other sectors. The distribution ratio of 1963 - 64 classified by industries consisted of 45.8% of agriculture (that of 1959 - 60 being 48.2%), 13.9% of manufacturing industry (that of 1959 - 60 being 12.6%) and 41.2% of the other sectors (that of 1959 - 60 being 12.6%). These indicators clarify that West Pakistan, although falls slightly behind East Pakistan in the growth percentage, carrying a great weight in manufacturing industries and other sectors, exceeds the latter in the growth of the absolute total to a considerable extent.

The concrete progress of the industrialization is also shown in Table 3 which concerns the whole of Pakistan; during the five years from 1958 to 1962, for instance, the production of vegetable oils increased threefold, that of art silk, rayon cloth and paper increased by 2.5 - 3.0 times and that of other goods, except tea and steel ingots, was rapidly increasing. However, we have to take note of the stagnant production of steel ingots, which may be called the basis of industrialization, together with the rapid and considerable decrease in the turn-out of

such natural resources, except natural gas, as iron ore, bauxite and chromite.

Table 3. Production indices of principal manufacturing & mining industries

	unit	1958	1959	1960	1961	1962	1962/1958 (%)
Cotton Yarn	1000 Lbs	345,140	392,090	408,709	412,603	432,243	125.2
Cotton Cloth	1000 Yds	576,225	618,534	628,795	699,035	725,234	125.9
Art silk and rayon cloth	"	8,963	19,334	26,041	21,987	24,963	278.5
Jute goods	tons	172,075	232,645	264,674	250,354	286,394	166.4
Paper	"	24,848	28.725	48.308	60,725	63,377	255.1
Board	"	11,340	13,397	14,152	17,906	17,785	156.8
Sugar	"	162,639	167,181	145,410	123,462	190,816	117.3
Salt	1000 tons	354	283	424	383	442	124.9
Hydrogenated vegetable oils	tons	20,412	27,062	34,273	45,197	62,689	307.1
Tea	1000 Lbs	57,537	57,971	42,508	59,940	52,516	91.2
Cigarettes	Million Nos.	7,468	8,771	9,946	12,065	13,696	183.4
Coal	1000 tons	597	723	818	906	975	163.3
Petroleum crude	1000 Imperial Gallons	79,527	81,674	92,264	99,030	116,840	146.9
Motor spirit	"	21,946	24,969	28,460	27,898	33,764	153.9
Kerosene	"	3,774	3,914	5,732	6,672	7,667	203.2
Natural Gas	1000000 Cubic feet	19,308	22,365	29,842	34,665	42,076	217.9
Cement	1000 tons	1,072	986	1,120	1,223	1,373	128.1
Steel ingots	tons	9,450	9,052	7,371	8,517	6,554	69.4
Rubber tyres & tubes	1000 nos.	2,705	2,778	2,951	3,982	4,590	169.7
Safety matches	1000 Gross boxes	7,406	8,326	9,790	9,831	10,199	137.7
Iron ore	tons	8,097	2,250	5,421	3,804	-	47.0**

	unit	1958	1959	1960	1961	1962	1962/1958 (%)
Bauxite	tons	1,977	2,319	574	405	-	20.5**
Limestone	tons	1,119,169	926,649	1,063,577	1,176,442	1,137,563*	101.6
Chromite	tons	23,767	16,023	18,094	25,103	21,135*	88.9
Electric energy	1000 KWH	1,225,400	1,301,610	1,449,894	1,818,929	2,307,487	188.3

Source: Pakistan Statistical Yearbook 1963

* Provisional

** 1961/1958

Fundamentally speaking, scarcity of natural resources is characteristic of the Pakistan economy; labour is abundant in quantity, but the greater part of its national income depends on agriculture; the level of capital accumulation is quite low. In the case of a national economy, saddled with such structural conditions, the realization of a rapid industrialization will inevitably depend on the import of capital goods and industrial materials. As a matter of fact, this country is facing an acute crisis of its international trade balance while it has made a remarkable progress in the industrialization.

The export index of 1962-63 is only 110.4 as against 100 of 1959-60, while the import indices are rapidly increasing as 155.2 of 1962-63 and 180 of 1963-64 accompanied with a rapid increase in the deficits of trade balance which grew from 618 million Rupees of 1959-60 to 1785 million Rupees of 1962-63. (Table 4)

Table 4. Exports, Imports and Trade Balance

All Pakistan

	Actual amount (Rs. million)			Index: 1959-60=100	
	Export	Import	Balance	Export	Import
1959 - 60	1843	2461	- 618	100.0	100.0
60 - 61	1799	3188	-1389	97.6	129.5
61 - 62	1843	3109	-1266	100.0	126.3
62 - 63	2034	3819	-1785	110.4	155.2
63 - 64		4430			180.0

West Pakistan

1959 - 60	763	1806	-1043	100.0	100.0
60 - 61	540	2173	-1633	70.8	120.3
61 - 62	543	2236	-1693	71.2	123.8
62 - 63	785	2800	-2015	102.9	155.0
63 - 64		2981			165.1

Relative share of West Pakistan in foreign trade

1959 - 60	41.4	73.4
60 - 61	30.0	68.2
61 - 62	29.5	71.9
62 - 63	38.6	73.3
63 - 64		67.3

Source: Statistical Bulletin: Central Statistical Office, Sept. 1964

As will be clarified by the distribution ratio classified by merchandise groups which will be treated of later, it is obvious that this rapid increase in import accompanied with the aggravation of trade balance is an immediate result of the industrialization stated above.

In connection with West Pakistan's degree of contribution to the total foreign trade of the country an extreme unbalance is found between the cases of export and import; in the former case the degree of contribution is not more than 30-40% while in the latter the degree is no less than 70%. The deficit in the trade balance of West Pakistan has been yearly well over the total deficit in the total trade balance of all Pakistan since 1959-60. This means that the black-ink figures obtained by East Pakistan have been applied toward the use of West Pakistan whose import amount has been exceeding to a great extent the above figures. Such state of things is not without connections with the progress of the industrialization, as will be made clear by the analysis of the distribution ratio classified by merchandise groups.

The above-mentioned deficits due to unfavourable balance of trade are being covered by the donations from abroad. According to Table 5 which shows the balance of trade of Pakistan (ordinary revenue and outlay), it was, for instance, chiefly due to the official donations, which amounted to 988.7 million Rupees, that offset the deficit in the item 'Goods and Services' of 864.7 million Rupees in 1959-60, bringing black-ink figures in the trade balance of 118.1 million Rupees. In spite of such large amount of foreign aid, however, the trade balances of the two years of 1960-61 and 1961-62 showed

deficits of 55.5 and 101.3 million Rupees respectively, as a result of which Pakistan's reserve in gold and foreign currency (U.S. Dollar and Pound Sterling) decreased from 1,227.2 million Rupees at the end of 1959 to 1,169.6 million Rupees at the end of June in 1960. The reserve in gold and foreign currency as of the end of June 1960 corresponds to 36.7% of the amount of import during 1960-61.

Table 5 Balance of Payments (million Rupees)

	1959-60	60 - 61	61 - 62
Total Credit	3,117.7	3,590.5	3,214.2
Goods and Services	2,098.1	2,255.8	2,348.2
1. Merchandises (F.O.B.)	1,759.4	1,877.4	1,919.6
2. Non Monetary Gold (Net)	12.9	2.7	0.7
3. Foreign Travel	4.3	6.2	8.9
4. Transportation and Insurance	80.9	79.7	84.3
5. Investment Income	34.8	44.4	47.4
6. Government Expenditure	67.6	96.7	121.3
7. Miscellaneous	138.0	148.9	166.2
Donations	1,019.6	1,334.6	865.9
8. Private Remittances and Migrant Transfers	30.9	30.2	35.5
9. Official Donations	988.7	1,304.4	830.5
Total Debits	2,999.7	3,646.1	3,315.5
Goods and Services	2,962.8	3,610.1	3,281.6
1. Merchandises (F.O.B.)	2,473.7	3,015.3	2,638.3
2. Non Monetary Gold (Net)	..	..	..
3. Foreign Travel	29.3	37.9	39.4
4. Transportation and Insurance	213.4	255.7	290.5
5. Investment Income	68.1	76.7	84.3
6. Government Expenditure	90.7	101.5	130.4
7. Miscellaneous	87.6	123.0	98.7
Donations	36.9	36.1	33.9
8. Private Remittances and Migrant Transfers	36.9	35.5	33.9
9. Official Donations	..	..	..
Net Surplus(+) or Deficit(-)	+118.1	-55.5	-101.3

Source: Pkistant Statistical Year book 1963

Table 6. Distribution of export & import

	Actual amount (1000 Rs.)				Rate of increase	Composition ratio					Composition ratio of West Pakistan				
Exports	1960-61	61-62	62-63	63-64	1962-3 1960-1	1960 -61	61-62	62-63	63-64	aver-age	1960 -61	61-62	62-63	63-64	aver-age
Grand Total	1,799,405	1,843,429	2,033,721	1,688,807	113.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0. Food	130,806	208,572	305,677	181,164	235.1	7.2	11.3	15.0	10.7	11.1	25.8	24.2	27.1	18.7	21.5
1. Beverage and Tobacco	70	81	290	287	414.3	0	0	0	0	0.0	0	0	0	0	0.0
2. Crude Material inedible, except fuels	1,164,429	1,165,032	1,243,689	994,292	106.8	64.7	63.2	61.2	58.8	2.0	51.8	51.7	52.8	48.3	51.4
3. Mineral fuels, lubricant and related materials	56	27	-	3,798		0	0	0	0.2	0.1	0	0	0	0.6	0:2
4. Animal and Vegetable Oils and Fats	350	146	172	595	48.6	0	0	0	0	0.0	0	0	0	0.1	0.0
5. Chemicals	3,091	2,545	5,968	21,743	193.1	0.2	0.1	0.3	1.3	0.5	0.6	0.4	0.7	1.3	0.8
6. Manufactured goods classified chiefly by materials	465,610	418,415	421,770	433,501	90.6	25.9	22.8	20.7	25.7	23.8	25.4	15.2	12.8	22.2	18.9
7. Machinery and Transport Equipment	12,790	16,924	20,189	12,847	157.8	0.7	0.9	1.0	0.8	0.9	2.1	3.0	1.9	2.0	2.3
8. Miscellaneous Manufactured Articles	22,956	30,250	33,783	38,132	147.2	1.3	1.7	1.7	2.3	1.8	4.1	5.5	4.3	6.5	5.1
9. Miscellaneous Transactions & Commodities	46	437	2,183	2,448	4,745.7	0	0	0.1	0.1	0.1	0	0	0.3	0.4	0.2
Imports					1963-4 1960-1										
Grand Total	3,187,636	3,109,098	3,818,771	4,429,961	139.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0. Food	627,246	394,131	486,745	661,520	105.5	19.7	12.7	12.7	14.9	15.0	18.0	14.3	11.3	12.9	
1. Beverage and Tobacco	9,927	12,171	16,796	14,619	147.3	0.3	0.4	0.4	0.3	0.4	0.4	0.5	0.6	0.4	0.5
2. Crude Material inedible, except fuels	127,236	148,842	176,326	180,226	141.6	4.0	4.8	4.6	4.1	4.4	4.0	5.1	4.5	4.6	4.6
3. Mineral fuels, lubricant and related materials	363,313	300,385	291,995	293,293	80.7	11.4	9.7	7.6	6.6	8.8	10.1	8.6	6.4	5.4	7.7
4. Animal and Vegetable Oils and Fats	103,803	101,544	208,012	164,570	158.5	3.3	3.3	5.4	3.9	3.9	2.2	2.5	4.2	2.9	3.0
5. Chemicals	326,022	291,761	306,571	400,044	122.7	10.2	9.4	8.0	9.0	9.2	10.4	9.5	8.1	9.7	9.5
6. Manufactured goods classified chiefly by Materials	712,948	740,540	785,136	1,056,948	148.3	22.4	23.8	20.6	23.7	22.6	22.6	20.8	21.0	32.3	21.7
7. Machinery and Transport Equipment	831,058	1,032,088	1,428,699	1,541,566	185.5	26.1	33.2	37.4	34.8	32.9	29.1	35.6	40.8	38.6	36.0
8. Miscellaneous Manufactured Articles	86,026	87,539	118,314	116,680	135.6	2.7	2.8	3.1	2.6	2.8	3.1	3.0	3.3	2.9	3.1
9. Miscellaneous Transactions & Commodities	56	97	177	495	883.9	0	0	0	0	0.0	0	0	0	0	0.0

Source: Statistical Bulletin, Oct. 1962, Oct. 1963, Sep. 1964
Foreign trade Statistics 1960-61

* July 1963 - May 1964

Next let us examine the composition of export and import classified by merchandise. (Table 6) Crude materials come first, forming the majority of the total export amount, namely 60 - 65% (yearly average of the four years from 1960-61 to 1963-64 being 62.0%). However, we have to take note of the fact that the relative share of the crude materials are gradually decreasing and the yearly percentage of growth during the three years from 1960-61 to 1962-63 is 106.8 which is comparatively stagnant. Manufactured goods including cotton and jute goods come next, their shares in the total export being 20 - 25% (average 23.8%). The export of cotton and jute goods means the success in processing, manufacturing and exporting the staple primary merchandise of the country, which itself being the result of the initial stage of the industrialization, the significance must be appreciated. However, it is a problem that the export is making a tardy progress. No. 3 export merchandise is food principally consisting of rice and fish and having the weight of 10 - 15%. Its growth percentage was considerable (235.1) so far as the period of 1962-63 is concerned. Incidentally the total export of Pakistan is actually composed of the above-mentioned three groups of merchandise, the sum of their percentages amounting to no less than 96% (average). The other items of export are negligible. Nevertheless, it is noteworthy that such miscellaneous manufactured goods as consisting principally of sundries, chemicals, machinery and transport equipments are showing, though their relative weights are extremely small, comparatively high growth percentages in connection with the industrialization.

As regards import composition machinery and transport equipments whose weight is 25 - 35% (average being 32.5%) rank first followed by

manufactured goods consisting principally of metallic primary products whose weight being 20 - 25% (average being 22.6%); No.3 is food which has a weight of 10 - 20% (average 15%) and consists principally of wheat. The growth percentage of machinery and transport equipments is 185.5 and that of manufactured goods 148.3, both of which being well over the growth ratio of the total import amount. We have to give attention to this fact. Nearly all of these goods are connected with the industrialization and when we take the import of mineral fuel also into account we may regard at least 60-65% of the total import amount as directly connected with the industrialization(6). As we have already pointed out, the progress of the industrialization in the country has resulted in such a rapid increase in the import of mechanical equipments and industrial materials which, coupled with the stagnation of export, is the cause of the serious crisis of the trade balance of the country.

Let us now perform a similar examination of West Pakistan. As for the export we notice that the respective weights of food (15.0% on the average), machinery and transportation equipments (2.3%) and miscellaneous manufactured goods (5.1%) are relatively high as compared with those of all Pakistan and that in the import the average weight of machinery and transport equipments is 36.0%, exceeding that of all Pakistan. The higher weight of West Pakistan in the export and import of such goods than that of all Pakistan accounts for the higher stage of the industrialization of the former than that of the latter. We also consider the large import percentage of machinery and transport equipments, coupled with their high percentage of growth as the principal cause of the great deficits in the trade balance of West Pakistan.

We have, as stated above, made clear the actual circumstances of the industrialization of Pakistan, which is restricted by the low level of its capital accumulation as well as by the scarcity of its domestic resources, by pointing out the rapid increase in its import connected with the progress of the industrialization accompanied with an acute crisis of the trade balance as a result of insufficient income by export to cover the deficit. In a word, the state of things in the present economy of Pakistan may be grasped as a conflict between the progress of the industrialization and the crisis of its trade balance. The situation is all the more severe in West Pakistan which is the immediate object of our survey. As we have already seen the trade unbalance has been seemingly covered by the large amount of foreign donnations. However, the trouble is that the donnations are external factors of the Pakistan economy. As a matter of course foreign capital is an indispensable factor for the economic development of a country and effective measures must be taken for the future introduction of constant and abundant foreign capital. However, more fundamental measures are the efforts to realize the balance of the ordinary revenue and outlay and eventually the balance of foreign trade.

It is needless to say that there are two ways of improving trade balance; one is the promotion of export and the other the curtailment of import. In its initial stage of industrialization Pakistan endeavoured to multiply the articles of export by getting rid of its dependence on the export of primary products, as a result of which the country succeeded to a considerable extent in the export of textile products and general merchandise by making use of its domestic resources and abundant labour. There are of course many problems which hamper a further expansion of the export in the trend of demand for.

such products and the present conditions of the world market. However, in view of the fact that the import of a country is determined by its capability of export which leads to restrict even the tempo of its economic development the highest priority must be given to the promotion of export by making the most of every opportunity of pushing forward the export of such products of light industry. In order to improve, therefore, the trade balance by letting the export be a datum and without reducing the tempo of the industrialization a substitution for import on the level of capital goods has to be sought for. As a matter of fact the third five-year plan of the country attaches the greatest importance to the development in this direction. The measures to develop the engineering and metallic industry, which we take up in this report, are also directly connected with it. Of course we are not opposed to such direction of development. Considering the importance of engineering and metallic industry, which is one of the key industries of a national economy, and the existing conflict between the industrialization and the trade balance, which, in our opinion, is the present economic situation of the country, it is fundamentally correct to advance to the direction of founding and developing industries of capital goods. However, it will be extremely simplifying the matter if we identify the promotion of export with the subsitution for import and appreciate both of them in an entirely alternative manner. We cannot ignore the effects of domestic production which is a substitution for import on the promotion of export in the course of influencing the trade balance together with the sacrifices the national economy may make even in the absence of effects on the promotion of export. That is to say, we should like to lay stress on the possibility of adverse effects, caused by excessive

domestic production of capital goods, on the international competitive power of such merchandise of export as already finding a market together with the possibility of bringing about the high cost of productive equipments and inefficiency of domestic industries. There is another possibility of exerting heavy pressure on the trade balance by a further increase in import, even when transitory, resulting from excessive substitution for import of capital goods. Considering such points of issue as above-said there will naturally be a definite limit and order in the domestic production of capital goods. Furthermore, there are appearing some actual records of export of capital goods, although their weights are still small, consisting principally of machinery and transport equipments.

We have no negative opinions of the necessity of developing the engineering and metallic industry, its effects on other export industries and its own possibility of growing up to be an export industry. We believe that the economic development of this country is fundamentally determined by the promotion of its export.

Beginning with the understanding of the present state of the economy of Pakistan we have clarified the meaning of developing the engineering and metallic industry of this country and also pointed out the necessity of giving proper consideration to the effects, which such development will have, on the export of Pakistan and promotion of other domestic industries. Consideration given to export will naturally determine the scope of the engineering and metallic industry, where such relevant questions as the productivity, cost and quality of products will be taken up. From these viewpoints we shall deal with the present situation of the industry and examine one by one the possibilities of cooperation and division of work in this

field of the industry.

Notes:

(1) Pakistan Times, November 15, 1964

(2) The growth rate of the G.N.P. during the period 1963-64 was especially remarkable, showing an increase of 7.5% in the total sum, and 5% per capita; if classified by industries, it was 6% in agriculture, 9% in manufacturing industry and 9.2% in other sectors.

(3) Important trade counterparts during 1963-64 were as follows:-

(Million Rupees)

	Exports	Imports	Total	%
U.S.A.	177	1,559	1,736	29.7
United Kingdom	312	591	903	15.4
West Germany	89	397	486	8.3
Japan	166	257	423	7.2
India	194	105	299	5.1
Iran	18	141	159	2.7
France	86	65	148	2.5
Belgium Luxemburg	103	37	140	2.4
Italy	56	80	136	2.3

Source: Pakistan Statistical year book, 1963.

(4) Latest figures of capital account in trade balance have not been available; those during the three years of 1956-58 are as follows:-

(Million Rupees)

	1956	1957	1958
Overseas borrowings	109.8	192.4	98.9
Repayment of debt	14.0	29.1	41.4
Changes in Gold dollar and Sterling	+106.5	-241.5	-255.6

Source: Pakistan Statistical year book, 1963.

Helpful figures classified by nationalities concerning investments by foreign private persons are as follows:-

	Value (Million Rupees)	%
U.S.A.	48.0	27.8
United Kingdom	43.8	25.2
West Germany	40.0	23.2
East Africa of the British Empire	22.5	13.0
Others	18.6	10.8
	172.6	100.0

Investment during the period ranging from April 1959 to February 1961.

Source: Morning News, February 28, 1961.

Quotation from 'Economic development of Pakistan' compiled by Terumaru Inoue.

(5) Exports and imports of textile goods are as follows, the former being well over the latter:-

(1,000 Rupees)

	1960-61		1961-62		1962-63	
	Imports	Exports	Imports	Exports	Imports	Exports
Textile yarn, fabrics made up articles	63,556	443,575	64,122	380,561	54,712	391,039
Thrown silk & other silk yarn & thread incl. Schappe	1,283	--	1,047	--	1,289	--
Yarn of wool and hair	438	119	1,502	15	1,617	5
Cotton yarn and thread	21,913	73,612	13,196	10,172	11,263	16,644
Yarn and thread of flax, hemp and ramie	436	--	351	--	603	--
Yarn and thread of synthetic fibres and spun glass	19,556	--	27,960	3	24,790	1
Yarn of textile fibres mixed with metal	70	4	104	--	263	--
Yarn of textile fibres n, e, s, incl. paper yarn	384	--	470	--	502	--
Cotton fabrics	2,408	44,619	3,631	30,910	1,794	51,234
Silk fabrics	116	3	119	16	35	4
Woolen & worsted fabrics	292	17	521	17	1,014	6
Linen, hemp & ramie fabrics	160	2	198	--	226	--
Jute fabrics incl. jute canvas	4	115,960	1	119,507	4	121,606
Jute bags and sacks for packing	60	192,170	2,440	198,473	11	183,468
Jute carpet and mats	--	101	--	74	6	203
Jute yarn	1	639	5	444	8	22
Jute rope and twine	10	5,034	1	3,273	--	1,450
Other textile fabrics & other related made up articles	16,425	11,295	12,576	17,657	11,227	16,396

Source: Pakistan Statistical Year book, 1963.

(6) According to Chap. 1, Part I of the 'Economic Survey of Asia and the Far East' published by ECAFE, the total income of Pakistan from exports during 1961-62 was appropriated for the import of capital goods and their materials; the exports of the period corresponded to 59.2% of the imports.

(7) Outline of the Third Five Year Plan, Government of Pakistan, 1964.

2. Engineering and metallic industry in Pakistan economy.

(1) Present state.

In this chapter we limit our object to the engineering and metallic industry and deal with its present state, beginning with its trade situation. The amount of the export and import of this industry consisting of such lines as manufactures of metals, machinery, electrical machinery, transport equipments, etc. is shown in Table 7. By the comparison between the respective amounts of export and import classified by items we know that the former is extremely small or only 1.5 - 1.7% of the latter in total amount. While the import amount of each item is on the increase every year, the export amount of each item shows wide fluctuations every year in spite of the increase in the total sum. The sharp variation of the ratio of export to import is also due to such changes in export. All of such facts indicate that this industry is nearly at all points an import industry; the export of its products, in spite of the increase in the total amount, is still in the stage of exporting the surplus products which are subjected to the sharp changes in the domestic demand and supply, that is, a regular export system has not been established yet: In our examination of the development of this industry and its domestic production in connection with its exportation, consideration of establishing a regular system to stabilize the export will be important.

Table 7. Exports and imports of metallic engineering industry

	Exports				Imports				Exports/Imports (%)		
	60-61	61-62	62-63	63-64*	60-61	61-62	62-63	63-64	60-61	61-62	62-63
Manufactures of Metals	2,803	1,773	2,449	5,261	89,321	107,994	126,757	131,495	3.1	1.6	1.9
Finished structural parts and structures				2				45,408			
Metal containers for storage and transport				520				5,808			
Wire products (ex. electric) and fencing grills				5				13,261			
Nails, screws, nuts, bolts, rivets and similar articles of iron, steel or of copper				22				20,082			
Tools for use in the bond or in machines				79				25,060			
Cutlery				1,192				953			
Household equipment of base metals				2,084				1,118			
Manufactures of metals				1,357				19,805			
Machinery and transport Equipment	12,790	16,924	20,189	12,847	831,058	1,032,088	1,428,699	1,541,566	1.5	1.6	1.4
Machinery other than electric	5,711	8,178	11,988	6,563	402,439	541,256	825,960	807,527	1.4	1.5	1.4
Power generating machinery other than electric	1,931	4,122	481	495	42,508	43,439	69,260	55,852	4.5	9.5	0.7
Agricultural machinery and implement		1	134	14	6,924	4,052	6,751	68,513	0.0	0.0	2.0
Tractors other than steam	287	1,285	204		31,027	47,266	61,998		0.9	2.7	0.3
Official machines	6	59	16	8	9,840	7,684	9,028	14,559	0.1	0.8	0.2
Metal working machinery	12	204	957	170	8,172	15,569	29,827	26,860	0.1	1.3	3.2
Mining, construction and other industrial machinery	3,475	2,507	10,196		303,429	423,246	649,096		1.1	0.6	1.6
Textile and leather machinery				633				206,921			
Machines for special industries				945				208,559			
Machinery and appliances (other than electrical) and machine parts				4,298				225,262			
Electric Machinery, Apparatus and Appliances	1,252	1,225	1,581	2,602	174,366	174,484	262,779	255,457	0.7	0.7	0.6
Electric power machinery and switch gear				180				101,913			
Equipment for distributing electricity				23				37,992			
Telecommunications apparatus				908				34,268			
Domestic electrical equipment				674				21,387			
Electric apparatus for medical purposes and radiological apparatus				128				6,502			
Other electrical machinery and apparatus				689				53,395			
Transport Equipment	5,828	7,491	6,620	3,682	254,252	316,348	339,960	478,582	2.3	2.4	1.9
Railway vehicles	1		7		77,859	110,450	127,907	196,306	0.0	0.0	0.0
Road motor vehicles	4,292	3,879	1,828	2,092	146,750	164,807	153,330	217,373	2.9	2.4	1.2
Road vehicles other than motor vehicles	53	107	32	307	19,929	13,753	19,218	12,667	0.3	0.8	0.2
Aircraft	1,481	3,489	4,659	1,282	7,494	26,059	29,574	37,554	9.8	13.4	15.8
Ships and boats	1	16	94	1	2,220	1,279	9,931	14,682	0.0	1.3	0.9
Sanitary plumbing, heating and lighting and fittings	51	42	99	198	8,349	7,705	12,673	11,281	0.6	0.5	1.6
T o t a l	15,644	18,739	22,737	18,306	928,728	1,147,787	1,568,129	1,684,342	1.7	1.6	1.5

*Figures for 1963-64 are those of up to May, 1964.

Source: Same as Table 6.

To enumerate now the items whose export and import amounts are comparatively high in 1963 - 64 the followings are noteworthy:- exports - metal containers, cutlery, kitchen utensils, power generating machinery, textile and leather machinery, communication apparatuses, domestic electric apparatuses, road motor vehicles: imports - materials for construction work, power generators, agricultural machinery and implements, textile and leather machinery, electric motors and switch gears, rolling-stock, etc.

Table 8 clarifies the weight carried by West Pakistan in the export and import of such goods of engineering and metallic industry. According to this the degree of West Pakistan's contribution is overwhelmingly high both in export and import, that is, 80 - 95% of export and 75 - 80% of import belong to West Pakistan; especially its weight in export is so high that many of such articles as construction materials, wire nets, nuts and bolts are 100% of West Pakistan's export and textile and leather machinery may belong to rare exceptions. Of all the imports to Pakistan those imported by West Pakistan in comparatively small amounts are limited to such small number of goods as cutlery, textile and leather machinery, electric machinery for medical use, vehicles (other than motor vehicles), sanitary, plumbing, heating and lighting fixtures and fittings, etc. Such high degrees of West Pakistan's contribution to both export and import indicate the relative priority held by West Pakistan up to now in the stage of industrialization.

The sole clue to the statistical grasp of the general aspect of the engineering and metallic industry of Pakistan is 'Census of Manufacturing Industries' which has been published six times since 1953(1). It does not necessarily convey the full details of the

Table 8. Relative weight of West Pakistan in the exports and imports of metallic engineering industry

	Exports				Imports				
	60-61	61-62	62-63	63-64*	60-61	61-62	62-63	63-64*	*Figures for 1963-64 are those of up to May, 1964. Source: Same as Table 6.
Manufactures of Metals	98.3	81.7	94.9	99.1	68.0	79.6	80.1	74.6	
Finished structural parts and structures				100.0				85.0	
Metal containers for storage and transport				95.4				86.5	
Wire products (ex. electric) and fencing grills				100.0				64.4	
Nails screws, nuts, bolts, rivets and similar									
Articles of iron, steel or of copper				100.0				72.3	
Tools for use in the hand or in machines				100.0				69.3	
Cutlery				99.9				59.3	
Household equipment of base metals				99.6				90.3	
Manufactures of metals				98.9				67.8	
Machinery and Transport Equipment	88.4	96.2	81.4	91.4	76.2	77.1	80.0	74.7	
Machinery other than electric	83.5	93.9	72.2	88.6	69.3	71.5	76.9	75.7	
Power generating machinery other than electric	100.0	97.6	63.4	100.0	66.5	66.6	68.0	71.8	
Agricultural machinery and implements		100.0	100.0	100.0	82.7	73.9	79.8	91.6	
Tractors other than steam	100.0	100.0	100.0		89.6	93.0	96.4		
Office machines	100.0	100.0	56.3	100.0	71.6	82.4	83.2	73.2	
Metal working machinery	100.0	84.3	100.0	100.0	77.8	67.1	79.1	66.6	
Mining, construction and other industrial machinery	73.0	85.2	69.2		67.2	69.5	75.7		
Textile and leather machinery				18.4				58.9	
Machines for special industries				100.0				91.4	
Machinery and appliances (other than electrical) and machine parts				93.4				74.4	
Electric Machinery, Apparatus and Appliances	65.5	96.4	98.8	98.1	74.6	81.2	83.3	73.0	
Electric power machinery and switch gear				96.7				73.7	
Equipment for distributing electricity				100.0				62.3	
Telecommunications apparatus				99.8				79.4	
Domestic electrical equipment				94.1				81.8	
Electric apparatus for medical purposes and Radiological apparatus				100.0				55.2	
Other electrical machinery and apparatus				99.7				73.6	
Transport Equipment	98.2	99.0	93.7	91.8	88.1	84.6	84.9	73.9	
Railway vehicles	100.0		100.0		92.9	95.4	91.1	62.5	
Road motor vehicles	97.5	98.8	74.8	91.1	90.2	78.0	82.2	86.2	
Road vehicles other than motor vehicles	100.0	73.8	100.0	100.0	59.1	55.4	62.0	50.3	
Aircraft	100.0	100.0	93.2	91.0	77.4	98.9	99.2	95.8	
Ships and boats	100.0	100.0	100.0	0	85.1	9.4	47.6	79.9	
Sanitary plumbing, heating and lighting fixtures and fittings	72.5	83.3	89.9	99.0	66.2	60.1	72.9	58.7	
T o t a l	90.2	94.7	82.9	93.7	75.3	77.3	80.6	74.6	

manufacturing industry of Pakistan since it covers only such factories, registered in accordance with the factory law of 1934, as keeping at a certain time of the year of census not less than 20 employees and using motive power in its manufacturing process. However, in order to obtain some preliminary knowledge of the analysis let us, by the aid of this publication, try to clarify the actual situation of this industry.

Table 9 indicates the summaries of the number of the establishments, distribution of establishments by employment size, number of persons, value of products and by-products manufactured and value added by manufacture in such components of the industry as metal working, machinery, electric machinery and transportation equipments; it also shows the changes which took place during the years 1957 - 59. Table 10 is a further elaboration of the indices shown in Table 9 in accordance with a more concrete classification of the lines of the industry. Let us examine the existing situation by making reference to these two Tables.

First of all the number of establishments is 750 - 900, about one half of which consists of metal working industries; the greatest majority of them are of such lines as furniture, hardware and metal containers together with a comparatively large number of lines including agricultural machinery and implements, engines and turbines, textile machinery and attachments, repair of motor vehicles and bicycles. The percentage of these lines is a little more than a quarter of the total number of manufacturing industries enumerated in the Census; especially interesting is the fact that the increase percentage of the total number of manufacturers corresponds exactly to that of the engineering and metallic industries, that is, the

Table 9. Scale of metallic engineering industry

	Number of establishment			Distribution of establishments by employment size					
				Less than 20 persons	20 and less than 250 persons	250 persons and more	Value of Products and by-products manufactured (1000 Rs.)		
	1957	1958	59-60	1959-60/1957 (%)	1959-60/1957 (%)	1959-60/1957 (%)	1957	1958	59-60
Manufacture of Metal Products except Machinery and Transport Equipment	365	401	425	92.6	133.5	200.0	98,309	106,846	146,076
Machinery except Electrical Machinery	218	218	258	106.7	132.4	60.0	46,604	47,808	64,523
Electrical Machinery Apparatus Appliances and Supplies	68	92	95	168.2	123.3	166.7	45,634	59,757	64,703
Manufacture of Transport Equipment	90	98	107	104.0	122.0	150.0	43,083	58,112	84,294
Total	741	809	885	103.5	130.5	142.1	233,630	272,523	359,596
Grand Total (all manufacturers)	2,910	3,170	3,465	104.4	130.7	131.0	3,178,793	3,704,417	4,458,121
	25.5	25.5	25.5				7.3	7.4	8.1

	Value added by manufacture (000 Rs.)			Average daily employment			Value of fided assets (1000 Rs.)		
	1957	1958	59-60	1957	1958	59-60	1957	1958	59-60
Manufacture of Metal Products except Machinery and Transport Equipment	34,981	38,491	60,135	16,820	16,878	21,543	40,701	44,978	50,499
Machinery except Electrical Machinery	21,365	20,630	32,534	10,474	9,407	10,871	24,081	25,861	28,272
Electrical Machinery Apparatus Appliances and Supplies	17,737	24,663	28,561	4,637	6,813	7,260	24,321	30,424	31,932
Manufacture of Transport Equipment	21,925	30,847	45,358	8,836	13,045	14,667	58,821	70,240	83,487
Total	96,008	114,631	166,588	40,767	46,143	54,341	147,924	171,503	194,190
Grand Total (all manufacturers)	1,025,978	1,339,013	1,544,715	343,093	398,101	449,942	1,529,040	1,908,374	1,963,853
	9.4	8.6	10.8	11.9	11.6	12.1	9.7	9.0	9.9

Table 10. Present situation of metallic engineering industry

Value: 1000 Rs.

	Total number of Establishment	( ) West Pakistan	Legal Organization								Employment									Wages		
			Individual enterprises	Partnership firms	Private companies	Joint stock companies	Co-operative enterprises	Government undertakings	Corporation	Others	Less than 20 persons	More than 20 & less than 250 persons	250 persons and more	Total	Production workers	Adults	Children	Male	Female	Total	Per head	
Manufacture of Metal Products except Machinery and Transport Equipment	425	(345)	116	242	47	8	3	8	1		148	267	10	21,543	18,485	17,960	525	18,424	61	17,314	0.94	
Arms and accessories	4	(4)	1	2	1						3	1	-	110	98	93	5	98	-	91	0.93	
Metal sanitary wares and fittings and other plumbers supplies	22	(20)	7	12	3						6	16	-	813	682	665	17	682	-	695	1.02	
Heating, cooking and lighting apparatus	26	(25)	12	11	3						6	20	-	1,266	1,151	1,101	50	1,130	21	992	0.86	
Cutlery	8	(8)	3	4		1					1	7	-	612	514	479	35	514	-	443	0.86	
Hand and edge tools and implements	7	(7)	3	3	1						1	6	-	293	264	263	1	264	-	209	0.79	
Hardware	66	(49)	19	41	2	2	1	1			25	41	-	2,409	2,025	1,939	86	2,025	-	1,924	0.95	
Blacksmithing, welding and repairing workshops	16	(12)	2	6	3			4	1		6	8	2	1,696	1,351	1,348	3	1,351	-	1,488	1.10	
Utensils	123	(100)	17	97	7	1	1				32	88	3	5,771	5,040	4,844	196	5,012	28	4,244	0.84	
Metal containers	41	(29)	13	14	11	3					14	25	2	3,456	2,926	2,874	52	2,920	6	3,247	1.11	
Safes, vaults and trunks	13	(12)	4	8	1						9	4	-	269	228	226	2	228	-	209	0.92	
Metal products	99	(79)	35	44	15	1	1	3			45	51	3	4,848	4,206	4,128	78	4,200	6	3,772	0.90	
Machinery, except Electrical Machinery	258	(234)	59	172	17	3	2	2	2	1	112	143	3	10,871	9,160	8,994	166	9,146	14	9,093	0.99	
Agricultural machinery and appliances	54	(48)	7	42	2	1	2				27	27	-	1,777	1,491	1,471	20	1,491	-	1,216	0.82	
Engines and turbines	38	(38)	6	32																		
Textile machinery and accessories	32	(32)	10	19	3						14	18	-	1,211	1,039	1,036	3	1,039	-	1,027	0.99	
Metal working machinery and machine tools	1	(1)			1																	
Pumps and compressors	10	(10)	4	4	2						5	5	-	340	278	268	10	278	-	271	0.97	
Sewing machines	14	(14)	3	10						1	4	10	-	630	565	529	36	565	-	518	0.92	
Machinery, except electrical	109	(91)	29	65	9	2		2	2		48	59	2	4,962	4,041	3,954	87	4,027	14	4,332	1.07	
Electrical Machinery, Apparatus, Appliances and Supplies	95	(90)	22	43	22	4	1	2		1	37	53	5	7,260	5,930	5,898	32	5,901	29	6,276	1.06	
Electrical appliances, except electric fans	3	(3)	2	1							1	2	-	256	226	223	3	226	-	172	0.76	
Electric fans	27	(26)	7	14	3	2	1															
Electric bulbs	2	(2)		1	1																	
Radios and related products	11	(10)	2	3	6						2	9	-	585	445	445	-	419	26	582	1.31	
Electrical products	52	(49)	11	24	12	2		2		1	23	26	3	3,912	3,060	3,049	11	3,057	3	3,309	1.08	
Manufacture of Transport Equipment	107	(88)	15	36	26	16	3	8		3	26	72	9	14,667	12,101	12,048	53	12,101	-	14,438	1.19	
Water transport equipment	16	(7)	1	2	6	7					-	12	4	5,934	4,818	4,813	5	4,818	-	5,925	1.23	
Manufacture of motor vehicles	19	(17)	1	8	5	3		1		1	1	16	2	2,649	2,080	2,076	4	2,080	-	2,890	1.39	
Repair of motor vehicles	35	(30)	3	6	13	5	1	7			6	28	1	2,852	2,335	2,324	11	2,335	-	3,003	1.29	
Cycles	34	(31)	10	19	2	1	2				18	14	2	2,978	2,687	2,664	23	2,687	-	2,167	0.81	
Manufacture of transport equipment	3	(3)		1						2	1	2	-	254	181	171	10	181	-	453	2.50	
Total (%)	885	(757) (85.5)	212 (24.0)	493 (55.7)	112 (12.7)	31 (3.5)	9 (1.0)	20 (2.3)	3 (0.3)	5 (0.6)	323 (36.5)	535 (60.5)	27 (3.0)	54,341	45,676 (84.1)	44,900 (98.3)	776 (1.0)	45,572 (99.8)	104 (0.2)	47,121 (12.5)	1.03	
Grand Total (all manufactures)	3,465	(2,758 (79.6)	786 (22.7)	1,859 (53.7)	451 (13.0)	277 (8.0)	22 (6.3)	43 (1.2)	16 (0.6)	11 (0.3)	1,341 (38.7)	1,900 (54.8)	224 (6.5)	449,942	386,994 (86.0)	383,293 (99.0)	3,701 (1.0)	380,430 (98.3)	6,564 (1.7)	376,119	0.97	

Value: 1000 Rs. Source:Census of Manufacturing Industries, 1959-60

Legal Organization							Employment															
Partner ship firnns	Private companies	Joint stock companies	Co-operative enterprises	Government undertakings	Corporation	Others	Less than 20 persons	More than 20 & less than 250 persons	250 persons and more	Total	Production workers	Adults	Children	Male	Female	Wages Total	Wages Per head	Cost of fuel and electricity consumed	Cost of raw materials consumed	Payment for work given out	Value of product and by product made	Receipts for work done for others	Value added by manufacture
242	47	8	3	8	1		148	267	10	21,543	18,485	17,960	525	18,424	61	17,314	0.94	4,941	85,904	1,146	146,076	6,050	60,135
2	1						3	1	-	110	98	93	5	98	-	91	0.93	19	117	-	328	3	195
12	3						6	16	-	813	682	665	17	682	-	695	1.02	273	2,618	8	5,558	64	2,723
11	3						6	20	-	1,266	1,151	1,101	50	1,130	21	992	0.86	99	3,110	78	6,068	1	2,782
4		1					1	7	-	612	514	479	35	514	-	443	0.86	39	1,157	60	2,769	-	1,513
3	1						1	6	-	293	264	263	1	264	-	209	0.79	53	549	1	1,238	-	635
41	2	2	1	1			25	41	-	2,409	2,025	1,939	86	2,025	-	1,924	0.95	353	7,104	29	12,974	688	6,176
6	3			4	1		6	8	2	1,696	1,351	1,348	3	1,351	-	1,488	1.10	274	1,463	1	4,052	3,350	5,664
97	7	1	1				32	88	3	5,771	5,040	4,844	196	5,012	28	4,244	0.84	2,005	28,113	210	45,251	74	14,997
14	11	3					14	25	2	3,456	2,926	2,874	52	2,920	6	3,247	1.11	896	28,104	491	42,443	494	13,446
8	1						9	4	-	269	228	226	2	228	-	209	0.92	16	509	-	1,020	3	498
44	15	1	1	3			45	51	3	4,848	4,206	4,128	78	4,200	6	3,772	0.90	914	13,060	268	24,375	1,373	11,506
172	17	3	2	2	2	1	112	143	3	10,871	9,160	8,994	166	9,146	14	9,093	0.99	3,314	34,544	348	64,523	6,217	32,534
42	2	1	2				27	27	-	1,777	1,491	1,471	20	1,491	-	1,216	0.82	607	4,911	22	9,353	234	4,017
32																							
19	3						14	18	-	1,211	1,039	1,036	3	1,039	-	1,027	0.99	296	2,763	24	6,277	180	3,374
	1																						
4	2						5	5	-	340	278	268	10	278	-	271	0.97	70	2,946	-	6,754	19	3,757
10						1	4	10	-	630	565	529	36	565	-	518	0.92	105	5,503	12	10,131	-	4,511
65	9	2		2	2		48	59	2	4,962	4,041	3,954	87	4,027	14	4,332	1.07	1,479	11,710	178	19,415	5,192	11,240
43	22	4	1	2		1	37	53	5	7,260	5,930	5,898	32	5,901	29	6,276	1.06	985	38,009	190	64,703	3,042	28,561
1							1	2	-	256	226	223	3	226	-	172	0.76	29	435	-	1,144	10	690
14	3	2	1																				
1	1																						
3	6						2	9	-	585	445	445	-	419	26	582	1.31	33	4,264	72	7,274	136	3,041
24	12	2		2		1	23	26	3	3,912	3,060	3,049	11	3,057	3	3,309	1.08	552	24,111	39	38,295	2,856	16,449
36	26	16	3	8		3	26	72	9	14,667	12,101	12,048	53	12,101	-	14,438	1.19	2,289	71,321	79	84,294	34,753	45,358
2	6	7					-	12	4	5,934	4,818	4,813	5	4,818	-	5,925	1.23	845	9,389	17	7,355	18,758	15,862
8	5	3		1		1	1	16	2	2,649	2,080	2,076	4	2,080	-	2,890	1.39	316	48,794	30	63,734	2,770	364
6	13	5	1	7			6	28	1	2,852	2,335	2,324	11	2,335	-	3,003	1.29	734	6,254	30	253	12,401	5,636
19	2	1	2				18	14	2	2,978	2,687	2,664	23	2,687	-	2,167	0.81	375	6,579	2	12,486	19	5,549
1						2	1	2	-	254	181	171	10	181	-	453	2.50	19	305	-	466	805	947
493 (55.7)	112 (12.7)	31 (3.5)	9 (1.0)	20 (2.3)	3 (0.3)	5 (0.6)	323 (36.5)	535 (60.5)	27 (3.0)	54,341	45,676 (84.1)	44,900 (98.3)	776 (1.0)	45,572 (99.8)	104 (0.2)	47,121 (12.5)	1.03	11,529	229,778	1,763	359,596	50,062	166,588
1,859 (53.7)	451 (13.0)	277 (8.0)	22 (6.3)	43 (1.2)	16 (0.6)	11 (0.3)	1,341 (38.7)	1,900 (54.8)	224 (6.5)	449,942	386,994 (86.0)	383,293 (99.0)	3,701 (1.0)	380,430 (98.3)	6,564 (1.7)	376,119	0.97	165,536 (7.0)	2,860,984 (8.0)	6,488 (27.2)	4,438,131 (8.1)	120,607 (41.5)	1,544,715 (10.8)

latter remained constantly 25.5% of the former during the three years after 1957. As to the number of engineering and metallic industries the greatest majority is found also in West Pakistan, where, for instance, 757 (85.5%) out of the total number of 885 were operated in 1959 - 60. As the percentage of the manufacturers operating in West Pakistan is 75.6% of the total number of all Pakistan, the degree of concentration in West Pakistan of engineering and metallic industry may well be called exceedingly high.

As for the classification by types of the industry partnership types are more than half (55.7%) in number followed by types of individual enterprise (24.0%), private company (12.7%) and joint stock company (3.5%). As compared with all manufacturing industries the types of partnership and individual enterprise are a little larger in number and that of joint stock company, smaller.

Let us next classify the establishments by the number of employees as 'class of less than 20 persons', 'class of 20 and less than 250 persons' and 'class of 250 and more persons' and then consider the scale of engineering and metallic industry in connection with the number of establishments. If we compare the numbers of each class in 1957 with those in 1959 - 60 the increase percentages of each class are 103.5, 130.5 and 142.1 respectively, which clearly indicate the tendency that the larger the scale the greater the increase in number. As the corresponding indices in the case of all manufacturing industries are 104.4, 130.7 and 131.0, it is seen that there appeared an especially great increase in number of the large scale establishments in the engineering and metallic industry. If we consider the matter according to classification by lines of the industry, the above tendency is conspicuous in the metal working

industry; while the class of less than 20 persons decreased in number that of 250 and more persons increased twice. In the line of machinery, on the contrary, the class of 250 and more persons decreased and in electric machinery the number of the class of less than 20 persons remarkably increased. Thus the changes in individual lines were not common to all, but, on the whole, we may say that establishments are becoming large-sized. When we notice, however, the distribution of establishments by employment size in 1959 - 60, we see that the class of less than 20 persons constituted 36.5% (38.7% in the case of all manufacturing industries), the class of 20 and less than 250 persons, 60.5% (54.8% ") and the class of 250 persons and more, 3.0% (6.5% "), which indicate the characteristic of this industry consisting mostly of medium and small scale enterprises. Table 9 clearly indicates that this industry which is about a quarter of all manufacturing industries in number constitutes only 11 - 12% in the number of employees, 7 - 8% in the value of products and 9 - 10% in the value added. This is also one of the data which prove the smallness of scale as a whole characterizing the industry.

While the number of employees of all manufacturing industries, which had been about 343,000 in 1957, increased to about 450,000 in 1959 - 60, that of the engineering and metallic industry increased from 40,767 (11.9%) to 54,341 (12.1%); this increase of the latter was nearly in concert with the former. The average number of employees per establishment in 1959 - 60 were 50.7 in the metal working, 42.1 in the machinery, 76.4 in the electric machinery, 137.1 in the transport equipments and 61.4 in all engineering and metallic industries. It was 129.9 in all manufacturing industries, the number being exceeded only by the transport equipments industry. This fact shows

again that the industries other than the transport equipments line contain a very small number of employees, which at the same time indicates the smallness of scale of this industry.

According to the distribution of employees, those who are engaged in the actual work of production are 45,676 in number, which are 84.1% of all (86.0% in the case of all manufacturing industries), consisting of an overwhelmingly large number of adults (above the age of 17) and a very small number of minor workers, which is only 1.7% (1.0% "); nearly all employees are male workers including only 104 female ones. As compared with those of all manufacturing industries the number of minor workers is slightly greater and it is characteristic of this industry that the number of female workers is negligible.

As for the wages of workers engaged in production the total average of the engineering and metallic industry are Rs 1,030 a year per head which are a little more than those of all manufacturing industries. Average wages of the transport equipment industry rank highest (average Rs 1,190) and especially Rs 2,500 of the 'other transport equipment industry's are a great deal more (3.3 times) than Rs 760 of electric implement industry. Generally speaking, wages of the transport equipment industry are high and followed by the electric machinery (Rs 1,060), machinery (Rs 990) and metal working (Rs 940) industries. As is also shown in Table 11 wages of the engineering and metallic industry are 13.1% of the value of products and 28.3% of the value added. As compared with the corresponding figures of all manufacturing industries which are 8.4% and 24.3% respectively, and taking, at the same time, the comparison of wages per head into consideration, we may say that the wage conditions of this industry are fairly advantageous of all manufacturing industries(2).

Table 10 indicates such figures of the engineering and metallic industry as cost of fuel and electricity consumed, cost of materials consumed, value of product and by-product made, payment for work given out (payable to other enterprises for processing the materials of the payer), receipts for work done for others (receivable from customer enterprises for the repairing, mending and other service applied to the materials) and value added. The weights of the engineering and metallic industry concerning these items of all manufacturing industries are expressed respectively as 7.0% of the cost of fuel and electricity consumed, 8.0% of the cost of materials consumed, 27.2% of the payment for work given out, 81.% of the value of product and by-product made, 41.5% of the receipts for work done for others and 10.8% of the value added; especially payment to and receipt from other enterprises are by far greater than the amounts of other items. The weights of these indices when letting the value of product be their basis are respectively 3.2% of the cost of fuel and electricity

Table 11. Ratio of other indices to value of product (%)

	Cost of fuel and electricity consumed/ Value of product	Cost of raw material consumed/ Value of product	Payment for work given out/ Value of product	Receipts for work done for others/ Value of product	Value added by manufacture/ Value of product
Metallic engineering industry	3.2	63.9	0.5	13.9	46.3
All manufacturing industries	3.7	64.2	0.1	2.7	34.6

consumed (3.7% of all manufacturing industries; note-figures enclosed within brackets that follow will be understood as pertaining to all manufacturing industries), 63.9% of the cost of materials

consumed (64.2%), 0.5% of the payment for work given out (0.1%), 13.9% of the receipts for work done for others (2.7%) and 46.3% (34.6%) of the value added; payment to other enterprises, though its weight is small, is five times and receipts from other enterprises are 5.1 times those of all manufacturing industries respectively. Incidentally the relationship among these indices may be expressed as

cost of fuel and electricity consumed + cost of materials consumed + payment to other enterprises + value added = value of product and by-product made + receipts from other enterprises.

Here we notice many cases of payment and receipt especially between the engineering and metallic industry and other lines of industry, which mean that this industry is making a comparatively better progress in the field of industrial co-ordination. However, such high level of co-ordination between enterprises is one of the essential characteristics of this kind of industry, and, as will be emphasized later in 'structural characteristic of engineering and metallic industry', in spite of the existing level of the co-ordination, which is fairly high as compared with that in other industries, we have to point out its thin and weak character.

Lastly we should like to point out the high rate of the 'value added', too. As regards this item the weight of the engineering and metallic industry constitutes 10.8% of that of all manufacturing industries, and considering at the same time the relative share of the former in the G.N.P. may be about 1% at extremely rough estimate(3).

Let us now turn back to Table 10 to pick up some lines of industry whose product amounts are fairly large: hardware, kitchen utensils, metal containers, agricultural machinery and implements, sewing

machines, motor vehicles (manufacture), bicycles, etc.: they are followed by metal sanitary wares and fittings and other plumber's supplies, heating, cooking and lighting apparatus, textile machinery and accessories, pumps and compressors, radios and attachments, transport equipments by water, etc.

Thus we have considered in detail and from all its aspects the present state of the engineering and metallic industry of Pakistan. Our views which resulted from our field survey shall be added to our understanding of the situation which is based on a statistical analysis in order to enumerate the concrete lines of this industry which will be taken up in this report.

(2) Lines of engineering and metallic industry we suggest.

First of all the standards of selecting the concrete lines of the industry we suggest are the following four:-

(a) Existence of a fairly large demand for the products and prospective growth of this demand.

It is hardly necessary to say that the most important factor of either industrialization or domestic production is demand or market. Demand is indeed a decisive factor of selecting the lines of industry when we consider the co-ordination that the size of market determines the scale of production, which in turn governs the cost of production and then leads to the conclusion of the possibility of domestic production; the co-ordination that the domestic production influences export - export has particularly a great deal to do with cost of production. Usually domestic demand is given by an expression:

amount of domestic demand = domestic production + import - export

and overseas demand is of course expressed by export. Therefore, the amounts of export, import and production shown in Tables 7 and 10, although of different base year and different classification of lines, provide a kind of clue to our standards of selection.

(b) Capability of contributing to improvement of trade balance through realization of export or substitution for import.

Since the present stage of Pakistan economy is, as we pointed out in the preceding chapter, regarded as a crisis in its trade balance, and the development of the engineering and metallic industry is sought for as one of the measures of avoiding the crisis, contribution to the improvement of trade balance is an important standard of our selection. Table 7 will furnish us a clue to the export and import classified by lines of the industry. However, we have to consider here, as we stated in the preceding chapter, the co-ordination of substitution for import and promotion of export and avoid such excessive substitution as will affect production cost. Import is more advantageous than domestic production, even when it is physically possible, whose cost is exceedingly high from an international point of view.

(c) Lines based on intensive labour and comparatively facile commencement.

It may of course be desirable to select the lines of industry based on intensive labour from the viewpoint of its supply in Pakistan. However, it is necessary to select such lines as can be started with comparative facility, considering the equality of labour and technical conditions together with the

level of capital accumulation at the present stage. As is obvious from the analysis in the preceding chapter, those lines which are considered important in connection with the amount of export and domestic production are at present strongly tinged with the production of consumer's goods with a negligible amount of high-degree capital goods. Furthermore, they still remain in the field of handicraft and only a few of them are highly mechanized. We must of course aim at the development from handicraft to mechanized manufacture and from substitution for consumer's goods to that for capital ones, but there may be naturally a definite scope and order in the development. During our survey on the spot we often heard many complaints about the precision of technology applied to some capital goods whose home production had been already realized. In this connection the desirable lines may be such that will apply slight processing work to basic materials or have charge of the final stage of assembly work.

(d) Disadvantageous import in view of transportation cost.

If the import of certain finished goods is found disadvantageous in view of transportation cost, it is of course remunerative to import their parts or materials in order to make them into finished goods at home, as curtailment of transportation cost is favourable to trade balance.

Now considering the above-mentioned standards the development of the following lines, in our opinion, need to be promoted for the purpose of expediting the future industrialization especially in connection with the co-ordition and integration of industries which constitute our main subjects to deal with.

1. Re-rolling and wiredrawing
2. Forging
3. Iron casting
4. Nonferrous casting
5. Hardware for building and construction
6. Sheet metal working
7. Electroplating
8. Wire rod secondary products (bolts, nuts, rivets, screws, wood-screws, wire nets, etc.)
9. Diesel engine manufacturing (medium and small size: medium and slow type)
10. Agricultural implements
11. Textile machinery and spare parts
12. Water pumps
13. Air compressors
14. Valves, pipes and joints
15. Electric illuminating apparatus
16. Wiring appliances and attachments
17. Gas and water meters
18. Trucks and bus bodies
19. Bicycles, spare parts and attachments
20. Sewing machines and spare parts

Paying attention chiefly to these concrete lines let us consider in the chapters that follow the actual circumstances of the co-ordination and cooperation between industries together with their promotive measures.

(3) Structural characteristics of the metal engineering industry.

(a) Small enterprises as well as large ones, whatever their scale may be, are so strongly inclined to complete the whole process of production within their own frameworks, that is, from the very beginning of processing raw materials followed by manufacture of half-finished goods to production of finished-goods that co-ordination among different enterprises is rarely found, as a result of which social division and specialization of work among different lines and fields of production are making a tardy progress.

Although we pointed out in the preceding chapter, from our statistical analysis of the existing conditions of the industry, that the degree of co-ordination in this industry was higher than that in other kinds of industry, we were strongly impressed by the extreme scarcity of such co-ordination as a result of our investigation on the spot; that means, the degree, though it may be higher than that in other industries, is markedly lower than it should be among the industry itself.

This accounts for the fact that metal engineering industry is essentially characteristic of co-ordination among its different lines; that the 'payment for work given out', which may be called a kind of processing fees payable to others, amounted to only 5% of the value of product, though this amount is higher than that of other industries. Nearly all the factories we visited were operating foundries, press and metal plating mills of their own and even making bolts and nuts on their own, by means of all these they were producing finished-goods.

(b) Large scale enterprises intervene in the field of production

which should originally belong to small scale ones, bring competition and concurrence into existence.

For instance, a certain large scale enterprise was producing such goods as hardware for building and construction work, spare parts of sewing machine and bicycle, looms, various types of machine tools and electric implements. Another large enterprise, besides operating a re-rolling mill, was producing machine tools, looms, concrete mixers, hardware for building work such as window sashes, turbine pumps, motors of small size, diesel engines of small size, window frames, safes, containers, bicycles, etc.

(c) Large scale enterprises have an appearance of gathered small ones. As a result of producing such a large number of goods co-ordination and cooperation between different departments are rarely found even within the framework of production system of large scale enterprises; the units of their production are little greater than those of small scale ones; they have, so to speak, an appearance of gathered small scale ones. This means that even the large scale enterprises are not enjoying the advantage of large scale production, which makes it almost hopeless to utilize the outside minor factories of auxiliary function on the basis of co-ordination and integration.

(d) Absence of co-ordination and integration between different industrial areas resulting in lack of so-called advantage of concentration.

It is hardly necessary to say that metal engineering industry enjoys best the so-called advantage of concentration. However, in the present situation of Pakistan, the concentration is still inadequate except those to some extent in the vicinities of

Karachi and Lahore; on the contrary even a tendency of diffusing the industry to remote districts in accordance with the policy of equal metal in each district.

Such structural characteristics of this industry may be expressed, in short, as 'absence of co-ordination and integration' which is related to the subjects of our investigation; the reasons for, disadvantages resulting from and, moreover, countermeasures against such 'absence' will be treated of in the Chapter that follows.

Notes:

(1) Report for 1959-60 is the latest; no new publication is available since then.

(2) Other than wages there are such cash benefits as expenses of transport (traffics), house rent, insurance, bonus, etc., the sum of which amounts to about 6.2% (in all manufacturing industries) and 4.4% (in the metallic engineering industry). The small percentage of such cash benefits in the metallic engineering industry means an offset in a way of its advantageous wages.

(3) The relative 'value added by manufacture' of the Indian metallic engineering industry (which covers approximately the same lines as that of Pakistan) to the total value added by manufacture of all Indian manufacturing industries was 17.2% in 1959. This value was, like in Pakistan, 1% of the total value of G.N.P., while in Japan the relative 'value added' in metal manufacturing and machinery manufacturing industries to the total 'value added' in all manufacturing industries (which mean establishments with more than 4 employees) was, also in 1959. 13.4% and 3.9% to the total value of G.N.P.

Problems concerning co-ordination and integration between large scale enterprises and small ones of metallic engineering industry.

(1) Absence of co-ordination and integration and its disadvantage.

We have pointed out that one of the structural characteristics of this industry consists in the so-called vertical production system in which each enterprise, whatever its scale may be, completes the whole process of production including the treatment of raw materials and manufacture of parts. This means that the social division of work is rarely found which enables the development of large scale enterprises and small ones as well by means of their organic combination supplementing each other, taking charge mutually and alternately of each stage of production such as the supply of raw materials, provision of parts, finishing of final assembly, and at the same time leads to the establishment of an efficient production system as a whole. It denotes the absence of co-ordination and integration within the framework of this industry.

The industry has reasons for such characteristics in its own way which will be made clear in the following chapter. However, let us enumerate here some of the existing disadvantages apparently resulting from the absence of co-ordination and integration.

(a) Absence of 'economy of scale' based on concentrated mass production is affecting the cost and quality of products. When we compare an enterprise which completes in itself the whole process of production from the treating of materials to the assembly of finished goods with another which centralizes and specilizes in one process of production we can clearly point out the disadvantages of the former. Absence of technical training obtainable by specializing in one process and consequently the hampered

improvement and modernization are the defects caused by such separate and vertical system of production in many enterprises.

(b) Absence of advantages resulting from blanket purchase of materials and sale by bulk of products.

We can easily imagine that the absence of concentrated mass production accompanies that of regular distribution system which necessitates the purchase in small quantities and sale by instalments leading to adverse effects on cost.

(c) Absence of concentrated production of specific kinds causes each enterprise to comprise a number of separate processes of operation; that is, each enterprise must have its own production equipments corresponding to the separate processes whose constant and effective use cannot be expected. This tendency requires excessive investments, which could otherwise be saved, in this industry as a whole and is diminishing the effect of the investments. This means that the investment in equipments can not help being excessive in relation to demand for the products; it gives rise to the high cost of products through the channel of investment cost and the fall of operational rate which is at the mercy of the amount of demand.

(d) Excessive or double investment is in no way desirable in view of its efficiency; especially in the case of Pakistan the investment has to be performed in the shape of import of machinery which means an immediate waste of foreign currency.

The above-said structural characteristic of this industry, in which vertical production within separate enterprises is being conducted, is resulting in such disadvantages as inefficient investment, waste of foreign exchange and high cost of finished-

goods, the significance of which cannot be ignored when considering the realization, in this country confronted with a serious difficulty of its trade unbalance which we have pointed out, of successful substitution for import of metallic engineering products and their ensuing export in future. For this reason rapid execution is urgently needed of effective measures to establish the organic combinations, co-ordination and integration of enterprises.

(2) Reasons for absence of co-ordination and integration.

However, before proposing concrete measures regarding co-ordination and integration we have to inquire into the reasons why such structural features and accordingly such disadvantages have been brought about, as an exact grasp of the existing situation as well as reasons for its growth is indispensable for the proposition of effective measures.

The reasons for necessitating the vertical production system on the level of separate enterprises may be observed from the respective viewpoints of demand and supply.

The most decisive reasons consist, of course, in those on the part of demand, which, in spite of its very complicated appearance, may be understood as having two phases: the first one is a demand given, so to speak, transitively to manufacturers by the protective measures of the Government: the second is that which they have to develop on their own by overstepping the first.

In the case of Pakistan which is anxious for industrialization and self-sufficiency the Government, as soon as the domestic production of a certain commodity gets into shape, extends strong protective measures to it by means of placing it under a direct import ban

or raising the import duties on it. Consequently the manufacturers of such a commodity who come to enjoy the protection can at once secure a domestic demand of a certain unit - its upper limit being the import amount at the time of instituting the protection - which means that a kind of sellers' market as established in spite of some defects in the quality and price of home-made goods, thus bringing them a broad margin of profit. Incidentally protection is usually given to the final commodities whose manufacturers can proceed with their production under extremely favourable conditions until they meet the domestic demand originally given to them without any motivation to reduce the cost by means of rationalization and higher efficiency of production. To start the production of final commodities naturally means to begin with the final process of assembling imported parts. With gradual development of situation the time comes when the assembly of home-made parts or domestic treatment of raw materials is possible which accompanies scarce motivation of the above-said rationalization and efficient operation in addition to the various conditions on the part of supply which will be stated later, the manufacturers of the final commodities will have to take charge of the whole process of production one by one until a usage of vertical production is established. That is, the demand at this time is rather excessively large as compared with production or supply, which brings into existence a situation where co-ordination and integration of enterprises are not so much needed. Generally speaking, domestic market of developing countries is rather narrow. However, we could ascertain the existence of sellers' markets through our investigation on the spot or interviews with proprietors of factories; we saw many factories running full time without holidays by means of work in three

shifts a day and many proprietors having acquired a considerable amount of profit which they were keeping in the form of their own funds for use in new investment, enlargement and new construction of factories. These facts, though may seem strange at a glance, will be quite comprehensible when we think of the protective policy of the Government and the birth, which dates back to a quite recent time, of many of the enterprises in this new field of the industry. Such absence of co-ordination and integration resulting from the excessive demand must be modified by introducing moderate competition through elastic application of the import policy and induced to rationalization and efficient operation; here is the motivation of establishing the co-ordination and integration.

Naturally not all of the lines of the industry are in such stage of production, but some have already come to a deadlock in the domestic demand. As soon as the supply arrives at a stage of meeting the demand in domestic market, the size of which is limited, excessive equipments begin to be revealed, operational rate to fall and productive capacity to lie idle. We came to know these facts in some factories we visited; for instance, in a certain large factory the degree of operation was only 40% chiefly due to the stagnant demand which had already reached its upper limit. Here, a relative shortage of demand is a question. In the absence of the growth of demand over a certain definite amount there is naturally an absence of the backgrounds which promote the introduction of such efficient productive methods based on the co-ordination and integration of enterprises as mass production system and re-organization of the processes of operation. In case such relative shortage of demand is prevalent the enterprises which have come to the deadlock of domestic demand may have

recourse to some measures to break through. On the other hand, however, if there are any novelties which can secure still a sellers market, they will advance into this new field of production, leaving the existing line as it is. This accounts for such facts, which we indicated in the preceding chapter, as the competition between and concurrence of large scale enterprises and small scale ones, advance of the former into the field of the latter and, furthermore, the existence in the former itself of a productive system which presents an appearance of gathered latter. In the following chapter we shall propose some countermeasures against such absence of co-ordination and integration which is being preserved by the retarded growth of demand. Our proposals, which will be stated in detail in the following chapter, are, on the contrary, based on the political introduction of co-ordination and integration to overcome the difficulty.

First of all we can indicate the fact that the manufacturers of final commodities are unable to order necessary parts or raw materials which need treatment from outside enterprises because of the absence of productive fields, resulting from the immature development of the national economy as a whole, where enterprises can supplement their deficiencies each other; that even in the case of existence of such industrial fields their low level of technology is hopeless. At a stage where actual production is conducted not by drawings and standard gauges but by experience and a kind of sixth sense it is impossible to assemble a number of parts made in large quantities by specialized manufacturers into final commodities, which need co-ordination and integration between various enterprises. Thus enterprises will have to produce necessary parts by themselves to fit the final commodities. Through our interview with a number

of managers of factories we came to know that ordering from outside enterprises was impossible from a technological point of view and also extremely unsteady regarding the appointed date of delivery. However, such a question of the date of delivery is, broadly speaking, also a question of technology. A technological question of this kind is, after all, related to a question of economy that ordering what one needs from other specialized makers will result in a higher amount of expenses than that of one's own manufacture; it may be reduced to a question of cost. So far as such question of cost is concerned, it is quite conceivable how the makers of final commodities are obliged to conduct vertical work by taking charge of all processes of manufacture.

Secondly we can point out a fact, which is closely related to the above-said technological conditions, that the spirit and rule of mutual cooperation and co-ordination have not developed yet among manufacturers who are disposed to detest to let a portion of their own production depend upon the supply of the others. As a matter fact such mutual distrust of the manufacturers may have originated from their discontent with the technology and date of delivery of the others, but as time went by it has come to form a separate and independent mental basis which is a fundamental factor detrimental to the establishment of co-ordination and integration.

Such technical, economic and mental factors as above-said are the situation on the part of supply which makes it enevitable for the manufacturers of final commodities to comprise all processes of the production within their own frameworks once they start the manufacture. In order to overcome such adverse factors we have prepared such measures, which will be stated in the following chapters, as

the unification of industrial standards, improvement of level of technology by the training of the workmen, cultivation of mental soil favourable to co-ordination and integration through the formation of trade associations.

4. Measures to promote co-ordination and integration between large scale enterprises and small ones.

(1) Direct measures to promote co-ordination and integration.

The metallic engineering industry of this country seems to be suffering disadvantages above-said due to the lack of co-ordination and integration, and great efforts must be made to overcome them. We propose the following direct measures which are five in number to be taken up immediately either by the Government or by the W. P. I. D. C.

(a) Promotion of social division of work and selection on priority basis of specialized lines of industry.

As there is only a small number of large scale enterprises in the industry at the present moment such as Wah Industries, T. I. P., Karachi Shipyard, Batala Engineering Co., etc., the room for the realization of social division of work based on sub-contract between large scale enterprises and small scale ones is fairly limited and a rapid expansion of such room can not be hoped for, too. Therefore, it is advisable for the time being to lay stress on the specialization of various lines of the industry by means of promoting a horizontal division of work between them. As such horizontal division of work matures, an enterprise system will be gradually arranged to enable the establishment of a vertical division of work such as subcontract relationship between large and small enterprises.

In order to expedite the social division of work between various lines it is advantageous for the present to attach importance to the specialization of the lines which comprise the following processes in common as well as to the manufacture of

the following parts common to the lines.

1) iron casting 2) nonferrous casting 3) Forging

4) Electroplating 5) Sheet metal working

6) Precision rivets and screws

7) Cold forged rivets and screws

8) Hot processed rivets and screws

9) Metal machining

Another important question in connection with the co-ordination is the adjustment of the fields between large and small industries. As we have already pointed out, large enterprises are intervening in the field which should originally belong to the small ones and competing with the latter in the same line; this is one of the marked characteristics of the relations between the two in this country. Such tendency, which, we believe, will gradually disappear as the national economy develops, must be mended by the proper guidance of the Government which will bring about a more efficient development.

The field of activity originally fitted for large industries consists in such ones as the line which needs a large amount of investment (for instance, iron and steel, heavy machinery and heavy electric machinery), the line which needs high level of technology (heavy machinery, heavy electric machinery, electronics, etc.), the line in which mass production is advantageous (automobiles, household electric instruments), etc.; and such ones ought to be assigned to small industries as the line of assembly which does not need a large amount of investment (for instance, bicycles), simple processing of parts (small parts of sewing machines, etc.), make to order of machines in

small quantity, etc. Government control of the lines of industry had better be avoided because it might lead to evils. However, good results can be expected if the advice of the Government, followed by proper measures concerning the allocation of foreign currency, is given to newly established enterprises.

(b) Construction of model plants by W.P.I.D.C.

In order to promote the social division of work we stated in the preceding paragraph we recommend the construction of private model plants either by the direct management of the W.P.. I.D.C. or by the aid of the Government. Our proposal is that the W.P.I.D.C. will build model plants as its own projects to take charge of the parts and processing of materials common to various lines of the industry; this will be done in accordance with the principle of social division of work and the plant will be made to play the role of a core to promote the standardization and the division as well as the co-operation of work between large and small enterprises. Various lines of metal engineering industry essentially comprises some parts and processings in common. It may be possible for the W.P.I.D.C. to institute industrial standards of its own (in case there are already national standards, these are of course to be applied) and construct such model plants as will conduct production in accordance with such standards. If there happen to be private plants which specialize in the line, the W.P.I.D.C. can give the standards and concentrated aid to them. If the products of such plants are in conformity with the standards and their prices are also reasonable,

each manufacturer will come to specialize in its own line, discarding the production by themselves of parts common to other manufacturers.

Such are our proposals which contain three important items:

(i) Specialist plants shall be established of common parts and common processes.

(ii) Products of these plants shall be made in conformity with the standards so that they may give a sense of security to all those who make use of them.

(iii) From the first the parts shall be offered and orders of processing shall be accepted at low prices.

Of the above three items the importance of specialization (or division of work) will be stated in the following chapter and, here, the reason for the sale at low prices alone will be explained.

As we have already pointed out, one of the causes of the tardy development of the co-ordination and integration between large and small enterprises is the general shortage of demand, which is retarding the social division and specialization of work and vice versa, attended by high price of products. That is, there is recurring in the Pakistan economy a vicious circle:

Insufficient demand → absence of division and specialization → high price of products → insufficient demand, and this circle must be cut off at some point or other.

Let us now consider the ways and means of letting the model plants of W.P.I.D.C. have the important function of finding as occasion of breaking the circle.

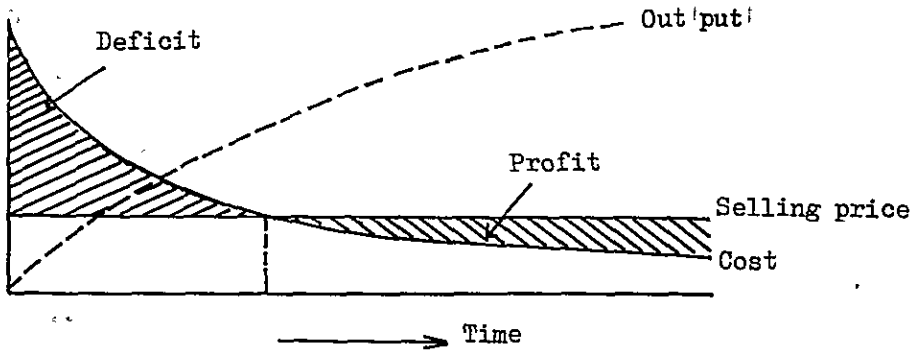
If the sale price offered by W.P.I.D.C. of the products

made by its model plants is reasonable, independent of the cost, - if this price is less than the cost of the other private enterprises' own make, private enterprises in general will, we believe, be led to depend upon the model plants for the supply of the common parts they need, discarding the manufacture of such parts by themselves. In case W.P.I.D.C. aids the manufacturers of such common parts and enterprises engaged in such common processing work it will be able to function as an intermediary organ of purchasing this products. That means, it will be able to promote the specialization of the manufacture of common parts and common processing work by means of guaranteeing a certain definite amount of demand to private enterprises on the one hand, and, on the other, to break through the wall of the vertical production system by means of supplying to them such products at reasonable prices as they have purchased.

At its initial stage in each case W.P.I.D.C. will have to make sacrifices equivalent to the difference of its sale price and its cost of production or its purchasing price. However, if appreciation is once established regarding the standard, quality and price of the products of the model plants, private enterprises will convert their own production of the common parts, which is now being conducted in their vertical work system, to that of the model plants of W.P.I.D.C., whose cost can be expected to be curtailed by such rapidly increased demand.

Thus the sacrifices of the model plants will be rapidly reduced and, in the course of a few years, past sacrifices will

be also made up for by the advantage of mass production.



Furthermore, the social division of work thus created will obviously help to curtail the cost of final commodities as a whole, which will make it possible to expect the price effect of enlarging the demand, resulting in the more increased demand for the common parts and common processing work; this will of course be favourable to the payability of W.P.I.D.C. C.

Now the lines of production favourable to the model plants, which are expected to function as the pioneers, are naturally the nine selected ones we referred to above which will take charge of the manufacture of the parts and processing work common to various branches of metal engineering industry. Although some specialists are already found in these lines, in view of the comparatively large demand, enough room for specialization and comparatively small amount of investment needed they will constitute a proper field of activity of W.P.I.D.C. in paving the way for the promotion of social division of work.

In Part C of this report such standards will be indicated as

the necessary amount of production, scale of equipments and amount of labour for the construction of specialized-model plants of these lines, and Chapter V will comprise some proposals concerning the small industries estates centering around these model plants. We hope that W.P.I.D.C. will make more detailed plans on the basis of our proposals and start their realization.

(c) Positive increase of Public Sector's orders from specialized plants.

As is obvious from the above examination, the absolute amount of demand exercises great influence on the promotion of co-operation between large scale enterprises and small scale ones on the basis of co-ordination and integration.

As a matter of fact, however, cost reduction of products by means of promoted division and specialization of work is possible according to the intention of the users even when the absolute amount of demand remains invariable. That is, in case of the users' purchase of manufactured machines or parts for mending use, instead of ordering them from all-round makers like a department store, if priority is given to such makers as specialized in and concentrated on some specific machines and parts, manufacturers themselves will, of necessity, be specialized and rationalization by means of division of work will accordingly be promoted.

Fortunately the great majority of orders given to the metal engineering industry come from the Public Sector, and, if the Government intends, a fair measure of specialization and division of work will be made possible by the move on the part of

the users.

(d) Unification of industrial standards and popularization of standardization.

As one of the measures to promote the social division of work improvement of the level of technology on the part of suppliers is of great importance, since the largest cause of distrust on the part of large scale enterprises concerning small scale ones lies in the low level of technology on the part of the latter.

The measure involves a number of aspects such as the renewal of equipments, re-training of skilled workers, etc., which belong to the general measures of technological improvement and will be stated in other chapters; here, we treat of the unification of industrial standards and popularization of standardization which are closely related to the co-ordination and co-operation between large and small industries or those questions concerning the division and specialization of work, subcontract, etc.

It is scarcely necessary to state in detail that the unification of standards of the products, parts and materials have highly valuable effects on the division of work and mutual supplement between large scale enterprises and small scale ones in metal engineering industry. Here is an example of a brilliant success in such standardization of Japan's sewing machine industry. The industry is now yearly producing 3,350,000 sets (for household use only), of a scale large enough to supply 45% of the world's total demand and trusted by customers all over the world because of the superior quality and low price

of its make. However, before the World War II it was in difficulties due to foreign competition resulting from its low quality and high cost.

It was the unification of the standards and thorough promotion of division of work carried out in 1949 - 50 that overcame the difficulties and brought about the present prosperity.

Up to that time most of the sewing machine makers in Japan were producing nearly all necessary parts in their own mills except only a few items such as shuttle laces, shuttle bodies, etc. purchased from outside parts makers; the products of parts specialists were also made according to different specifications of different orderers. Such being the case there was no interchangeability of the parts between the finished machines of different manufacturers; there was naturally no advantage of division of work, either.

In order to reform such state of things all makers of sewing machines decided in 1947 to combine their efforts to institute common standards and perfected standard drawings in 1949, which have enabled each maker to use with a feeling of security those parts manufactured by the other makers.

As a result it was made possible for the small enterprises to specialize in the production of such parts as fitted to their own scale and equipments, and for the large enterprises to specialize in the finishing work and assembly of arms and beds which are advantageous to them by means of purchasing almost all parts from the former at lower prices than the cost of their own production.

Thus the division of work was rapidly promoted between large

and small makers and between the latter themselves together with a sharp increase in the amount of production of each item per maker, resulting in a sharp reduction of production cost and a rapid increase in new demand due to curtailed selling price. Such circumstances are clearly shown in Fig. 2 and Table 12.

Fig. 2. Production & Export of Sewing Machines in Japan (domestic use only)

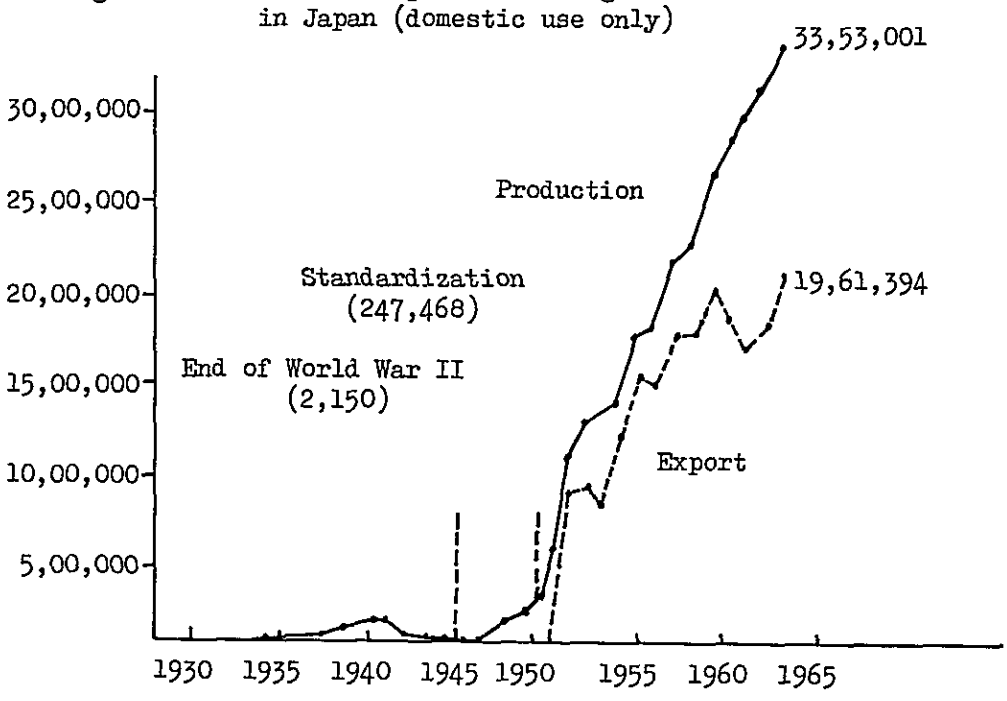


Table 12 Comparison between Prewar Sewing Machine Industry and Present One in Japan

	Prewar (1941)	Present (1963)
Production	1,42,317	33,53,001
Number of Manufacturer	500	327
Assembler	-	67
Parts manufacturer	140	260
Parts manufacturing assembler	360	-
Average number of Parts manufactured by each parts manufacturer	parts 60 - 70	parts 3 (1 - 5 parts)
Number of Manufacturers producing same kind of parts	300 - 500 (Include self manufacturing)	2 - 40

The unification of the standards has enabled the smallest assembler to complete, by means of purchasing a number of different parts from a number of different parts makers, finished sewing machines which are exactly similar to or sometimes better in quality than those manufactured by large makers in their vertical work system.

Furthermore, from the general consumers' point of view besides the price reduction of the machines due to the unification it has become possible for them to purchase free from anxiety about the quality guaranteed by the JIS (Japanese Industrial Standards) marks and to change the parts much more conveniently.

We have seen above how useful measures the unification and standardization of standards are for the development of engineering industry, but as a matter fact we cannot help pointing our that their institution is making a tardy progress in Pakistan. We appreciate of course the earnest efforts of the Pakistan Standards Tnsitution for their realization during the short period of time after the independence, but we believe that increased efforts are necessary in future in view of their importance in industry. The existing standards of engineering industry are only a few, that is, those of screw threads, induction motors, electric iron, A. C. fan, etc.; the Pakistan Standards Institution will have to attach importance to those related to machinery.

In the case of their institution special attention must be paid to the relationship with those of the advanced industrial countries as well as international ones. Nowadays machinery is

being interchanged between principal countries of the world, its coloring as international merchandise deepened and at the sametime demand for unified international standards increased. There are two recognized systems of standards now in use in the world: the Yard and Pound System which is employed in the United States of America, the United Kingdom and some other countries: the Metric System employed by France, Germany, Japan and the majority of the countries in the world. Although the existing international standards are made up of the above two systems written side by side, we believe that they will be unified to be one based on the Metric System whose decimal numeration being a more rational way of measurement. The number of the countries which adopt the Metric System are: compulsory use-72 including Germany, France, Italy, Holland, Switzerland, U.S.S.R.,Czechoslovakia, Japan, etc.: optional use-18 including the United States, United Kingdom, etc. Only seven countries such as Nepal, Ceylon, Laos, etc. do not adopt the system. The United Kingdom where the use of this system is optional is reported to be finding it very hard to convert its industrial standards based on the Yard and Pound into those of the Metric System. Accordingly, it is advisable in the future institution of the Pakistan standards to make reference to the international ones - if there are any - and in the absence of such ones, those of the advanced industrial countries which adopt the Metric System.

The role which W.P.I.D.C. has to play in connection with the unification of standards and promotion of standardization is, as one of the largest comsumers, to extend positive

cooperation to the realization of standards by P. S. I. and to fully value the Pakistan standards in its purchase of materials. In the absence of such standards it makes up, as a provisional measure, its own standards, in accordance with which it conducts strict inspection of goods delivered to it. By so doing, we, believe, it will be able to contribute a great deal to the introduction of the concepts of standards and improvement of the quality of commodities.

(e) Consideration of the conditions of location.

Another important factor which cannot be neglected is the consideration of the condition of location for the purpose of promoting the social division and cooperation of work.

The present policy concerning the conditions of location of industry attaches importance, we believe, to the correction of the disparity between East and West Pakistan and to the betterment by means of local development of the standard of living of the inhabitants in the remote country. The latter policy will not be applicable as it is to the metal and engineering industry. This industry, as we have repeatedly indicated, depending to a great extent on the co-ordination and integration among its various lines, the dispersal of which into a number of districts will be a great loss to the national economy. For instance, a good foundry of Peshawar and a specialist parts maker of Quetta could not be made use of as cooperative factories of a machine assembler of Karachi and accordingly cooperation relationship among the three could not be realized with facility owing to the inconvenient transport of intermediary products and other connection.

That means that the promotion of division and cooperation of work, which is indispensable to the development of metallic engineering industry, necessitates the concentration of its various lines in districts, the number of which should be as small as possible. This principle is cleary proved by the fact that in such advanced industrial countries as Japan, Germany, the United Kingdom, etc. almost all of the production of metallic engineering industry are being conducted in a few limited number (3 - 4) of concentrated industrial districts. Therefore, we are inclined to emphasize that at the existing stage of this industry in West Pakistan the two great industrial zones of Lahore with its satellite towns and Karachi district are necessary and sufficient for this purpose and that the dispersal of industries into districts in pursuance of the local development policy should be carried out regarding such industries as will gain little by concentration and accumulation or closely connected with the districts in view of materials or market.

(2) Problems concerning small industries in connection with co-ordination and integration and their countermeasures.

In the preceding chapter we made some proposals concerning the promotion of integration between large scale enterprises and small ones. But the latter enterprises comprise many other problems of more general character which cannot be solved by means of the above-said direct measures alone. To solve such general problems for the purpose of improving on small scale enterprises may mean wandering from our theme, but in view of their importance as the basis of establishing the integration between large and small enterprises

we shall state their points of issue together with their counter-measures in connection with their capital, labour, technology and the organization of the trade.

(a) Capital.- consideration of improving on allocation of foreign exchange and introduction of foreign investment.

As regards the formation of capital it is necessary to distinguish savings which mean the supply of capital from inducement to investment which means the demand for it. So far as domestic funds in Pakistan of to-day are concerned, they are not so stringent, as their supply is fairly well secured in the form of one's own funds and bank loans. Inducement to investment is not so scarce, as the domestic market is maintained for the domestic enterprises to a considerable extent by virtue of the protective measures of the Government. Thus both demand and supply of capital involving no knotty problems, its formation ought to proceed with facility. As a matter of fact, however, investment in small industries is not going on smoothly. This is due to the inconvenience of importing machinery and equipments accompanied with nearly all cases of investment in Pakistan. Regarding the allocation of foreign exchange practical discrimination seems to exist especially against small industries as compared with large ones which, we think, is hampering new investment in small industries, renewal of their equipment, expansion of their scale of production, etc. Although the Government does not of course discriminate but is rather giving special consideration to the small industries, they are handicapped, in the actual stage of investigation by financial establishments, by their insufficient ability of

repayment, guaranty, technology, etc. as compared with those of large industries, as a result of which the allocation of foreign exchange is maldistributed to large industries, leaving little or no share to the small ones.

If the Government hopes for a balanced development of large and small industries instead of expecting solely of the large ones to be responsible for the development of industry, such unbalanced investment, must be corrected as soon as possible.

The measures of correction will be such as the enlargement of special allocation frame to, simplification of procedures for and enlarged guarantee by Government organs of loans of small industries, etc.; some of these are being carried out to a certain extent by W.P.I.D.C., which is expected to act on a larger scale in future.

However, the fundamental question concerning foreign exchange does not consist in its distribution, but in how to secure it when necessary for investment and how to increase its absolute amount to make use of. Thus the most important measure lies in the promotion of export and introduction of foreign investment. In this connection Japan's law concerning foreign investment, which was enacted with success after the World War II, may be suggestive; the law guarantees, for the purpose of positive introduction of excellent foreign investment, the overseas remittance of the profit and the withdrawal of the principal of foreign investment. In spite of the Pakistan Government's preferential treatment of foreign investment it does not seem to be going on satisfactorily in the country, the largest cause of which is obviously the lack of sense of security on the part of

the investors about the safety of their investment. If the Government guarantees by means of establishing a law the overseas remittance of the profit of investment and the withdrawal of the principal invested in foreign currency.

(b) Labour, - improvement of its quality.

Labour is abundant in quantity but very inferior in quality. The quality of labour consists of such elements as technical ability, efficiency and a will to work, all of which involves problems in this country. Firstly from the viewpoint of technical ability such fundamental training of engineering industry as the reading of mechanical drawings is rarely given and workmen are acquiring technology by following another's example. Accordingly it is almost impossible even for skilled workmen to conduct machining work of machine elements according to drawings or make up machines of high precision by paying sufficient attention to quality control. If such matter is left alone, it will be practically impossible to establish a modern engineering industry in which the division of work, statistical quality control are the order of the day. Therefore, it is extremely important to lay great stress on the training of skilled workers which is now being carried out by P.I.T.A. or W.P.I.D.C.

We propose the strengthening of the training system of skilled workers by making reference to that of Japan which we introduce in Part C.

Secondly, let us examine the efficiency of labour. The labour productivity (value added by manufacture per worker) of Pakistan is approximately one - third of that of Japan, which offsets the merit of the extremely low wages per head (approximately 1/2.5 of

those of Japan), making it handicapped by the amount of other unfavourable conditions (high costs of materials and capital) and leading to unfavourable competition with foreign countries.

Table 13. Comparison of productivity between Japan and Pakistan

Pakistan 1959-60 Census of manufacturing industries

Japan 1960 Census of manufactures

Industries	Countries	A Employment	B Wage (Million Rupees)	C Value added by manufacture (Million Rupees)	C/A Productivity (Rupees)	B/A Wage per head (Rupees)
1. Manufacture of Metal Products	Pakistan	21,543	26.1	60.1	2,800	1,210
	Japan	431,208	1,200	2,970	6,900	2,780
2. Machinery except Electrical	Pakistan	10,871	11.7	32.5	3,000	1,080
	Japan	726,748	2,565	6,570	9,030	3,530
3. Electrical Machinery	Pakistan	7,260	11.2	28.6	3,940	1,540
	Japan	664,198	1,972	6,580	9,930	2,970
4. Transport Equipment	Pakistan	14,667	23.5	45.5	3,100	1,600
	Japan	498,137	2,025	5,865	11,800	4,040
Total of Engineering Industries	Pakistan	54,341	72.5	166.6	3,070	1,330
	Japan	2,320,291	7,762	21,985	9,470	3,340
Ratio of Pak / Jap		1/43	1/107	1/132	1/3	1/2.5

Such low productivity of labour is partly due to the retarded modernization of the old-type equipment, but principally due to the inefficiency itself of the labour. Even in some of the fairly modernized factories we visited we felt that the number of workmen per machine was greater than that of Japan.

One measure to improve on such low efficiency is training and another is the strengthening of supervision, by which several of the joint enterprises (shared by foreign investment) is attaining success. Another effective measure is to stimulate the will-to-do of workmen. It seems to be a long-established custom in Pakistan that a labourer is a labourer all his life and the son of a bearer is destined to be a bearer. So long as such deep-rooted customs continue to exist the growth of a progressive spirit to raise one's status by exertion cannot be hoped for. Therefore, it requires that the managers of industry will establish a system of opening up avenues of promotion according to ability and of paying wages according to efficiency. It is also very important to realize the stabilization of employment, as the turnover of workmen will diminish the effects not only of the stimulation of will-to-do but of the improvement on the quality by means of training. When considering this matter 'Japan's wage system for stabilization of employment', which is stated in Part C, will be of suggestion.

(c) Raw materials.- consideration of commercial base.

As in the case of machinery the supply of raw materials which Pakistan needs depends, for the most part, on import. Firstly the country has to purchase the raw materials at extremely high prices which affect a great deal the prices of various final

products. The quantity of such materials is also insufficient, which makes low the operational rate of industry. In order to make up for the insufficiency some enterprises are purchasing, by means of the Bonus Voucher system, raw materials at very high prices which lead naturally to the high prices of final products. The fundamental solution of such insufficiency problem naturally requires the increased supply of foreign exchange which results in the increased import of raw materials. However, there is a question to be considered between the import of equipments and that of raw materials; that is, which one of the following two should have priority over the other:- the measure to raise the operational rate of the existing equipments by means of supplying it with sufficient amount of materials: the measure to establish new industries by means of importing new machinery and equipments. While inspecting the metallic engineering industry of West Pakistan we noticed one or two factories, in spite of their large capacity, whose degree of operation was only as much as 50%; on the other hand, factories of similar lines are going to be built in the third five-year plan. It is clear that the reason for such low operational rate in large factories lies not in the material but in the demand for their products. Incidentally, the degree of operation of not a few small factories has to remain low owing to the shortage of materials. The relationship is tabulated in Table 14, which makes it clear that the new establishment of large scale enterprises of a size similar to the existing ones will have to suffer a low operational rate for sometime due to insufficient demand. Therefore, it will be quite effective to raise the efficiency of the national economy

as a whole to spare the foreign exchange in connection with programming the Heavy Engineering Projects now being planned by W.P.I.D.C. by making use of the existing equipments of Karachi Shipyard and other large private enterprises in order to appropriate the foreign exchange thus spared for the increased allocation to small industries.

Table 14. Relation between demand for metallic engineering industry and allocation of foreign exchange

	Demand in comparison with capacity	Allocation of foreign exchange		Operation rate
		Equipments	Raw material	
Project of new large industry	?	Sufficient		?
Existing large industry	Insufficient	Sufficient	Sufficient	Low
Existing small industry	Sufficient	Insufficient	Insufficient	Average

Furthermore, as to the purchase price of raw materials, in view of the fact that 60 - 70% of the cost of heavy machinery consists of the cost of raw materials efforts should be made to purchase them at international prices which are comparatively low.

(d) Technology and mechanical equipments - preferential treatment of introduction of foreign technology and renewal of mechanical equipments.

The technological problems of this country may be divided into the technology of designing, that of production and productive equipments. First of all the existing designing technology of the metallic engineering industry is scarcely possible to design new type of products by its own efforts and the development of new products has to depend for some time on the introduction of foreign technology, the preferential treatment of which must be

considered. Generally speaking, there is a tendency in underdeveloped countries of grudging compensation for such intangible properties as technical know-how, patents, designing, consulting service, etc. However, these are the accumulations of years' efforts and enormous amounts of investment, and, unless they are duly appreciated, advanced nations will be unwilling to offer really useful technology. Although Japan is now a member of the group of industrialized nations, it introduced a number of various kinds of technique during the period of its rehabilitation after the World War II, yearly paying royalty amounting to no less than one hundred million U.S. Dollars, as a result of which Japan's industrial technique has made great strides, its export bringing back to-day foreign currency several times as much as it paid for royalty. We believe that this fact may make a useful suggestion to Pakistan in its future establishment of the policy of treating foreign technology.

Secondly, regarding the technology of production and productive equipments the metallic engineering industry is employing a primitive technique of production as well as extremely old-type and obsolete equipments. In most of the factories, with some exceptions of course, the main part of their equipments consist of old machinery past its durable years, its deteriorated capacity being covered by the skill of workmen. So long as such obsolete machinery is in use, the manufacture of machines of precision and superior quality is impossible. Therefore, measures must be taken to introduce new and efficient equipments, scrapping down the old ones. However, in the execution of such equipment renewal the import of foreign make is not always necessary, as great effects

can be expected by mere replacement with such machine tools as can be made in Pakistan now. This will prove a very effective step as it serves to enlarge the demand for machine tool industry. The ways and means of stimulating the proprietors of small machine mills for the renewal of their equipments may be such as granting of subsidies, exemption from taxation, preferential allocation of materials, financing of funds, etc. Japan has experienced a great success in a case of this kind by enacting the 'law of provisional measures for promotion of machine industry' which stipulated for the reduction of tax and preferential loan of funds to those proprietors of small industries who wished to renew their equipments. The productive technology which, combined with the use of old-type machinery, still remains primitive must be quickly improved, keeping pace with the introduction of up-to-date equipments. Special urgency is needed of the establishment of the customs of manufacture according to drawings and inspection by guages, to which we have repeatedly referred. Private enterprises and W.P.I.D.C. as well as the Government must make efforts to the realization by every conceivable means.

(e) Organization of the trade. - promotion of organization of trade association and its use.

We are not going to make detailed explanations here. The absence of cooperation and harmonization of the trade is disadvantageous to the development of division and specialization of work. As the organization of trade associations is rarely found in this country we point out the necessity of encouraging such organization, investing them with fair measure of authority, bringing up and

strengthening their leadership, making them to improve on the cooperation and harmonization of the trade and letting them co-operate with the realization of various measures to promote small industries.

We have indicated above, in connection with the direct counter-measures, general problems confronting the small industries of this country together with the direction of efforts to be made. In conclusion we emphasize again that the solution of these problems, by way of strengthening the economic basis of the small industries, will lead to the formation of integration between large and small enterprises, which constitutes the theme of our investigation.

5. Problems of Small Industries Estate and Countermeasures

A. Role to be played by Small Industries Estate for promotion of co-ordination among small industries.

o The reason for taking up the Small Industries Estate as one of our themes of this report is that it constitutes a powerful measure to modernize the small industries and enables a more efficient execution of our proposals stated in the preceding chapters. It is of course possible to put these proposals into practice independently and separately, but when carried out in combination with the Small Industries Estate, greater results can be expected.

o The concept of the Small Industries Estate as used in this report involves not only the Industrial Estate of small industries as its components but also an idea combined with it of cooperation among the components.

o The term "Industrial Estate" has different meanings according to the countries where it is constructed and to the kind of its sponcers which may be either public or private. Generally speaking, it does not usually limit either the line or scale of the industry comprised in it to any specified one. However, the scale of industry to be located in the Estate is naturally limited, as its capacity is not large enough to accomodate such super-big factories as can themselves be units of location of the Estate.

o One of the characteristics of the Industrial Estate consits in its advantage of concentration. That means, such common facilities as electric power-lines and lamp-wires, waterworks, roads, sewers, etc. may be acquired more efficiently by dint of concentrated location which diminishes the initial cost of enterprises and, at the same

enables the efficient investment on the part of the suppliers-principally the Public Sector-of such common facilities.

Another characteristic is its planned construction. That is, a reasonable Estate plan gurantees not only the proper arrangement of roads, factories, etc. but also the just location of factories from the viewpoint of town planning.

- The Industrial Estate characterized by such features is one of the mighty measures to be taken by the Government in its execution of the policies of proper arrangement of industries, materialization of town planning, development of under-developed districts.

  Measures mightier than this are limited to the direct control by the Government, administration of business licenses, allocation of foreign exchange, etc. and establishment of state policy companies, etc.

- The Small Industries Estate aims, in addition to the aims of the Industrial Estate, at the fundamental improvement on the constitution of the small industries by making use of their accumulation on the basis of their efficient cooperation.

- The "cooperative work" of small industries means, in a word, the realization of the so-called advantage of scale by means of their organization, in every aspect of business such as purchase, production, sale, etc.

  Cooperation in purchase and sale is generally carried out in the shape of common purchase of raw materials and common sale of products respectively, but that in production is divided into two types.

  One is to place a certain portion of several productive processes

under the common performance of the members of the organization; the common process is capable of amply effecting mass production and mass treatment, for instance, the processes of seasoning, painting, etc. of wood in the case of wooden furniture and those of winding, warping, sizing, printing, etc. in the case of textile weaving. Another is the division of work. For instance, in the case of light engineering industry which has a number of processes to perform such common processes as stated above are seldom found. In a case of this kind cooperative work is conducted in the shape of division of work by means of which each member comes to realize mass production while concentrating, specializing and supplementing each other in each field of production. Such division of work is conducted at various stages of production beginning with the concentration and specialization of processes common to a considerable number, though not all, of the enterprises in such simple ones as casting, metal plating, painting, heat treatment, etc. to such high stages as concentrated production of common parts, blanket acceptance of correlated parts, allotment of production to members. The concept of division of work does not always involve the production by each member of all kinds of parts by the assembly of which finished products are manufactured, since the parts being consisted of a large number of different kinds, some of their manufacturers cannot attain the best scale of production which is possible in other factories with a higher degree of specialization.

o The Small Industries Estate which needs such cooperative work as its factor can be established only when a certain extent of industrialization has been accomplished; at an early stage of industrialization, on the contrary, when there are few enterprises of the

same line an ordinary kind of Small Industries Estate which sets no limit to the line of industry is possible. This means an Industrial Estate.

- o Generally speaking, promotion of cooperative work among small industries is possible to be executed independent of the Small Industries Estate; that is, the Industrial Estate is nothing but a more effective measure of carrying out the cooperation. However, in the case of metallic engineering industry the division and specialization of work means the change of productive technology which often necessitates the renewal of factory buildings, enlargement of factory sites, not to mention the renewal of equipments; all of these, as a matter of fact, make it indispensable to construct a S.I.E. In other words, this industry is essentially fitted to S.I.E. as is clear from the instances of Japan whose S.I.E. consists mostly of metallic engineering industries.

B. Existing state of things about S. I. E. in West Pakistan and its problems.

- o We have inspected six of the nine S.I.E. in West Pakistan now under construction; they are: Lahore, Sialkot, Gujrat, Gujranwala, Peshawar and Quetta. We found the following facts common to all.
  - i) We can expect that the function of these S.I.E. are sufficient as to the promotion of cooperative work which we stated in 'A' (the Lahore programme may be an exception, but there are some problems in the scale of production.)
  - ii) The promotion of cooperation among small industries is executed not by the industries themselves but by W.P.I.D.C.
  - iii) The construction of factories is being greatly delayed owing to

the insufficient foreign exchange for the import of machinery.

o Our opinions on these facts are as follows:-

i) At an early stage of industrialization, that is, when there is no accumulation of the trade the realization itself of cooperative work is difficult. At this stage, however, the function alone as an industrial estate is significant enough, for it is useful as the measure for small industries and developing the under-developed districts.

ii) It is quite significant at this stage of immature organization of the trade that W.P.I.D.C. is playing the role of a driving force in paving the way for realizing the organization. However, the role must be strictly limited to the transition period, that is, it can continue until the enterprises are fairly under way, as cooperation is originally to be realized by the organization consisting of small industries concerned.
In some districts where the accumulation of small industries belonging to the same line already exists connection is being sought for with the promotion of cooperative work by S.I.E. and W.P.I.D.C. Unless a great deal of efforts are made for the organization of industries within the estate there will not appear in future organizations competent enough to succeed this function of W.P.I.D.C.'s.

iii) Measures to secure the absolute amount of foreign exchange must of course be taken, but at least such measures may be worth studying for the efficient use of foreign exchange which is limited in amount as the simplifying the investigation procedures when making a loan of funds and shortening the investigation period, which will be made possible by raising the

compensation sum of W.P.I.D.C. to full amount of the financed funds (at present 7.5%) and instead making the bank investigation only formal.

iv) In conclusion those S.I.E. based on the second five-year plan are functioning satisfactorily as general measures for the small industries and developing the under-developed districts; this is enough for the stages corresponding to the plan. But at the stage of the third five-year plan S.I.E. plans aiming at high-pitched cooperation will have to be taken up.

o These are the problems common to all estates. Besides, we are going to state some problems peculiar to each estate, which may be a little wandering from the original object of this report but will have the meaning of concretely elaborating the problems above and of substantially clarifying the S.I.E. problems.

i) Sialkot S.I.E.

This district is the place of production of sporting goods, surgical instruments, musical instruments and cutlery, and a number of small industries belonging to these lines are found here; in this sense this is a proper district to construct a S.I.E. At present these lines depend on the manual work based on tradition of skilled craftsmen and most of the products are being exported.

In the case of mechanizing the production the S.I.E. will be able to contribute a great deal to its promotion and its facilities will have a great appeal to the industries. On the other hand, in the absence of cost reduction in spite of cooperation construction of new factories within the S.I.E. will not be

paying in general unless mechanized mass production is conducted. However, there appears no move for mechanization of these industries at the present moment; their strong point consisting in the accumulation of traditional manual work; shift to mechanized production might mean giving up this advantage of their own accord. Therefore, we cannot easily conclude that they should be mechanized.

Accordingly this estate may appeal to those enterprises which construct new factories in it for the purpose of manufacturing new kind of products, increasing the present ones or openining new business, but can hardly attract to it the existing industries which will have to close the present factories in operation.

What we have stated above exactly applies also to the traditional industries of Japan. In Japan, too, there are several places of special products having years' tradition, where S.I.E. on the basis of such specialty industries have seldom been built except some rare cases. (note) This may be attributed to the difficulty of coexistence of tradition with mechanized mass production. Besides, in the case of Japan the founders of the estate are the industries themselves which want to get grouped, and, accordingly, no estate will be constructed unless there is a move for their getting grouped.

Note:- Changes of productive technique took place which brought about mechanized mass production as in the case of lacquer wares when an entirely new technique was introduced, according to which the plastic ground was coated with synthetic lacquer instead of japanning the

conventional plain wood with natural one; when there is a number of processes of production in which effects of cooperative work are conspicuous as in the case of manufacturing wooden furniture: purchase of materials, sawing, seasoning, painting, common sale (especially sale as sets), etc.

We are not going to deny the meaning of constructing here a S.I.E. based on the traditional industries, because the most important matter for the S.I.E. in this district at the present stage is to promote the cooperation of technical guidance, and for this purpose S.I.E. will be a useful means. In this sense we highly appreciate the service centre in the S.I.E., but at the same time we think it necessary to organize the industries located in the S.I.E. For the realization of this organization, instead of the existing way of deciding to admit each individual industry to the S.I.E. after inspecting the each individual plan of the industry, such method may be advisable as organizing the industries beforehand and letting them locate in the S.I.E. as groups in order to realize cooperative work by making use of the common facilities. Such common facilities should be built and operated originally by the small industries themselves, but may be done so by W.P.I.D.C. In the latter case admission to the S.I.E. of the industries organized as groups beforehand will be the sole difference from the existing usage.

ii) Lahore

The S.I.E. plan comprising the sewing machine industry in this district is closely related to the problems of the Pakistan metallic engineering industry which we have already stated

in detail. To repeat our opinion briefly here, the makers of finished goods and those of parts have little connection with each other from a viewpoint of production. The former is manufacturing for themselves almost all kinds of parts which they assemble to make finished goods, because they cannot depend with a feeling of security on the latter whose equipments are obsolete, products inferior in quality falling short of standardization and appointment of the date of delivery is often broken. Such attitude on the part of the assemblers accounts for the tardy increase in the demand for the parts makers who in turn diminish the will of modernizing their equipments giving rise to a vicious circle.

In order to cut off such vicious circle, modernize the small industries and establish a system of division of work it is necessary to modernize their equipments, raise the level of their technology and, at the same time, take measures to secure the demand for their products or parts.

Such securing of the demand presupposes the establishment of standardization, and naturally vice versa. This is the fundamental measure, which, however, must be supported, at its initial stage, by some other ones capable of producing immediate effects for a transition period; that is, until the time comes when parts makers, whose products are more moderate in price and in conformity with the standards, can secure a certain amount of demand; otherwise, they may hesitate to invest in the modernization of their equipments, giving rise again to the vicious circle.

Therefore, it will be an excellent measure of securing the demand for the modernized parts makers located in the S.I.E. to establish assemblers there to produce finished goods by making

use of the parts manufactured by industries in the S.I.E. However, we must take note of the fact that this function of the assemblers is nothing but a motive power of modernizing the processing work industry of parts and comes to an end when the standardization has been established and new demand begins to come from users outside the S.I.E. That means, each parts maker should not be limited by the demand within the S.I.E. but conduct a mass production to meet the demand outside; accordingly, each industry should be planned to have enough room for the expected amount of increase in demand.

The assembler's task consists in securing the demand for the parts produced within S.I.E., that is, their consumption (total parts produced at first, but afterwards outside demand will gradually increase), but it does not follow that all kinds of parts needed by the assemblers should be manufactured within the S.I.E.; on the contrary, those produced within the S.I.E. should be limited rather to universal kinds or such kinds as their mass production is possible with effect.

After all, the measure taken by W.P.I.D.C. is very suggestive as it paves the way for securing demand which presupposes the promotion of division of work as well as modernization of equipments.

However, in the case of this S.I.E. the problem is that it will be bringing into existence another sewing machine industry aided by P.I.D.C. amid the trade where sharp competition is going on among a number of existing private enterprises. Therefore, it would be better here to limit the role of P.I.D.C. to the purchase and sale of the parts and let it make efforts to

cultivate new demand by means of a double price system (in this case assembly is conducted by existing private enterprises) than to establish another new assembler under the aid of P.I.D.C.

Incidentally this S.I.E. is called Japanese Type, but Japan, where division of work is highly developed, does not need assemblers within S.I.E. for the purpose of secring demand.

There are some instances of assembling in S.I.E. those parts produced also in the S.I.E.: (1) the assembler and parts maker moved into the S.I.E. at the same time: (2) when intermediary products are manufactured by means of common acceptance of order and common production which belong to a higher stage of cooperative work.

These cases are different in essence from those of Pakistan S.I.E. in Lahore.

Accordingly this S.I.E. should rather be called Pakistan Type, which is to be highly appreciated as a good idea of creating demand for the promotion of integration.

We add now for your information that in the S.I.E. of Japan there are many cases of small industries which, before their location in the S.I.E. had been the subordinate enterprises of certain specific ones (the so-called parent company), came, as a result of investment in modernized equipments, to increase their productivity well over the demand of the parent companies and to supply to other consumers. Even in this case the largest customer is of course the parent company, but the prospect that it will purchase the greater part - not all now - of the products manufactured by means of the mass production system to be

... adopted is encouraging the investment of the small industry. Thus, the parent company as well as the new customer, not to mention the small industry itself will gain much more than in the case of investment corresponding to the amount of demand of the parent company.

It may be said that the role and situation of the parent company quite resemble those of the assembler in Lahore S.I.E.

iii) Gujranwala

Firstly, as for the lines of industry the idea of locating, besides the light engineering and textile industries which are the principal ones in this district, all the other lines in the S.I.E. should be reconsidered; instead more stress should be laid on these two lines which are not only the leading industries in this district but also able to give full play to the function of the S.I.E. That means, the former needs the modernization of equipments and enlargement of factory scale which are the presuppositions of realizing mass production and division of work while the latter comprises a number of processes of production, the common performance of which produces satisfactory effect, and all of these requirements are made possible by the S.I.E.

Secondly, lacking in sufficient knowledge of the detailed plan our opinion is inevitably based on our impression.

Each industry seems to be intent on constructing too many factory buildings. Enterprises located in the S.I.E. has to reserve a thoroughly wide area of open space for its future expansion; otherwise, it will, in case of enlarged scale of production, have to look for other factory site again or return

to its former dangerous and inefficient state ignoring the layout. This is undesirable and the plan of each industry must be carefully checked at the time of its application. We believe that our suggestion may hold true in the case of other S.I.E., but, as regards this S.I.E., it will be especially useful.

Like other S.I.E. the raising of the funds of factory construction in Pakistan is practically beside the question so far as the domestic funds are concerned; therefore, the question is limited to those of foreign exchange. This is a great contrast to the situation in Japan where the greatest question is how to make a loan of the funds necessary for the construction of S.I.E. and how to reduce the cost of the loan, as 20 - 30% of such funds (including the price of land) are to be covered with one's own funds and the remainder is financed by making a loan (including a loan of interest free money from Prefecture). This is due to the difference of the economic situation between the two countries. It is indeed a good thing in itself that the raising of the domestic funds is beyond the question, but for this reason the investigation of their source seems to be rather neglected. The investigation, we believe, will have to be given a little more serious consideration, as the cost of products varies according to the interest of the funds which are either one's own or loaned money.

iv) Peshawar

Industrialization has been just commenced in this district which has no such industries of noteworthy importance as found in other districts. This is the reason why the problems here are different from those of other ones where a certain extent of the

accumulation of industry has been accomplished centering around several specific lines.

It means that there will probably be no dominant lines of industry in this S.I.E. just as it is so at present; that is, effective cooperation of work will not be expected here while the difficulty of technical guidance by Service Centre and the common use of the facilities is anticipated. As the number of the existing enterprises is small, those to be located in this S.I.E. will have to be newly established. As regards the lines of such industries which will develop and have to be developed are those connected with the charateristic of this district, which is an agricultural zone, consisting of agricultural machinery and implements and wood-working which is connected with the local resources, etc. However, it will be long before these lines grow up to be the leading industries of this district and, therefore, the main portion of its industrialization for sometime will be such lines as depending on the local market around Peshawar, making use of the local materials and handicraft.

From an ideal viewpoint this S.I.E. will be utilized for such specific lines of industry which will make in future the principal industries of this district; by so doing this S.I.E. will be able to have its dominant lines and to realize the cooperative work. In this case, however, it will take a considerable period of time before the S.I.E. can demostrate its function satisfactorily while keeping the investment of P.I.D.C. ineffective until then.

From another point of view this S.I.E. is now standing at a stage to promote the general manufacturing industry, that is,

a stage to develop the small industries in general without setting limits to their lines and to extend facilities to large industries as well. Accordingly, the most practical means of developing this S.I.E. consists in the effective construction of an Industrieal Estate regardless of the lines of its components and, we believe, this will also contribute at the same time to the development of the district. In this case, however, the character as S.I.E. will be lost, when there will be no need of setting limits to the scale of industry, that is, the location of large industries will be admitted.

Parallel to such practical construction efforts should be made to promote such lines as suitable to this district.

The approach will be done beginning with the foundation by means of experiments, researches and technical guidance, and at a certain stage of maturity, they may be industrialized in a S.I.E. to be newly constructed.

v) Gujrat and Quetta

Although we omit our opinion regarding these two, what we have stated in connection with Sialkot mostly applies to Gujrat and the case of Peshawar holds true with Quetta.

Construction of Small Industries Estate aiming at integration of metal engineering industry.

o We propose that the third five-year plan will take up the matters concerning the Small Industries Estate which aims at the realization of specialization and division of of work in metallic engineering industry. The reason for our selection of this industry lies naturally in its importance as a line of industry to which we have already referred. However, the promotion of cooperation in this

line cannot be realized until the S.I.E. is established and conversely the S.I.E. can best demonstrate its function in the line.

o The following is the outline of the S.I.E. of the metallic engineering industry which is, in a word, the S.I.E. centering around model plants:-

i) The enterprises to be located in the S.I.E. shall be limited in principle to those belonging to metallic engineering industry, but, when necessary for the realization of cooperative work, those belonging to the other lines and large industries (consisting of not less than 250 employees) as well shall be admitted. In the case of large industries which are admitted the application of such aid measures as stated in (vii) will be unnecessary.

ii) The S.I.E. plan is formulated by deciding first of all the construction schemes of those enterprises to locate in the S.I.E. and then forming the total plan by means of piling up those of each individual enterprise and model plants which will be referred to in (iii). As a matter of fact this is a complete inverse of the ordinary programming which consists of the acquiring, grading and proper partitioning of the land and allotting it to those who wish to locate; instead the decision of the contents comes first followed by the acquisition of the necessary land and layout corresponding to the contents. (It is of course necessary to leave room in anticipation of a certain extent of change in plan.)

iii) Model plants shall be constructed in connection with the manufacture of common parts and common processing work.

The operation of the model plants shall be taken charge of by such applicant enterprises assisted by P.I.D.C. as manufacturing the said parts or conducting the said processing work. In the absence of such applicant or in the case of the applicant found incompetent P.I.D.C. shall construct and operate the model plants. The aid of P.I.D.C. shall be given, in addition to the general ones stipulated in (vii), by means of purchasing a certain definite amount (on condition that the quality is in conformity with the standards).

iv) In order to realize the thorough performance of quality control and standardization inspection organs shall be strengthened and, if need be, cooperation with such organs as P.I.T.A.C., etc. shall be considered.

v) In investigating the plans of the other enterprises priority shall be given to those related to the production (processing work) of the model plants and correction shall be made of such portions, if any, as overlap the production (processing work) of the model plants. In addition thorough checking shall be made from the viewpoint of division and specialization of work in order to prevent as a matter of fact double investment and to take measures of using in common such equipments which are too large for an individual enterprise to conduct full-time operation.

vi) Measures shall be taken to realize the organization of the enterprises to locate in the S.I.E. It is desirable, if possible, to complete the organization beforehand, through which the opinion of each enterprise shall be made possible to reflect in the plan. In case such beforehand measure is

impossible it shall be realized even after the construction of the S.I.E. for the purpose of establishing a structure so that all enterprises in the S.I.E. may act with one accord.

vii) In order to select a number of enterprises qualified for the above incentives which are stronger than those in the past are necessary. It requires, therefore, that not only the supply of funds, especially in foreign currency, are abundant but also their qualitative improvement (reduction of interest, relaxation of repayment conditions, conversion of loans into subsidies, etc.) and favourable treatment concerning taxation are considered.

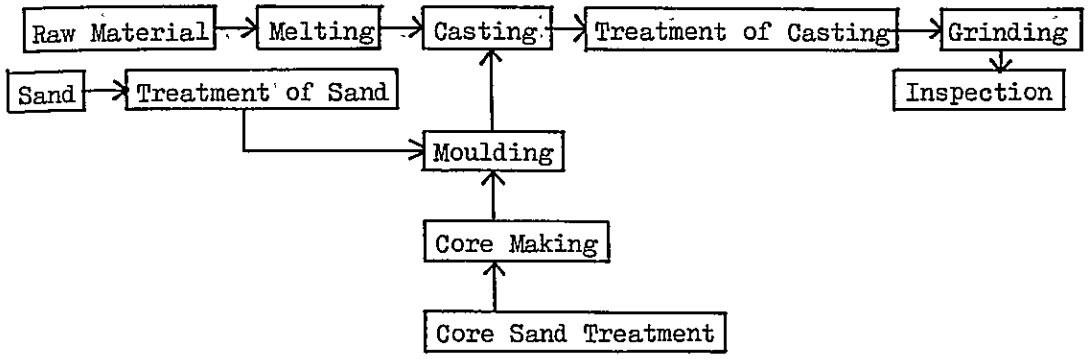
viii) The location of the S.I.E. shall be in Lahore district and Karachi district.

C. Data of reference

1. Model plant designs of nine lines of industry whose specialization needs to be promoted.

(1) Iron Casting Foundry

Flow sheet of the Process:



Principal Equipment:

1. Cupola

As a furnace for meling cast iron, the cupola is most generally employed for its maximum economy and efficiency. While there are two types of cupola, namely, the hot air type cupola and the cold air type cupola, and the former is more widely employed. Although the melting capacity of a cupola depends on its ratio of inner diameter to effective height as well as on other conditions, it may be expressed in terms of inner diameter at the tuyer level.

Standard Values of Melting Rate for Different Inner Diameter of Cupola

Inner Dia. (mm)	Melting Rate (ton/hr)		
	Air Volume to be Supplied (m^3/min) = 140 - 160	Air Volume to be Supplied (m^3/min) = 120 - 140	Air Volume to be Supplied (m^3/min) = 100 - 120
500	1.3	1.1	0.9
600	2.0	1.8	1.6
650	2.5	2.2	2.0
700	3.0	2.7	2.4

	Melting Rate (ton/hr)		
	Air Volume to be Supplied (m^3/min) = 140 - 160	Air Volume to be Supplied (m^3/min) = 120 - 140	Air Volume to be Supplied (m^3/min) = 100 - 120
Suitable Coke Ratio (%)	17 - 22	12 - 22	10 - 12
Ash in Coke (%)	10	10	10 - 12
Tap Temp of Molten Metal	1500°C	1450 - 150°C	1400 - 1450°C
Running Purpose	For high temp. melting especially suitable when steel scrap are chief raw material	Ordinary Running	Economical Running

2. Cupola Attachments

a) Blower

b) Volume Meter

A volume meter is provided for the purpose of numerically measuring the operational air volume, whereby the fuel consumption may be rationalized and quality control facilitated.

c) Blast Meter

A blast meter is attached to the air duct or the air box.

3. Front Slagging Spout

If the molten metal were intermittently tapped by opening and closing the cupola plug, the components of the molten metal would tend to fluctuate, making it hard to obtain a uniform molten metal. To prevent this trouble a front slagging spout is employed to guide the molten metal to the tilting fore-hearth for continuously tapping the molten metal without opening and closing of the plug.

4. Tilting Fore-hearth

The tilting fore-hearth consists of a cover, a carrier and a tilting mechanism, and is if a V-shaped teapot type, i.e., the

molten metal drains out across the bottom. The hearth is tilted by electric motor, and it is so arranged that the tilting of the hearth can be instantly stopped at any desired angle by means of a magnetic brake.

Also, for emergency use (such as electrical failures) a manual switch-over mechanism is also provided.

Specifications of Tilting Fore-hearth

Type	Capacity (ton)	Thickness of Lining (inch)	Motor (HP)
A	2	8	1/4
B	4	9	1/4
C	7	12	1/2

5. Cupola Charger

The cupola charger is employed to improve the efficiency of charging and insure the safety of operation. The materials are automatically charged by buckets into the cupola. It may also be so arranged that one charger serves two cupolas.

6. Filter

The pouring of molten metal into the mould is effected by the lifter ladle, which assures exceptional safety and easiness of pouring operation. The lifter is suspended at its wheeled top from a ceiling beam and is free to move right and left, while at its lower part is carried a ladle which may be moved up and down by means of a hand wheel provided on the lifter. The pouring is effected by a lever provided on the axis of the ladle.

7. Shake-out Machine

This machine separates the casting, flask and sand from each other by placing them on the vibrating table which is spring-loaded and covered with a reticulated screen, the vibration being

caused by the unbalance of the rotating main shaft. It is so designed that no resonant vibrations may be induced.

When the loaded flasks are set on the table, the vibration first act on the flasks, thereby shaking down the sand and castings from the flasks.

At the same time the flasks are removed, the castings on the table are gradually stripped off the sand, which is then finely crushed and drops through the meshes.

Specifications

Type		A	B	C
Shake-out Capacity	(ton)	0.3 - 0.5	1 - 2	3 - 5
Size of Table	(ft)	3 × 5	4 × 6	5 × 8
Height	(mm)	350	500	550
Power Required	(HP)	3	5 - 7-1/2	15 - 20

8. Vibra-screen

This machine is used for sorting out various types of moulding sand. The sorting frame supported by four springs is forced to vibrate by the motion of the oscillating shaft, whereby the sand is sorted.

9. Continuous Sand Mill

The sand mill is employed to impart a sufficient strength to the regenerated sand by mixing it thoroughly with new sand, water, and other additives so that a homogeneous moulding sand can be obtained. The foundry sand is fed into a hopper disposed in concentricity with a rotary pan and is gradually delivered by a centrally disposed scraper. The sand is then kneaded with a roller assembly and immediately stirred with two scrapers, when it is further kneaded by another roller assembly until it reaches the

outer periphery of the mill, where it finally emerges continuously through a discharge port provided in the side wall.

Specifications of Continuous Sand Mill

Type	Capacity (ton/hr)	Dia of Pan	Roller (mm)	Scraper (Pcs)	Power (HP)
A	5 - 10	2,000	450 - 500 (3 Pcs)	24	10
B	10 - 20	2,800	550 - 650 (4 Pcs)	28	20
C	20 - 30	3,200	600 - 750 (4 Pcs)	32	40

10. Aerator

The moulding sand is delivered to an aerator at the end of the process, whereby the sand is conditioned. This treatment homogenizes the sand, particularly by removing large aggregates and, at the same time, loosening the sand through aeration.

11. Moulding Machine

The moulding machine is employed to make sand moulds. It is not only higher in productivity than hand-moulding but even a layman can operate the machine easily if the bottom plate is properly arranged. In addition, it produces a more uniform, compact mould than does hand-moulding and, therefore, the sand mould obtained is harder and has a finer surface texture. The very fact means that it is sometimes unnecessary to use "facing" sand where not too rigorous standards of skin texture are required. In addition, since the squeezing operation can be mechanically accomplished, there will be less variances of size and weight. Another advantage is in that as the operator can work in a comfortable posture, less fatigue is involved. Thus, the machine not only helps maintain the health of workers but require no high degree of skill for its operation. The

moulding machine is capable of jolting and squeezing so that it can be best employed for the production of many types of small castings.

Specifications of Moulding Machine

Dimensions of Table (mm)	Dimensions of Flask (max.) (mm)	Depth of Flask (max.) (mm)	Table Stroke (mm)	Air Consumption (m^3/min.)	Air Pressure (atm)
400 × 500	340 × 430	300	120	abt. 0.12	3 - 6

12. Dust Eliminator

The air containing sand grits is sent by a fan to the dust eliminator, wherein it hits the water surface. Thereupon, the sand grits sink by gravity to the bottom of the eliminator. The remaining dust carried with air stream is then removed while passing through the coke bed of the eliminator, and the cleaned air is permitted to escape into atmosphere at the top of the eliminator through a duct or stack.

This type of dust eliminator is usually installed out doors, with its water vessel constructed of concrete.

13. Rotary Dryer

The rotary dryer is employed to condition the moving sand so that the latter may be better controlled. The fuel used is heavy oil.

Specification

Model	Drying Capacity (m^3/hr)	Consumption (lit/hr)	Motor (HP)
A	1	9	2
B	2.5	22	3
C	5	42	5
D	10	85	7.5

Note: Figures in the above table are based on sand containing 8 per cent moisture (Average grain size: #65)

14. Abrator

The abrator is a device which automatically and quickly polishes the skin of the casting by blasting steel shots against the casting without the help of compressed air, and consists of an impeller, a conveyer, a shot circulator, and a dust eliminator.

Model Plant:

In this model plant both medium-sized iron castings and large-sized ones (up to unit weight of 1 ton) are produced by means of a sand slinger, while small-sized castings are efficiently produced by making use of two moulding machines.

1. Production Capacity (8 hr./day, 25 days/month)

a) Monthly production of medium- and large-sized castings.

If we assume

unit weight per piece of product to be 100 - 1,000 kg. (average 400 kg.),

variety of products to be 40, and

1 - 10 (monthly average 5) pieces of each variety to be produced, we have

monthly production = 400kg. × 40 × 5 = 8,000kg. = 8t. (tons)

b) Monthly production of small-sized castings.

If we assume

capacity of moulding machine to be 30 flasks/hr., average unit weight of product to be 4 kg., and casting loss to be 35%, we have

monthly production = 4kg. × 30 × 8 × 25 × 0.65 = 15.6t.

Accordingly the monthly production of this plant is

80 t. + 15.6 t. = 95.6 t.

In order to continue the monthly production of 95.6 t. daily

melting quantity, casting loss being 35%, is

$$\text{daily melting quantity} = 96.5 \text{ t.} \times \frac{100}{65} \times \frac{1}{25} = 5.9 \text{ t.}$$

Accordingly 2 cupolas (capacity 2 t. each) are enough as melting equipment.

2. Machinery and Equipment

Monthly production 147 tons (inclusive of 35% loss)

Process	Equipment	Unit	Power Required (HP)	Remarks
Melting Process	Cupola (With heat exchanger)	2		Operated daily on an alternate basis
	Front Slagging Spout	2		
	Tilting Fore-hearth	2	1	
	Blower	1	20	
	Cupola Charger	1	4	for Winching & Traveling
	Automatic Air Quantity Controller	1		
Casting Process	Filter	2		
	Hand Shank	3		
Moulding Process	Sand Slinger	1	2	
	Moulding Machine	2		
	Core Machine	2		
	Mould Drying Furnace	1		
	CO_2 Process	1		
Sand Treatment	High Speed Muller	1	30	for loading, cooling fan and main motor
	Continuous Sand Mill	1	30	
	Sand Blender	1	3	
	Vibra-screen	1	2	
	Rotary Dryer	1	3	

Process	Equipment	Unit	Power Required (HP)	Remarks
	Aerator	1	5	
	Shake-out Machine	1	3	
Finishing Process	Abrator	1	7.5	for Impeller
			2	for Shot circulator
			2	for Dust disposal
	Grinding Machine	1	7.5	
	Sawing Machine	1	5	
	Dust Eliminator	1	10	for Exhauster
	Compressor	2	50	
			30	
Heat Treatment	Annealing Furnace	1		
Trans-portation	Overhead Traveling Crane	3	9 × 3	
	Mono-rail (with Hoist)	120m	2	
	Roller Conveyer	1		
	Belt Conveyer	1	2	with Magnetic Separator

3. Personnel Required

Process	Personnel
Pattern Inspection	1
Melting	4
Moulding	20
Core	5
Sand Treatment	3
Finishing	6
Heat Treatment	2
Transportation	2

Process	Personnel
Inspection	4
Equipment Maintenance	3
Miscellaneous	2
Office	6
Total	58

4. Testing Equipment

Equipment	Unit
Porosity Tester	1
Sand Rammer	1
Quick Hydrometer	1
Sand Washer	1
Versatile Sand Strength Meter	1
Hardness Tester	1

5. Space Required

	Floor Area (m^2)
Office	100
Workshop	1,400
Storage House	100
Others	150
Total	1,750

Ground Area: about 3,500 m^2

(2) Nonferrous Casting Foundry

Although we take up this subject of 'nonferrous foundry' independent of the above-mentioned 'iron casting foundry', the former's process is exactly the same as the latter's, and the testing equipments can be employed in common; therefore, it is advisable to locate the former in the same site as the latter.

In this case our description is limited to the necessary additional equipments, personnel and space.

Model Plant:

1. Capacity of plant

If we assume

unit weight per piece of product to be up to 60 kg.,

casting loss to be 40%,

capacity of melting furnace (crucible furnace of heavy oil burning type) to be 100 kg., and

melting to be conducted 3 times a day, we get

monthly production (inclusive of 40% loss) = 100 kg. × 3 × 25

= 7.5 t.

2. Machinery and Equipment

Process	Equipment	Unit	Power required(HP)	Remarks
Melting	Crucible Furnace	1		100kg capacity
Casting	Hand Shank	1		
Sand Treatment	Sand Mill	1	5	

3. Personnel Required

Process	Personnel
Melting	1
Moulding	4
Sand Treatment & Finishing	1
Total	6

4. Floor Area of Workshop Required is about 40 m^2

(3) Forging Plant

The forging plant as referred to here is that conducting mass production of the parts used for motorcars and small-sized diesel engines. The products are as follows:-

Drop forging products: connecting rods, blades, cam shafts, levers, etc.

Press forging products: links, cam gears, collars, yokes, journals, valve levers, ring gears, etc.

The product, whose weight per piece ranges from 10 to 0.5 kg., average being 1.2 kg., is manufactured by stamp forging process by making use of air drop hammers or forging presses.

Stamp forging, as compared with free forging, has a great advantage, as it can save raw material, which results in the reduction of the production cost. It is needless to say that this type of forging requires dies which need fairly large equipments and personnel. However, in case of continuous manufacture extending over a long period, it is more profitable than free forging in spite of the small quantity of one lot of products.

2. Monthly production of the Plant (7 actual working-hours per day and 25 days per month)

Monthly production (exclusive of forging loss) is 200 t., 80% of which, that is 160 t., are heat-treated.

As for the equipment of manufacturing dies, it is calculated as follows:-

While the average weight per piece of product is 1.2 kg. and the total monthly product in weight 200 t., the number of products amounts to about 170,000 pieces. If it is assumed that a die is usable for 5,000 pieces of product, 34 dies are necessary per month.

3. Machinery and Equipment

Process	Equipment	Capacity	Unit	Remarks
Cutting Off	Billet Shear	500 tons	1	
	Band Sawing Machine		2	

Process	Equipment	Capacity	Unit	Remarks
Forging	Air Drop Hammer	3 tons	1	
	"	2 tons	1	
	"	1 tons	2	
	Forging Press	1,000 tons	1	
	Reducing Roll		2	
	Air Hammer	250 kg	1	
	Trimming Press	300 tons	1	for 3 tons Air Drop Hammer
	"	200 tons	1	for 1000 tons Forging Press
	"	150 tons	1	for 2 tons Air Drop Hammer
	"	100 tons	2	for 1 ton Air Drop Hammer
	Coinning Press	500 tons	1	
	Heating Furnace		5	Slot type
	Slat Conveyer		10	
Heat	Annealing Furnace	1.0×2.5×1.0	1	Gas or Heavy Oil
Treatment	Tempering Furnace	1.0×2.5×1.0	1	"
	Hardening Furnace	1.0×2.0×1.0	2	"
	Oil Tank	2.0×3.0×2.0	1	for Quenching
	Water Tank	2.0×3.0×2.0	1	"
	Oil Pump		1	for Oil circulating
	Shot Blast		2	
Die Manufacturing	Die Sinking Machine (with Copying Apparatus)		2	
	Vertical Milling Machine	No. 2	1	
	"	No. 3	1	

Process	Equipment	Capacity	Unit	Remarks
	Horizontal Milling Machine	No. 2	1	
	Shaper	24"	2	
	Hydraulic Planer	4.5"	1	
	Lathe	8'	1	
	"	6'	1	
	Face Lathe	6'	1	
	Upright Drilling Machine		1	
	Bench Drilling Machine		1	
	Tool Grinder		1	
Inspection	Universal Testing Machine	50 tons	1	
	Hardness Tester		3	Brinnel, Rockwell, Shore,
	Metallurgical Microscope		1	
Power Source	Air Compressor	500 HP	1	6 kg/cm^2
	"	300 HP	2	"
Transportation	Overhead Travelling Crane	5 ton	2	
	Fork Lift	1 ton	5	
	Yard Crane	3 tons	1	

4. Personnel Required

Process	Personnel
Cutting Off	2
Forging	25
Heat Treatment	10
Die Manufacturing	16
Inspection	5

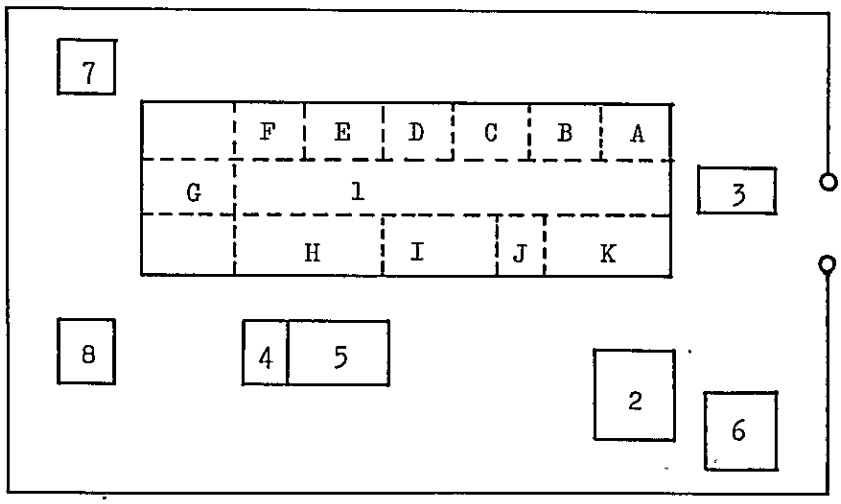
Process	Personnel
Maintenance	10
Transportation	10
Miscellaneous	4
Office (inclusive of 12 engineers)	30
Total	112

5) Space Required

No.	Item	Area m^2
1	Forging & Heat Treatment Shop	1,750
2	Die Manufacturing Shop	500
3	Cutting Off Shop	100
4	Inspecting Shop	75
5	Storage	150
6	Office	300
7	Electric Power Room	100
8	Canteen	150
	Total	3,125

Grand area is about 10,000 m^2

6. Summary Layout of Plant



Note: 1. Building No. refers to the foregoing.

2. A..... Air Hammer, 250 kg

B
.... Air Drop Hammer, 1 ton
C

D..... " 2 tons

E..... " 3 tons

F..... Forging Press, 1,000 tons

G..... Heat Treatment Section

H..... Depository for Products

I..... Depository for Forging Die

J..... Air Compressor Room

K..... Factory Office

(4) Electroplating Plant

General Information on Process

Viewed with the versatility required in the plating industry (a broad range of objects to be plated requiring different processes and facilities, and a corresponding range of plating metals), the scale of a plating plant covered in this example is for the monthly production of approximately 1,000 sets' bicycle parts (standard plating objects), including handles, hubs, brakes, pedals, spokes, luggage carriers, etc. Omission is made, however, of the special plating equipment for rims that have little connection with other products in plating. This specification is not limited merely to bicycle parts plating, but covers plating on electrical appliances, auto parts and other objects, too. The plant covered here handles the following:

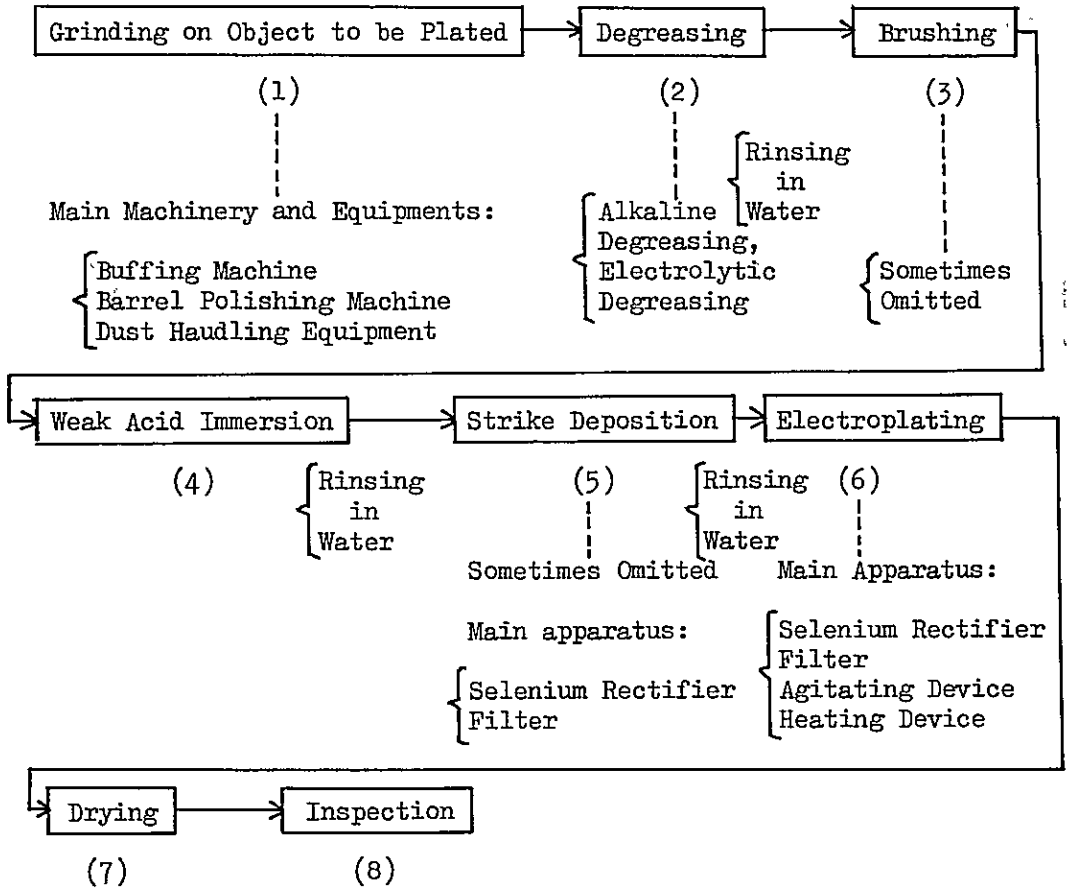
a) Bright copper, bright nickel, and chromium plating:
handles, hubs, brakes, pedals, luggage carriers, fenders, saddles, gears, cranks.

b) Barrel nickel plating: bolts, nuts, and other small parts.

c) Bright zinc plating: spokes, and other small parts.

Following is a flow sheet of Electroplating Process.

Flow Sheet of Electroplating Process



Model Plant

Electroplating equipment and facilities vary with the articles to be plated, output, and other factors. For an efficient mass production of a single product, semiautomatic and fully automatic equipment can be used. The electroplating plant covered in this example is efficiently handling of 1,000 bicycles' parts (excluding rims) per month, on the basis of 8 working hours a day and 25 working days a month.

Plating & Parts to be Plated

(1) Copper-Nickel-Chromium Plating:

handles, hubs, brakes, pedals, luggage carriers, fenders, saddles, gears, cranks, etc.

(2) Barrel Nickel Plating:

Bolts, nuts, and other small parts.

(3) Zinc Plating:

spokes and other parts.

1. Machinery & Incidental Equipment

Machinery & Incidental Equipment	Quantity	Power Required (KW)
For Polishing:		
Buffer	5	15
Dust Handling Equipment	1	7.5
Barrel Polishing Machine	2	1.5
For Plating, Pretreatment, Posttreatment:		
Alkaline Degreasing Batch (500×500×500 mm)	2	-
Electric Heater (iron) for Alkaline Degreasing Bath	2	4
Electrolytic Degreasing Batch (600×1,200×700 mm)	1	-
Selenium Rectifier (12V, 300A) for the same bath	1	5
Copper Plating Bath (700×1,800×900 mm)	1	-
Selenium Rectifier (8V, 500A) for Copper Plating Bath	1	5
Filter for Copper Plating Bath	1	1
Air-agitation Equipment for Copper Plating Bath	1	1
Electric Heater (iron) for Copper Plating Bath	3	6
Nickel Plating Bath (700×1,800×900 mm)	1	-
Selenium Rectifier (8V, 600A) for Nickel Plating Bath	1	5

Machinery & Incidental Equipment	Quantity	Power Required (KW)
Filter for Nickel Plating Bath	1	1
Air-agitation Equipment for Nickel Plating Bath	1	1
Electric Heater (quartz) for Nickel Plating Bath	3	6
Chromium Plating Bath (700×1,200×900 mm)	1	-
Electric Heater (quartz) for Chromium Plating Bath	2	4
Selenium Rectifier (12V, 800A) for the same bath	1	10
Zinc Plating Bath (700×1,800×900 mm)	1	-
Selenium Rectifier (8V, 500A) for the same bath	1	4
Filter for the same bath	1	1
Water Rinsing, Acid Rinsing, Alkaline Solution Bath (400×400×700 mm)	15	-
Barrel Nickel Plating Bath (2-barrel type)	1	1
Selenium Rectifier (12V, 300A) for the same bath	1	3.6
Heat Hot-blast Dryer	1	6
Total		88.6

Each plating bath (made of iron) is lined with vinyl chloride, and has a copper rod attached for hanging the anode and the object to be plated. Besides, the rock for hanging the object to be plated and various other things are also necessary.

The equipment described above is all heated by an electric heater, but can also be boiler-heated.

2. Power Required

Power required is as described in the foregoing paragraph 1, totalling approximately 90 KW. Electroplating requires a large quantity of water, say, about 10 tons per day in this model plant. Underground water and river water cannot be used in the plant, and

ion-exchange equipment must be provided, or city water must be utilized.

3. Personnel

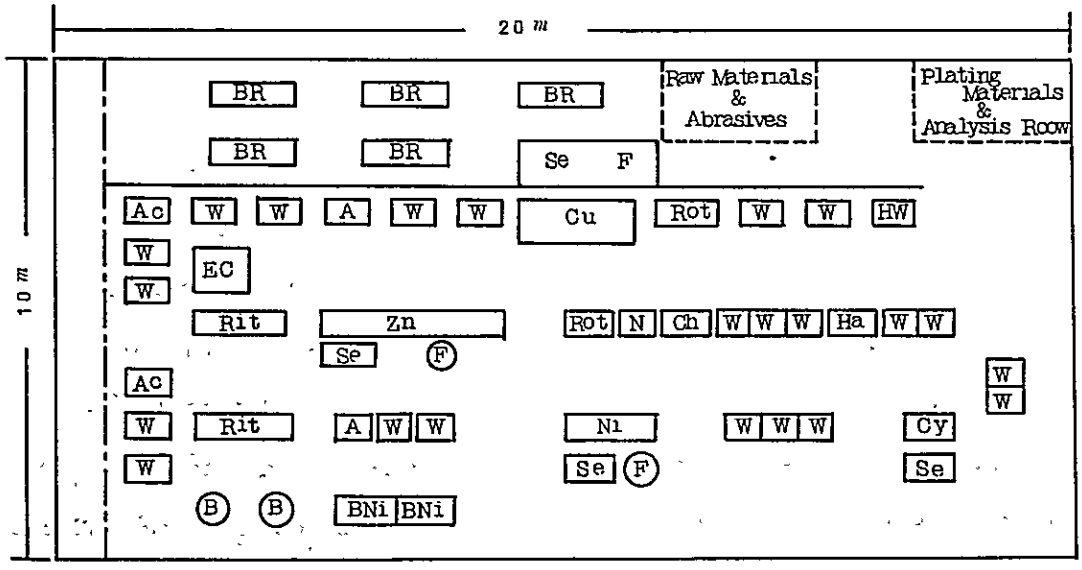
	Personnel
Analysis and Solution Control Engineer	1
Polishing Machine Operator	6
Electroplating Worker	12
Inspector	1
Packing and Odd Jobs	1
Clerk	1
Total	22

4. Amounts of Materials Used

	Initial Charge (Kg)	Monthly Replenish-ment (Kg)
Copper Cyanide	70	50
Sodium Cyanide	150	300
Caustic Soda	150	100
Potassium Tartaric	30	20
Copper Plate	150	50
Potassium Rhodanide	15	15
Nickel Sulphate	300	50
Nickel Chloride	50	10
Boric Acid	50	10
Brightening Agent for Nickel Plating (1)	abt.30 lit.	50 lit.
Brightening Agent for Nickel Plating (2)	2 lit.	50 lit.
Nickel Plate	150	50
Chromic Anhydride	300	200

	Initial Charge (Kg)	Monthly Replenish-ment (Kg)
Sulfuric Acid	5	10
Splash Preventive	0.5	0.1
Chromium Anode	10 Pcs.	-
Zinc Cyanide	60	30
Zinc Plate	100	50
Brightening Agent for Zinc Plating	abt.10 lit.	abt.10 lit.
Degreasing Agent for Iron	10	50
Degreasing Agent for Nonferrous Metals	10	50
Degreasing Agent for Electrolytic Degreasing	50	50
Emery Powder	-	60
Tripoli	-	50 Pcs.
Lime	-	50 Pcs.
Buff	4 sets	4 sets
Barrel Polishing Stone	200	50
Barrel Compound	-	50

5. Layout of Plant



A.C :	Alkaline Degreasing	Ch :	Chromating
W :	Rinsing in Water	Na :	Neutralization
E.C :	Electrolytic Degreasing	Ni :	Nickel Plating
A :	Immersion in Acid	BNi :	Barrel Nickel Plating
Cu :	Copper Plating	B :	Barrel Polishing
Rit :	Brushing, Rack-hanging	Se :	Selenium Rectifier
H.W :	Rinsing in Hot Water	F :	Filter
Rot :	Rock Removing	BR :	Buff Base
Zu :	Zinc Plating	Cr :	Chromium Plating
N :	Immersion in Nickel Acid		

6. Locational Conditions of Plant

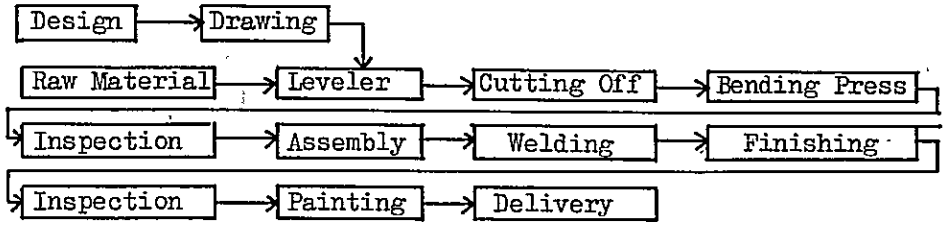
Electroplating is the final process before assembly.

The electroplating plant must be located as close to the assembly plant as possible. This will minimize scraches in plated surfaces that may be produced while in transit, and cut down freight, too. The most important factor to be considered in establishing an electroplating plant is an ample supply of city water available. What is still more important is a draining question. The drainage from the electroplating plant contains plenty of toxicants such as cyanic, chromic and other acids in addition to acids and alkalis. Draining these substances into the fields and rivers about the plant is not allowed. It is, therefore, necessary to lay out a drain, or to install drain hanging equipment. Also, it is necessary to provide ventilation facilities to allow the toxic gas filled air to go out. If possible, the plant must be located in the zone without dwellings in the vicinity. The plant must be designed to allow satisfactory draining and ventilation. Machinery and equipment must be so arranged that there will occur no congestion of process flows.

(5) Sheet Iron Work Plant

Although the principal products of the sheet iron work plant as referred to here are steel sashes, steel doors, etc., it can be appropriated for the production of other kinds of pressed products.

1. Flow Sheet of Sash Manufacturing Process



2. Monthly Production

It is of course impossible to make a sweeping statement of the monthly production of the plant which varies with the kind of products. However, we aim at the monthly production, of Rs 132,000 in value for the time being.

3. Main Machinery and Equipment

	Capacity	Unit	Remarks
Gap Shear	6^{mm} x $3,000^{mm}$	1	
"	9^{mm} x $3,000^{mm}$	1	
"	4.5^{mm} x $1,200^{mm}$	1	
Brake Press	150^{tons} x $3,600^{mm}$	4	
Hydraulic Streaching Press	16^{mm} x $3,600^{mm}$	1	
"	9^{mm} x $3,000^{mm}$	1	
Punching Press	75^{tons}	3	
Power Press	No. 3	3	
"	No. 2	2	
Leveler	3.2^{tons} x $1,500^{mm}$	1	
Engine Lathe	$1,800^{mm}$	1	for Punching
Shaper	500^{mm}	2	Die Machining

	Capacity		Remarks
Horizontal Milling Machine	No. 2	2	for Punching
Planer	3,800mm	1	Die Machining
Cut Off Grinder		2	
Band Sawing Machine		1	
Upright Drilling Machine		1	
Electric Arc Welder	10KVA - 30KVA	10	
Electric Spot Welder	35KVA - 50KVA	2	
Overhead Frawling Hoist	2tons	2	
Air Compressor	5 HP	1	for Painting

4. Personnel Required

Process	Personnel	Remarks
Machining	25	
Assembly and Welding	50	
Painting	4	
Maintenance	3	
Transportation	4	
Miscellaneous	2	
Office	25	inclusive of 15 Engineers
Total	113	

5. Space Required

Machine Shop	1,000 m^2	
Assembly & Welding Shop	1,000	
Painting Shop	150	
Storage	200	for Raw Material
Storage	200	for Finished Products

Office	300
Electric Power Room	100
Canteen	150
	3,100 m^2

Ground area required is about 10,000 m^2

(6) Machine Screw Manufacturing Plant

Summary of the processes of Machine Screw Manufacturing

1. The first process

As for the materials, wire rod (steel wire rod or brass wire rod) which is drawn into the specified size is used, from which rivets are manufactured by the "Header", the machine of the first process. The same machine is applicable to either round-head rivets or flat-head rivets.

2. The second process

To the rivets produced as above, milling is given; in other words, slots are to be cut into the rivet head. The machine to be used here is generally called "Slotter".

3. The third process

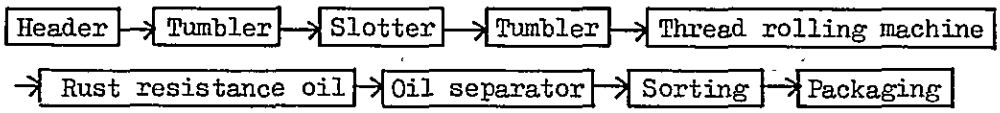
Threading is made by means of "Thread rolling machine". This operation is not the conventional cutting, but is a press-forming method in which the screw threads on the rivets are formed by movements of the plates which bear the screw threads on themselves.

In the intermediate courses between the processes of the first and the second, and between the processes of the second and the third, respectively, the rivets are subjected to the "Tumbler" for polishing and cleaning.

After the threading (the third process) is finished, the products are immersed into the rust-resistant oil, and then

the superfluous oil remaining on the surfaces of the rivet is thoroughly shaked off by using the separator. Then follows the sorting of the products. After sorting is carefully done, the products are stuffed into the cardboard cartons or boxes, thereby completing the whole processes of screw manufacturing.

4. Flow sheet for machine screw manufacturing



Machine screw manufacturing model plant

5. Principal & auxiliary machinery

Machine	Type	Number of Machine	Required HP	Personnel
Header	No. 05	2 Sets	(1 HPx 2) 2 HP	
Header	No. 1	1 Set	1 HP	2
Header	No. 2	1 Set	2 HP	
Slotter	No. 1	4 Sets	(1/2 HPx4) 2 HP	2
Slotter	No. 2	1 Set	1/2 HP	
Thread rolling machine	No. 1	2 Sets	(1/2 HPx2) 1 HP	
"	No.1-1/2	1 Set	1 HP	2
"	No. 2	1 Set	2 HP	
Cutter Grinder		1 Set	1/2 HP	
Oil separator		1 Set	1 HP	1
Tumbler		3 Sets	(1/2 HPx3) 1-1/2 HP	
For sorting and packaging				3
Grand Total		18 Sets	14-1/2 HP	10

Note: a) Specification of Header

Machine No.	Length	Production per min.
No. 05	1/2" - 3/4"	95 Pcs.
No. 1	3/4" - 1"	90 Pcs.
No. 2	1" - 2"	85 Pcs.

b) Specification of Slotter

Machine No.	Length	Production per min.
No. 1	1/4" - 1"	65 Pcs.
No. 2	1" - 2"	55 Pcs.

c) Specification of Thread rolling machine

Machine No.	Dia. of shank	Length	Threading Capacity per min.
No. 1	1/16" - 5/32"	- 1"	90 Pcs.
No.1-1/2	1/8" - 1/4"	1-1/2" - 2"	80 Pcs.
No. 2	3/16" - 5/16"	2" - 2-1/2"	60 Pcs.

6. Machine screw output by the model plant

Daily output (8 actual working hours)

Unit: gross

Length \ Dia.	1/8"	5/32"	3/16"	1/4"
1/4"	100			
3/8"	100			
1/2"	150	50	80	
3/4"	100	50	80	
1"			130	50
1-1/2"				70

Unit: gross

Length \ Dia.	1/8"	5/32"	3/16"	1/4"
2"				50

Total output: 1,010 grosses

Remarks:

The calculation was made on the conservative assumption that 80% of the capacity of the machine was set at the daily output.

7. Summary table of quantities required for chief & sub-materials, power and labour

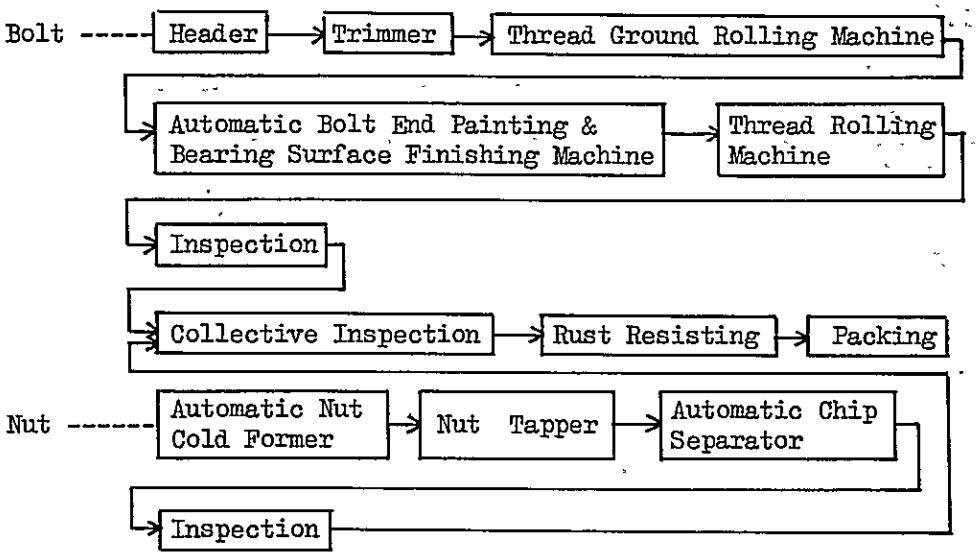
(Machineries and buildings excluded.
Working hours: 8 hours per day,
25 days per month)

Items	Descriptions	Quantity Required	Remarks
Material	Steel wire	10,200 Kg	
Sub-material	Cutters Dies Others	60 sheets each 2 Pcs.	Cutters & Dies must be used repeatedly by grinding or slotting. (Others) Springs, Pins, Washers, Bolts and Nuts, etc.
Labour	Trained Untrained	3 persons 7 "	
Oil and Tool	Various oils Tools	50 litres	(Oils) Machine oil, compound oil, other light oil, etc. (Tools) Files, Wrenches, Pliers, Spanners, Taps, Drills, etc.
Packaging	Paper Containers	25,250 Pcs.	
Motive power	Electric	2,200 K.W.H.	

8. Layout of Plant

(7) Cold Pressed Bolt & Nut Manufacturing Plant

Flow Sheet of the Manufacturing Process:



Outline Explanations on Processes:

Bolt manufacturing equipment is recently an automated, advanced and efficient machine.

The bolt material is inserted in the header, and pressed on one end into an oval fillister head, which is trimmed into a hexagon head with the trimmer. Further, with the cutting machine, the surface and slant face of the bolt head and the oval fillister of the bolt end are cut. Also, prior to thread rolling, thread ground rolling operation is carried out. Threading is efficiently exercised with the rolling machine.

After threading, the chips and cutting oil are removed from the bolt with the automatic chip separator.

Thus processed products are then inspected, cleaned, rust-resisting oil coated, packed in a paper box and further put in a wooden box to be shipped.

Explanations on Main Machine Tools:

Plastic Working

1. Header

A header is a press to head bolts. The range of similar machines is wide, and their types are numerous, but today by a header we mean a "double stroke header" which does jobs of double stroke heading through cold pressing and, at the same time, shaft forming.

Specifications

Type	Size of Bolt (mm)	Stroke	Diam. of Die (mm)	Power (HP)	Capacity (pcs/min)
A	6 × 75	120	45	3	80
B	8 × 100	150	50	5	70
C	10 × 130	185	60	7-1/2	60
D	12 × 150	210	72	15	40
E	16 × 250	350	86	20	35
F	20 × 300	400	105	30	30

2. Trimmer (Automatic bolt head trimming machine)

This is a machine which can efficiently do the job of automatically trimming the head of a cheese-form bolt into a hexagon head.

Specifications

Type	Diameter (in)	Stroke (mm)	Capacity (pcs/min)	Power (HP)
No. 1	1/4 (6.4 mm)	75	70	1
No. 2	5/16 (8.0 mm)	115	55	1
No. 3	3/8 (9.5 mm)	125	50	3
No. 4	1/2 (12.7 mm)	140	45	5
No. 5	5/8 (15.9 mm)	175	40	7-1/2

Cutting

3. Thread Ground Rolling Machine

By the use of the thread ground rolling machine, it is made possible to utilize the feature of the rolling machine, i.e., to attain mass production of high-precision thread. The cutting feeder is automatically operated and that with ease; so in short days anybody comes to continuously carry on cutting as nicely as skilled workers.

Specifications

Workable Rolled Thread Ground Diameter (mm)	6 - 16
Workable Length (mm)	150
Motor (HP)	2

4. Automatic Bolt End Pointing & Bearing Surface Finishing Machine

This is an efficient machine which does automatically and at a time the jobs of hexagon bolt end pointing and bearing surface finishing. Though small in size, its service-ability is high.

Specifications

Type	Diameter (in)	Max. Length under Neck (mm)	Capacity (pcs/min)	Power (HP)
No. 1	1/4 (6.4 mm)	75	45	1
No. 2	5/16 (8.0 mm)	75	40	1
No. 3	3/8 (9.5 mm)	75	40	1
No. 4	1/2 (12.7 mm)	100	30	1
No. 5	5/8 (15.9 mm)	125	25	1

Rolling

5. Thread Rolling Machine

A thread rolling machine provides a kind of special plastic

threading. A flat or round hardened thread rolling die is strongly pressed against the raw material and by rolling this plastic deformation is given to the surface of the raw material.

The raw material is depressed with the thread of the die to make screw recesses and the raw material portions are made to go up the root of the die to make threads of the bolt. The relation of the die to the product is just like that of the punch to the curved stamp, i.e., their concavo-convex is just the reverse; so the section of the die thread is just like that of the root of a thread.

Further, for the same reason, the thread of the die and the thread formed with the rolling machine should be the reverse of each other; so the diagonal line of the flat die surface for right-hand thread forming shall be made left up when seen from the die face, while the left-hand thread shall be made in the opposite way.

Specifications of Thread Rolling Machine

(Cylindrical Die)

Rolling Diam.	(mm)	3 - 50
Max. Length	(mm)	120
Pitch	(mm)	0.5 - 3
Max. Pressure	(kg)	12,000
Motor	(HP)	7

6. Automatic Cold Nut Former

This does the job of forming the material wire into nuts continuously and automatically.

The material wire inserted from the rear part is cut and formed into hexagon nuts, then after finish tapping, finished efficiently. It is an automated machine.

Specifications

Type	Size of Nut (Max.)	Capacity (pcs/min)	Power (HP)
A	1/4" (6.4 mm)	80 - 130	10
B	3/8" (9.5 mm)	70 - 100	15
C	1/2" (12.7 mm)	60 - 80	20
D	5/8" (15.9 mm)	50 - 60	30
E	3/4" (19.0 mm)	40 - 50	50

7. Nut Tapper

This is an automatic machine which can do the work of tapping nuts by the use of the tap.

Specifications

Type		No. 1	No. 2	No. 3	No. 4
Diam. of Thread	in	1/8 - 3/8	3/8 - 9/16	1/2 - 3/4	7/8 - 1
	mm	2 - 10	10 - 14	12 - 20	21 - 25
Capacity (pcs/mm)		40 - 15	16 - 10	12 - 7	6 - 4
Power Required (HP)		1/2	1	1-1/2	2

8. Automatic Chip Separator

The products which have been machined, come out mixed with chips. Then they are put in this machine which can do the work of separate products from chips in great quantities in a short time.

The number of pieces separable per minute ranges from 500 to 5,000. The power required should be 1 HP.

Screw Inspection:

1. Diameter Measurement

Generally, costly measuring instruments and long hours are required for inspections; so an economical inspection is being carried out with a limit gauge for screw thread. Thiat is, whether the

screws are within the specified tolerance or not, determined with a go-gauge for collective inspections and individual not-go gauges.

General information on using purposes of the limit gauge for screw threads which is used for clamp screws by mass production are given hereinafter.

a) Limit Snap Gauge

This gauge is intended to inspect the external diameter of the thread, and is quite the same as using for inspecting general cylinders. Applications are exactly the same as in the case of general cylinder inspection.

b) Limit Thread Ring Gauge

Limit thread ring gauges are intended to inspect minor diameters and pitch diameters, and may be broken down into two categories, i.e., "go thread ring gauge" and "not-go thread ring gauge".

c) Limit Thread Snap Gauge

Like thread ring gauge, limit thread snap gauges are intended to inspect male screw minor diameters and pitch diameters.

d) Limit Thread Plug Gauge

Limit thread plug gauges are intended to inspect female minor diameters and pitch diameters.

2. Pitch Measurement

In many cases the measurement of pitches is carried out with a tool microscope or a projector.

3. Flank Angle Measurement

Flank angles are measured with a tool microscope or a projector.

4. Pitch Diameter Measurement

For measurement of pitch diameters (a) a screw micrometer, (b)

an indicator with an oval end measuring point, (c) a needle, (d) a tool microscope, etc. are used.

Model Plant:

The model plant covered in this example is for production of 27,000 pieces 1/4 inch diameter bolts & nuts per 8 actual working hours.

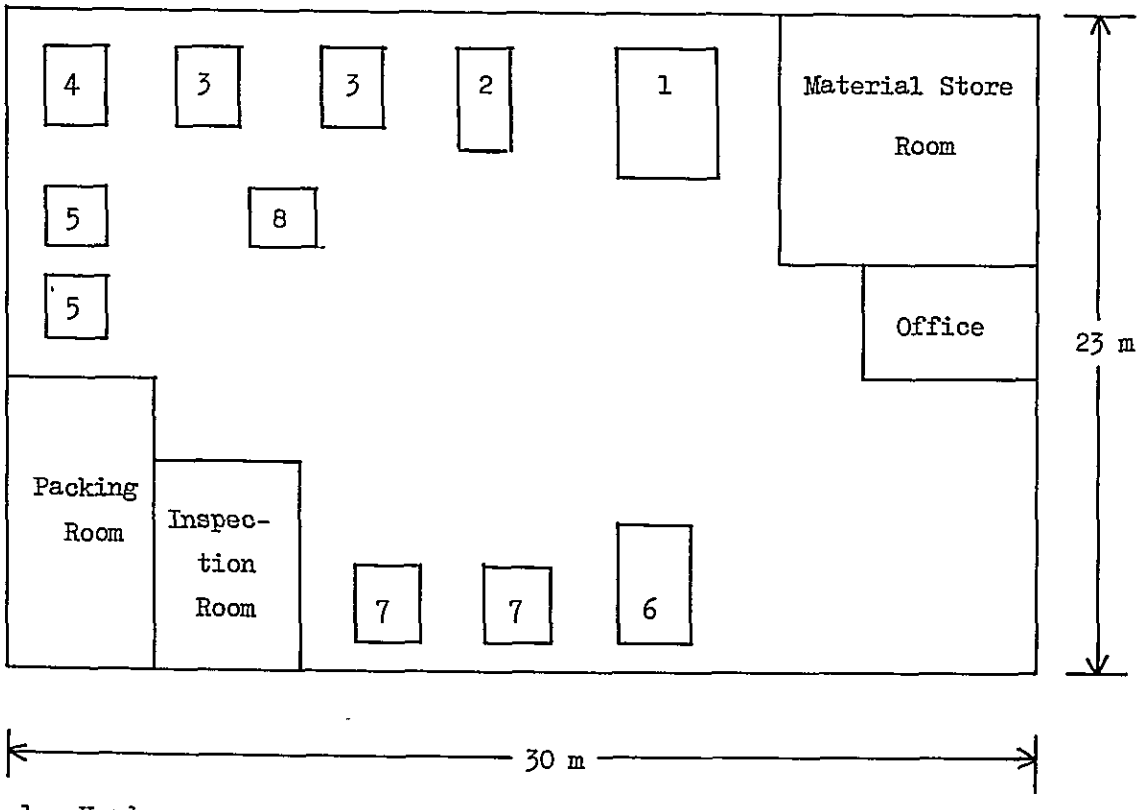
1. Process, Number of Machine & Operator

Process	Name of Machine	No. of Machines	No. of Persons
1. Plastic Working	Header	1	1
	Trimmer	1	1
2. Cutting	Thread Ground Rolling Machine	2	2
	Automatic Bolt End Painting & Bearing Surface Finishing Machine	1	1
3. Rolling	Thread Rolling Machine	2	2
	Inspection Instruments		
	Micrometer, Pitch measuring machine gauges	1 set	1
4. Nut Forming	Automatic Cold Nut Former	1	1
	Nut Tapper	2	2
5. Chip Separator	Automatic Chip Separator	1	1
6. Cleaning, Rust-resisting coating			1
7. Packing			1
8. Miscellaneous Services			1

2. Quantities of Chief Material, Personnel and Power

Items	Descriptions	Quantity required	Remarks
Material	Steel Wire	abt. 30,000 kg.	Vary with the length of Bolt
Oil	Various Oils	40 litres	Machine Oil, Compound Oil, Other Light Oil, etc.
Personnel	Trained Worker	7 Persons	Total 17 Persons
	Untrained Worker	10 "	
	Engineer	1 Person	
	Clerk	1 "	
Motive Power	Electric	4,600 kWH	

3. Layout of Plant



1 Header
2 Trimmer
3 Thread Ground Rolling Machine
4 Automatic Bolt End Paintirg & Bearing Surface Finishing Machine
5 Thread Rolling Machine
6 Cold Nut Former
7 Nut Tapper
8 Automatic Chip Separator

(8) Hot Forged Bolt & Nut

Summary of Hot Forged Bolt and Nut:

In the other section, the bolt manufacturing method through cold working was discussed.

Cold bolts are, however, not recommendable in that the size range of the material wire used is automatically restricted from the standpoint of the machine capacity, and the element layer of the head may become unbalanced and cause cracks unless special care is taken to select the material wire to be used, because the head is formed with a huge pressure. This is the reason why hot forging process exists an another technique.

In case of hot forging process, such inferior materials as would be cracked in case of cold pressing can be formed into heads without a crack and such large diameter bolts (up to 50 mm or so) which can not be attained through cold pressing can be produced.

In case of hot forged bolts, heating operation is included in production process. That is to say, the heading part of the raw material is heated "red" then forged into a head. This is where hot working differs from cold working.

1. Features of Hot Forged Bolts

   a) Bolts of large diameters 3/8 inch (9.8 mm) through 2 inch (50 mm) are mainly manufactured. Those of smaller diameters can be produced through cold working, so they need not be hot forged.

   b) Hot forged bolts were considered not to be so accurate, but now, with forging process and the improvement of the machine efficiency, high-precision can be achieved on axis threads and heads, and various kinds of special bolts are being

produced in large quantities. The equipment required for hot forged bolts includes material-cutting, heating, forging, and trimming equipment, etc., in addition to the machines used for making bolts.

Also, for nut forming, cutting, heating and nut manufacturing equipment are required instead in addition to the machines used in cold working equipment.

The hot forged products are as follows:

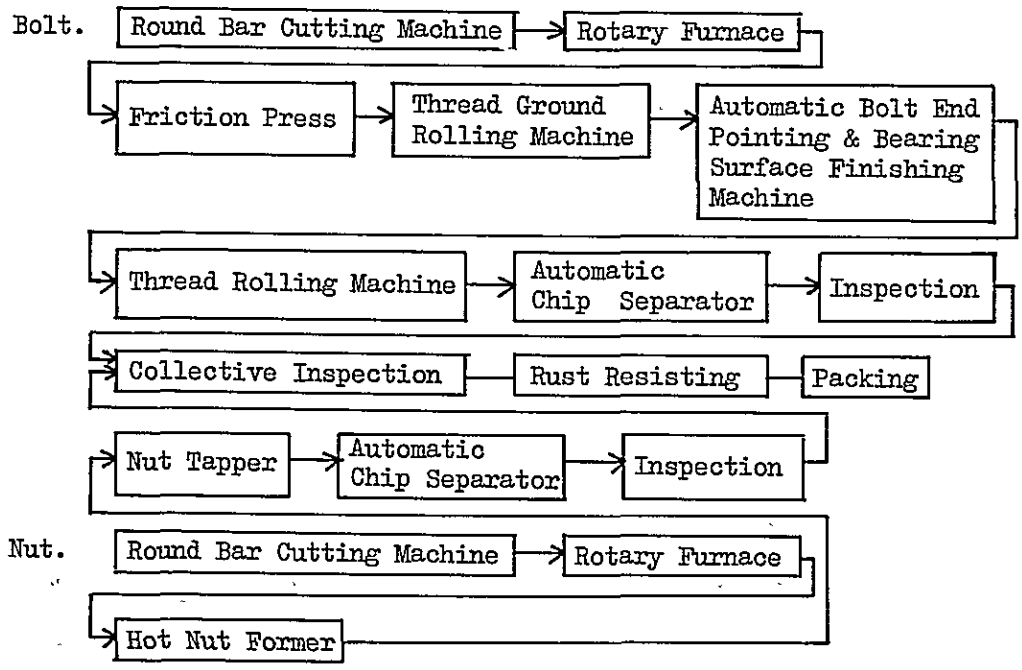
2. Bolts

Hexagon bolts, square head bolts, flush bolts, carriage bolts, fishplate bolts, stud reamer bolts, foundation bolts, eye bolts, and other types of bolts.

3. Nuts

Hexagon nuts, square nuts, slotted nuts, locking nuts, etc.

Flow Sheet of Manufacturing Process:



Explanations on Main Machines:

1. Round Bar Cutting Machine

This machine does the job of cutting long round bar into pieces of required length and is equipped with the upper blade of vertical motion and the lower blade which bears the material.

The material sent by the automatic feed is then received by the lower blade and cut between both blades as the upper blade moves up and down.

Specifications

Item \ Type	A	B
Capacity (mm)	50	38
Hourly Production	1,500	2,500
Stroke (mm)	45	50
Size of Cutting Blade (mm)	127 × 25	102 × 18
Req. Power (HP)	5	3

2. Rotary Furnace

This equipment does the job of heating the cut-off materials by the amount of the length required for forging, and its construction varies with each case bolt making or nut forming. In case of bolts, the construction of the furnace varies with the fuel used ** anthracite, coke or heavy oil, but generally speaking, the funnel type rotary furnace in which coke is put is most widely used.

Specifications

Item \ Type	A	B	C
Diam. of Fire Grate (mm)	1,050	850	750
Diam. of Draught Hole (mm)	102	102	102

3. Friction Press

This press does the job of heading bolts and is specially used for the production of hot bolts.

The main parts consist of equipment for setting the upper and lower dies and the mechanism for moving the lower die vertically. One end of the heated raw material of the required length is inserted in the lower die with the heated side up. The upper die is fixed and the lower die is moved upward to let it come in contact with the upper die, whereupon its head is formed by pressing between the dies.

Specifications

Item \ Type	A	B	C
Capacity (mm)	22 - 44	13 - 25	6 - 16
Body Length (mm)	500	300	300
Hourly Production	350	800	1,000
Stroke	525	330	330
Required Power (HP)	20	7-1/2	3

Machines required after the friction press, such as a bolt end pointing machine, a thread ground rolling machine and a thread rolling machine are the same as in the cold bolt and nut manufacturing processes, so we think it unnecessary to refer to them again.

4. Hot Nut Former

This machine is intended to form hot nuts. The material of round steel is cut short with the aforementioned cutting machine, heated "Red" in the rotary furnace, then worked on this machine to be formed hexagon, and at the same time tapping is made. This machine is a kind of crank press, so its lower die is fixed while

its upper die moves up and down to do the work of forging. According to the processing sequence, processes are divided into three categories and their respective dies are fitted on each process.

Also, in case of nut forming, the cutting machine and the rotary furnace are required, but no explanation on these machines may be necessary because they were in the foregoing section for bolt machines. Further, after nut forming, the nut threader and the centrifugal dehydrator are required, but explanations on them are given in the cold forming process, so we will not refer to them again in this section.

Materials and Fuels:

1. Materials

Most of the materials used for hot bolts and nuts are steel materials. In case of nonferrous metals, brass, aluminium alloys, etc. are used, but only in small quantities.

For bolts and nuts, rolled steel materials for general structures, carbon steel for mechanical structures, forged steel materials, etc. are mainly used. For black surface bolts and nuts and other ordinary bolts, rolled steel materials for general structures are used.

2. Fuels

Fuels are used for heating raw materials, but they are likely to give an effect upon the outer appearance of forged surfaces, so it is recommendable to use the best quality fuel. Anthracite, coke, heavy oil, etc. are normally used.

Model Plant:

The model plant covered in this example is for production of 9,000 pieces, 5/8" bolts & nuts per 8 actual working hours.

1. Machinery, Number of Machines, Powers and Operators

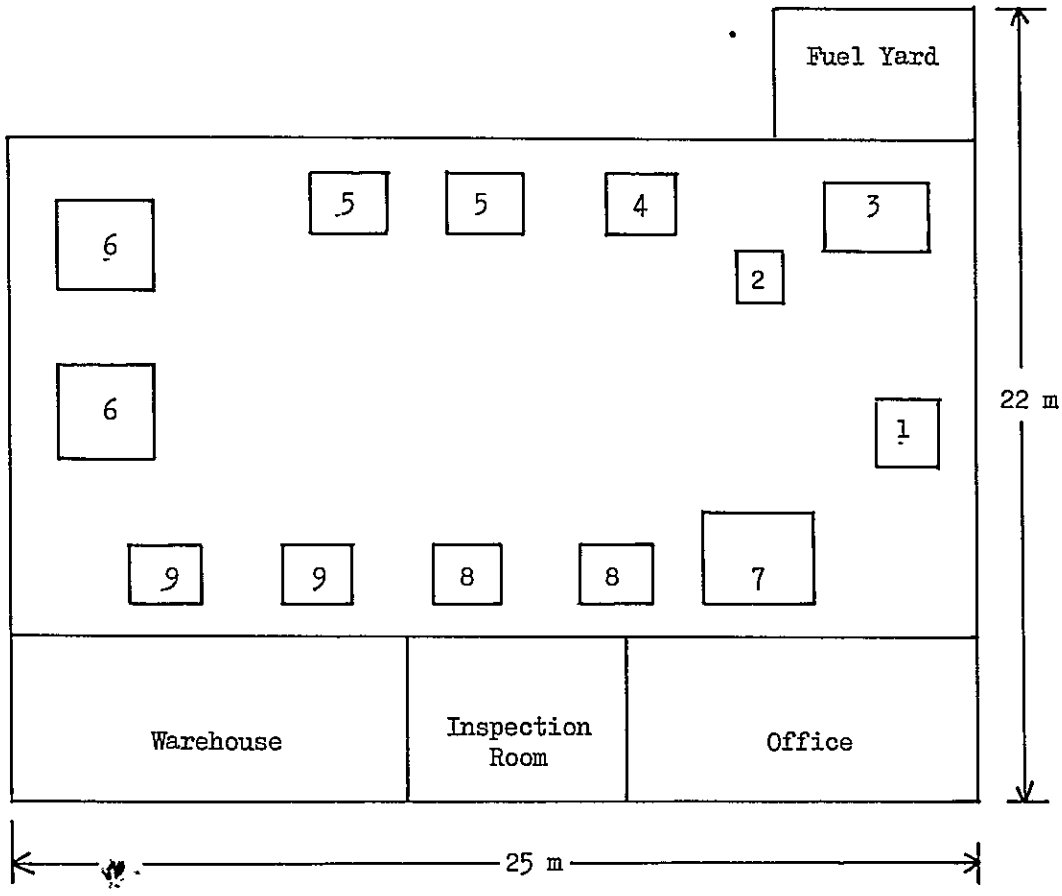
Name of Machine	No. of Machines	Power (HP)	No. of Operators
Bolt			
Round Bar Cutting Machine	1	3	1
Rotary Furnace	1		1
Friction Press	1	7-1/2	1
Automatic Bolt End Pointing & Bearing Surface Finishing Machine	1	1	1
Bearing Surface Finishing Machine	1	1	1
Thread Ground Rolling Machine	2	2	2
Thread Rolling Machine	2	14	2
Nut			
Hot Nut Former	1	7-1/2	1
Nut Tapper	2	3	2
Centrifugal Dehydrator	1	2	1

2. Personnel Required

Classification	No. of Workers
Machine Operator	12
Adjustor	1
Clerk	3
Auxiliary Worker	
for Inspection	1
for Rust Resisting	1
for Packing	1
for Miscellaneous Service	1
Total	20

3. Monthly Quantities of Materials and Power

Items	Description	Quantity Required	Remarks
Material	Steel Bar	abt. 72 tons	Vary with the length of bolt
Oil	Various Oils	50 litres	Machine Oil, Compound Oil, Other Light Oil, etc.
Motive Power	Electric	5,000 KWH	



1 Round Bar Cutting Machine
2 Rotary Furnace
3 Friction Press
4 Automatic Bolt End Painting & Bearing Surface Finishing Machine
5 Thread Ground Rolling Machine
6 Thread Rolling Machine
7 Hot Nut Former
8 Nut Tapper
9 Centrifugal Dehydrator

(9) Metal Machining Plant

Generally speaking, the project of a metal working plant is extremely difficult since the kind and number of machinery differ according to the parts to be machined. In this case the model plant is planned on the basis of the following ideas:-

a) It is hardly possible for some time to hope for a rapid enlargement of the field of social division of work which makes possible the farmed-out work by large enterprises. Therefore, our object in view is to attach importance to the improvement of the technical level of small enterprises, preparing at the same time for meeting in future the subcontract order of large enterprises.

b) For this reason the model plant will refrain from equipping universal machine tools already installed in medium and small scale enterprises such as lathes, shapers, drilling machines; instead, concentrated installation of only such machinery will be realized as its equipment is difficult for individual enterprises in view of the cost or such special machinery as of high efficiency and precision whose operational rate has to remain low due to the scarcity of work.

c) The model plant will conduct the machining work ordered by small enterprises so as to complete the finishing work of parts.

d) By so doing the model plant, in co-operation with the existing metallic engineering plants of small scale, tries to be able to conduct the subcontracted work by large enterprises.

1. Variety of metal cutting machinery

In case of machining the general parts, medium- and small-sized, of machine tools, internal combustion engines and industrial machinery, necessary machinery exclusive of lathes, shapers, upright drilling machines is as follows:-

a) Milling machine

Horizontal type, Vertical type, Planer type, Production type, Thread milling machine

b) Grinding machine

Cylindrical grinder, Internal grinder, Surface grinder, Centerless grinder, Cylinder grinder, Thread grinder, Cam grinder, Crankshaft grinder, Gear grinder, Spline grinder, Universal cutter grinder, Tool grinder

c) Boring machine

Horizontal boring machine (Table type, Floor type & Planer type), Vertical boring machine, Jig borer, Fine boring machine (Horizontal type, Vertical type)

d) Gear cutting machine

Gear shaper, Gear hobbing machine, Bevel gear generator, Rock cutting machine, Gear shaving machine

e) Lathe

Engine lathe, Face lathe, Vertical lathe, Turret lathe, Crank pin turning lathe, Vertical turret lathe

f) Drilling machine

Radial drilling machine, Multi-spindle drilling machine, Deep hole machine

g) Planer

h) Slotter

i) Spline hobbing machine

j) Broaching machine

k) Honing machine

l) Key sheater

2. Machinery and equipment

Not all of the machinery above-mentioned are to be equipped in this plant, but a portion of them which are meant for comparatively general use.

Under the programme of the first period the installation of those machines mentioned below is advisable for the time being.

The number of machinery has been calculated on the basis of and in proportion to the 40 lathes mentioned above and used for the machining work of the parts referred to abové; accordingly this number varies with the variation of the parts to be worked. However, the number of the gear cutting machine is different. It is based on the quantity of the monthly products which are 340 in number and consisting of either spur gears or helical gears whose outer diameter being 400 mm of module 4. By this equipment gears with outer diameters up to 600 mm of module 8 can be machined.

As for gear grinders, it is assumed that 25% of the products are ground gears.

Machinery & Equipment	Capacity	Unit	Power (HP)	Remarks
Radial Drilling Machine	1,500 mm	1	7	
"	2,000 mm	1	13	
Horizontal Boring Machine	Spindle die. 70 mm	2	7.5 x 2	Table type
"	" 100 mm	1	15	"
"	" 125 mm	1	30	"
Horizontal Milling Machine	No. 2	3	20 x 3	Plane type
"	No. 2	1	20	Universal type
Vertical Milling Machine	No. 3	1	25	
"	No. 2	3	20 x 3	

Machinery & Equipment	Capacity	Unit	Power (HP)	Remarks
Plane-miller	650×900×2,500	1	18	
Cylindrical Grinder	200ϕ × 500	1	12	
"	250ϕ × 800	1	15	
"	500ϕ × 1,000	1	25	
Universal Grinder	250ϕ × 800	1	20	
Internal Grinder	300ϕ × 500	2	5 × 2	
"	200ϕ × 500	1	3	
"	500ϕ × 1,000	1	6.5	
Surface Grinder	200×250×600	2	3.5 × 2	
"	500ϕ	1	5	Rotary type
Universal Cutter Grinder	No. 2	2	2 × 2	
Gear Shaper	7 M × 500ϕ	1	10	
Gear Hobbing Machine	8 M × 630ϕ	1	21	
Gear Grinder	12 M × 600ϕ	1	7.5	
Slotter	150 mm	1	7.5	
"	200 mm	1	10	
Face Cutter Grinder	250ϕ	1	10	for W.C. Face cutter
Bite Grinder		1	3	for W.C. Bite
Tool Grinder	250ϕ	1	2	
Overhead Traveling Hoist	1 ton	2	4 × 2	
Total		36	448.5	

3. Personnel Required

	Personnel	Remarks
Machine Shop	34	
Inspection	4	
Maintenance	4	
Transportation	5	
Miscellaneous	3	
Office	15	inclusive of 7 engineers
Total	65	

4. Space Required

Machine Shop	350 m^2	
Tool Room	50	
Inspection Shop	30	Ground area required is
Electrical Power Room	75	about 1,500 m^2
Office	75	
Canteen	75	
Total	655 m^2	

5. Programme of the second period

When this plant has come to operate efficiently enough, it is advisable to increase the equipment approximately as follows:-

a) Supplement of the machinery installed in the first period and found insufficient.

b) Machinery which has become necessary in view the new demand. Centerless Grinder, Cylinder Grinder, Spline Grinder, Floor type Horizontal Boring Machine, Fine Boring Machine, Honing Machine, Bevel Gear Generator, Gear Shaving Machine, Spline

Hobbing Machine, Broaching Machine, Jog Borer, etc.

c) Equipment of copying machines is advisable for working such parts as complicated in shape, require much time to machine, repeatedly demanded for a long time in spite of the small quantity.

2. Technical skill training system in Japan for the purpose of re-educating labourers.

The following description is meant for the information of West Pakistan in connection with our recommendations stated in (2) of 2, Chapter IV of the present report which treat of the countermeasures to improve the quality of labour; as one of such countermeasures the technical skill training system in Japan for the purpose of re-educating labourers may merit attention;-

Vocational training in Japan.- Vocational training in Japan in the broad sense of the term is given by such regular educational institutions as schools of compulsory education, high schools (which are divided into general, agricultural, industrial and commercial courses), higher technical schools, junior colleges and universities, and also in schools of various kinds and grades and in public vocational training centres. However, the vocational training which we refer to in this case will be limited to that in the narrow sense of the term whose chief aim consists in the bringing-up of skilled labourers especially in accordance with the 'Vocational Training Law'.

Vocational Training Law.- This law was established in 1958 for the purpose of bringing up such skilled labourers as needed by industries by means of letting unskilled labourers learn the necessary technical skill and conducting their skill measurement, which will result in the stabilization of their vocation, betterment of their status and contribution to the economic development of the country. (Article 1). The outline of the law is as follows:-

The so-called vocational training which the law stipulates is divided into two categories: the public vocational training given by the state and regional public bodies, and the private vocational training given by and

within the framework of private enterprises. The former is given by the General Vocational Training Centre, Synthetic Vocational Training Centre, Central Vocational Training Centre and Vocational Training Centre for Physically Handicapped Persons.

The purpose of the General Vocational Training Centre which is established by each Prefecture is to give fundamental technical training to those who seek employment. (Article 5)

The purpose of the Synthetic Vocational Training Centre is to give professional training either to employed labourers or to those who seek work, to educate instructors of vocational training and to extend assistance to the private vocational training centres. This Centre is established by the Association of Promotion of Employment as one of the welfare facilities under the provisions of the Unemployment Insurance Law. (Article 6)

The principal duty of the Central Vocational Training Centre is to perform investigation and researches concerning the vocational training together with the training of the instructors of vocational training. This Centre is established also by the Association of Promotion of Employment. (Article 7)

The Vocational Training Centre for Physically Handicapped Persons is established by the state. Its chief aim is to give vocational training adaptable to the ability of the trainees to those physically handicapped persons who find it difficult to receive training in the above-mentioned centres. (Article 8)

Vocational training within private enterprises, which had formerly been conducted by each individual enterprise, came to be authorized by the law at the application for authorization by the proprietor, if the substance was in conformity with the standards provided for by the law. It

was made possible for the state and regional public bodies to extend various aid and assistance to such authorized training centres. First of all, the standards of the course, period and equipments, etc. of private vocational training centres are stipulated by the Ministerial Ordinance of the Ministry of Labour. (Article 14). The competence of authorizing the conformity of the above-said items with the legal standards lies in the Governor of each Prefecture. (Article 15). If vocational training is given by the combined efforts of several proprietors, it can also be authorized. (Article 16) The aid and assistance to be given to such authorized vocational training centres within private enterprises are provided for in Articles 17 and 20. The law also provides that the instructors of vocational training in the public and authorized vocational training centres must be those who have obtained the instructor's license from the Ministry of Labour. (Article 22)

One of the noteworthy institutions of the law is that of skill measurement, which is meant, by means of officially examining, according to the types of trade, the actual skill and theoretical knowledge of those who have completed the course of the above-mentioned public or authorized training centres or those who are proportionate to the above persons, to confer a title of Ginōshi (a skilled person) to the successful examinees. (Articles 25 - 29)

Actual state of vocational training in Osaka Prefecture.- The actual state of vocational training in accordance with the Vocational Training Law naturally differs according to the different industrial structure of each prefecture. Here, the case of Osaka Prefecture is given as an example.

The Public Vocational Training Centre.- The principal items of the vocational training programme for 1964 are as follows:-

(1) General vocational training.

In five training centres one year or six months of fundamental technical training is given to 1,105 trainees belonging to 27 types of trade such as machine finishing, etc., the budget amounting to ¥31,384,000.

(2) Night training

Six months of night vocational training is given in three centres to 760 trainees, who cannot attend the daytime training centres, belonging to 11 different types of trade such as machine welding, etc., the budget being ¥7,990,000.

(3) Encouragement of changing occupations of day labourers.

To such day labourers who earnestly seek regular occupations six months of technical training in five different types of trade is given in two centres; the trainees are 120 in number, and the budget ¥8,459,000. This is done for the purpose of promoting their regular employment and stabilizing their life as well.

(4) Training of middle or old aged persons to promote their employment.

Such unemployed persons as middle or old aged and entering the training centres under the provisions of the Employment Security Law are given fundamental technical training necessary for making a restart as skilled labourers. This will mean the stabilization of their life and at the same time result in the bringing-up and securing the supply of skilled manpower needed by the industry. Training from six months to one year is given in two centres to 510 trainees belonging to 10 different types of trade such as mechanic, etc. In addition to the above, a short training course of 35 days in motorcar driving is given to 180 trainees at a certain drivers school, which is entrusted with the task, in the suburbs of Osaka City. The total Budget amounts to ¥52,411,000.

Public vocational training

Number of trainees at vocational training centers in 1964

	name of training center / category of trainees / training period / capacity / type of work	Yodogawa			Minami Osaka				Kita Osaka				Moriguchi				Women			physically handicapped	Total	
		general	night	junior high and high schools	general	night	day laborer	junior high and high schools	general	junior high and high schools			general		day laborer	junior high and high schools	general		night		capacity	total capacity
		one year	six months	35 days	one year	six months	six months	35 days	one year	one year	nine months	six months	one year	six months	six months	six months	one year	six months	six months	one year		
1	mechanic	50	40		40	40			30	60											260	340
2	finishing	40			40	40	10		30	30											190	240
3	welding	50	40								60										150	190
4	piping														20	20					40	80
5	sewing machine repair																			15	15	15
6	watch repair																			20	20	20
7	radio and television set repair	35	30																		65	95
8	electronic appliance assembling				40					60											100	100
9	chemical analysis				40																40	40
10	tailoring																40			25	65	65
11	dressmaking																50			20	70	70
12	auto maintenance	55			40	40	10			60											205	255
13	tiling												20			10					30	40
14	block building													30	10						40	80
15	carpentering												40								40	40
16	wood work												30								30	30
17	machinery drawing	45	30							60							30		30	10	205	265
18	memeographing																		30	20	50	80
19	coating with paint	30										30	30		10	30					130	200
20	artificial limb making																			5	5	5
21	seal carving																			25	25	25
22	auto driving			15				15													30	180
23	secretary																30				30	30
24	accounting																	30			30	60
25	English typing																	30	30		60	120
26	Japanese typing																	30	30		60	120
27	designing																30			10	40	40
total	capacity	305	140	15	200	120	20	15	60	270	60	30	120	30	40	60	180	90	120	150	2,025	
	total capacity		675		570				450				380				600			150	2,825	

(5) Running of the Vocational Training Centre of Physically Handicapped Persons.

Although established by the state, the running of this centre is entrusted to Osaka Prefecture which gives to such persons vocational training adaptable to their abilities. The trainees are 150 in number belonging to 9 different types of trade such as mechanical drawing, etc. This is meant to stabilize their life and raise their status as professional persons, the budget being ¥11,311,000.

The actual state of the Public Vocational Training Centres in Osaka Prefecture which we have stated above is tabulated as follows:-

Vocational training in the authorized training centres.- We now refer to the vocational training centres within private enterprises, which are established by the proprietors in order to cultivate such modern skilled labourers as suitable for the substance of the enterprises. As for the authorized training centres as of April 1964, which we mean authorized under the provisions of the above-mentioned Vocational Training Law, the independent ones (large scale enterprises establish their own training centres independent of outside organizations) are 64 in number with 3,836 trainees, while those joint ones (medium and small scale enterprises run such centres jointly) are 36 in number with 3,578 trainees. To such training centres the Prefecture extends various assistance and guidance including the use of the equipments of the Public Training Centres; furthermore, 1/2 of the expenses of the joint training centres are borne equally by the state and the Prefecture. The prefectural budget for fiscal 1964 for such private training centres amounts to ¥10,882,000.

Let us make some explanations about the substance of such training centres. As we stated above, out of the private training centres, those ones whose substance is up to certain standards are authorized. Let us see the standards, although they are naturally different according to the different types of trade which are at present 185, stipulated by the Ministerial Ordinance of the Labour Ministry. In the case of a mechanic, for instance, the standards of cultivation are as follows:-

1. Scope of technical skill to be trained.- technical skill of machining metal by means of machine tools.

2. Subjects of learning -

1) Subjects of study.

A. General subjects of study.- (1) Society (2) Physical education (3) Mathematics (4) Physics (5) Chemistry (6) Practical

foreign language (7) Japanese (8) Outline of business management

B. Professional subjects of study.- (1) Outline of mechanical engineering (2) Outline of electrical engineering (3) mechanical technology (4) Materials (5) Strength of materials (6) Mechanical drawing (Trainees are requested to select at least four (including physical education) of the general subjects of study.)

2) Technical practice.

A. Basic practice.- (1) Basic operation of measurement and marking-off (2) Basic operation of mechanical technology (3) Basic operation of machining (4) Basic operation of cutting and grinding (5) Basic operation of precision measurement

B. Applied practice (Training is given of special mechinery) (1) Machining (2) Finishing and assembly (3) Adjustment of machinery (4) Inspection of product (5) Inspection of precision

3. Training hours

The first year contains 1,800 h. (of which 440 h. are for classroom lesson)

The second " " " (of which 360 h. ")

The third " " " (of which 280 h. ")

Total 5,400 h. (of which 1,080 h. ")

4. Period of training

Three years

5. Necessary equipments

1) Buildings containing classrooms and machine shops for practice

which are equipped with such utensils, instruments, furniture, etc. as blackboards, desks, chairs, etc. necessary for training.

2) Machinery consisting of lathes, drilling machines, shaping machines, milling machines and grinding machines.

3) Others - such tools as used for operation, marking-off and finishing; measuring instruments and drawing tools and instruments

In short, the substance of such training centres consists in letting unskilled labourers, while engaged in productive work, systematically learn the practical technology based on theories for a period of three years (or two years according to the types of trade).

Some of the other standards are as follows:-

Number of trainees.- The number of trainees simultaneously trained in a classroom cannot exceed about 50.

Instructors.- Instructors are selected from the suitable employees of the enterprise who have obtained instructor's license, and at least one instructor must be assigned to every ten trainees at each practice shop.

Examination.- Examination of every subject of study must be performed at least once a year.

Site and equipment of training.- Special practice shops are not always necessary, but the places of actual production may be employed for this purpose. Council-rooms and dining-rooms may be used instead of classrooms. Equipments necessary for training need not be installed, but may be borrowed.

Lastly let us give two concrete examples of the training centre within private enterprises in the suburbs of Osaka City.

Example 1.- Independent vocational training centre belonging to A Company.

Type of industry Iron and steel manufacture

Number of employees 3,000

Commencement of training April 1953

Type of trade instructed Steel-manufacturing, mechanic and others
13 types of trade

Number of trainees 120

Number of instructors 100

Training equipments 3 classrooms and 1 practice shop

Substance of training

The first year Classroom lesson (given in the morning every day) totalling 1,150 h. a year.
basic technical practice (given in the afternoon every day) totalling 1,150 h. a year.

The second year Classroom lesson (every Monday, Wednesday and Friday) totalling 660 h. a year.
Applied technical practice (every Tuesday, Thursday and Saturday) totalling 1,340 h. a year.

Examination of technical skill 4 times a year

Example 2.- Joint training centre of B cooperative association

Number of joint member enterprises 100

Commencement of training October 1953

Type of trade instructed thin plate working

Number of trainees 150

Number of instructors 100

Training equipments 1 classroom (owned by the association)
1 basic practice shop (")

Substance of training

Classroom lesson	the first year	440 h. (11 h. a week)
	the second "	355 h. (9 h. ")
	the third "	245 h. (6 h. ")

Technical practice is not given collectively, but given at individual enterprise to which the trainees belong.

Examination of technical skill twice a year

Expenses of training in 1963

Outgoings	personnel cost (instructors' allowance, etc.	¥471,000
	equipment " (machinery and instruments, etc.	¥306,000
	teaching-stuff " (textbooks, etc.	¥158,000
	total	¥955,000*
	* (yearly expenses per head: ¥6,200)	
Incomings	subsidy granted by the Prefecture	¥323,000
	amount borne by proprietors and association	¥612,000

3. Wage system in Japan for the stablization of employment.

As in the preceding chapter, a few examples in Japan of the wage system for the purpose of stabilizing employment are given as follows; this is meant for the information of West Pakistan also showing one of the counter-measures to improve the quality of labour:-

Model wages (system) I

Table 1.

Male graduate of new-type college or old-type college

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
22	0	0	21,169	21,312
23	1	0	23,084	23,280
25	3	0	26,744	26,861
27	5	1	32,663	32,670
30	8	2	40,280	39,949
35	12	3	51,572	50,930
40	17	4	63,610	62,701
45	22	4	73,597	72,467
50	27	3	83,968	82,646
55	32	2	91,980	90,002

Table II.

Male graduate of new-type high school or old-type middle school

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
18	0	0	15,266	15,244
19	1	0	16,701	16,715
20	2	0	18,219	18,260
22	4	0	21,288	21,312
25	7	0	26,071	25,975
27	9	1	31,196	30,775
30	12	2	37,113	36,055
35	18	3	46,204	44,763
40	23	4	54,394	53,085
45	28	4	63,117	61,041
50	33	3	71,698	69,046
55	38	2	78,191	74,960

Table III.

Male graduate of new-type high school (physical labour)

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
18	0	0	-	15,283
19	1	0	-	16,759
20	2	0	-	18,240
22	4	0	-	21,254
25	7	0	-	25,728
27	9	1	-	29,970
30	12	2	-	34,854

Table IV.

female graduate of new-type high school

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
18	0	0	14,429	14,468
19	1	0	15,579	15,658
20	2	0	16,648	16,750
22	4	0	18,716	18,839
25	7	0	21,734	21,855
27	9	0	23,876	23,942
30	12	6	27,058	27,121

Table V.

Male graduate of new-type junior high school or old-type primary school

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
15	0	0	12,308	12,284
16	1	0	13,671	13,666
18	3	0	16,114	16,104
20	5	0	18,704	18,605
22	7	0	21,454	21,348
25	10	0	25,346	25,152
27	12	1	29,487	29,119
30	15	2	34,098	33,766
35	21	3	39,689	39,306
40	26	4	45,701	45,535
45	31	4	51,043	51,113
50	36	3	55,349	55,398
55	41	2	59,093	59,224

Table VI.

Female graduate of new-type junior high school

conditions pre-established			average salary (¥) per month of all lines of industries	average salary (¥) per month of all manufacturing industries
age	period(year) of service	number of dependents		
15	0	0	11,865	11,845
16	1	0	12,952	12,950
18	3	0	14,689	14,688
20	5	0	16,524	16,511
22	7	0	18,346	18,282
25	10	0	20,875	20,777
27	12	0	22,784	22,583
30	15	0	25,280	25,198

Explanations about model wage (system) I

(1) Source : 'Model wages of 1964' compiled by the Tokyo Chamber of Commerce and Industry

(2) Time of investigation : May 1964

(3) Subjects of investigation : 1271 enterprises in Tokyo and its environs

(4) This investigation of model wages is based on such conditions pre-established as 'a male graduate of a new-type college; age: 22; period (year) of service: null' or 'a male graduate of new-type college; age: 27; period (year) of service: 5' If a person happens to meet the pre-established conditions, his wages are considered model ones. However, in the absence of such a person, the wages of a standard person whose existing situation approximates to the above-mentioned conditions are made the basis of deducing that of a person who meets the pre-established conditions. The model wages include all payments for service during regular working-hours, but omit the cost of traffics paid, overtime allowance and bonus.

(5) Model wages are made up of the arithmetical mean calculated on the basis of each factor such as school career, age or period of service.

Model wages (system) II

Table VII.

age	I	II	III	minimum wages guaranteed
15	10,000			8,000
16	11,200			9,000
17	12,400			10,000
18	13,600	13,000		11,000
19	14,800	14,400		12,000
20	16,000	15,800		13,000
21	17,200	17,200		14,000
22	18,400	18,600	18,500	15,000
23	19,600	20,000	20,000	16,000
24	20,800	21,400	22,000	17,000
25	22,000	22,800	24,000	18,000
26	23,200	24,200	25,800	19,000
27	24,400	25,700	27,600	20,000
28	25,600	27,200	29,400	21,000
29	26,800	28,700	31,200	22,000
30	28,000	30,200	33,000	23,000
31	29,200	31,700	34,800	24,000
32	30,400	33,200	36,600	25,000
33	31,600	34,700	38,400	26,000
34	32,800	36,200	40,200	27,000
35	34,000	37,700	42,000	28,000
36	35,350	39,100	43,450	28,500
37	36,700	40,500	44,900	29,000
38	38,050	41,900	46,350	29,500
39	39,400	43,300	47,800	30,000
40	40,750	44,700	49,250	30,500
41	42,100	46,100	50,700	31,000
42	43,450	47,500	52,150	31,500
43	44,800	48,900	53,600	32,000
44	46,150	50,300	55,050	32,500
45	47,500	51,700	56,500	33,000
46	48,250	52,530	57,350	"
47	49,000	53,360	58,200	"
48	49,750	54,190	59,050	"
49	50,500	55,020	59,900	"
50	51,250	55,850	60,750	"
51	52,000	56,680	61,600	"
52	52,750	57,510	62,450	"
53	53,500	58,340	63,300	"
54	54,250	59,170	64,150	"
55	55,000	60,000	65,000	"

Explanations about model wage system II

(1) This system was established in November 1962, showing an example of a machine manufacturer (the number of whose employees being 190) in the suburbs of Osaka City.

(2) At the time of employment graduates of junior high schools are graded as I, those of high schools as II and those of colleges as III. However, in the application of this grading promotion from I to II and from II to III is taken into consideration.

(3) This is a standard list of regular increase in salary once a year. It shows that the amount of rise in pay is made larger during the period from the age of 25 to 35 than that in other periods. This is due to the consideration of a conceivable increase in the cost of living resulting from marriage, child birth, etc. together with the conceivable improvement of working ability during this period.

(4) As this system is a strictly standard one, there is some discrepancy between the wages of each individual person. However, the minimum wages classified by ages are guaranteed.

(5) This system was decided on the basis of the fact-finding conducted by the Research Institute of Industrial Efficiency, Osaka Prefecture and consultation with those in charge of the personnel and compensation of the enterprise together with the understanding of the trade union.

Model wages (system) III

Table VIII.

age	wages according to seniority	wages according to efficiency		
		A	B	C
15	6,300	2,700	2,700	2,700
16	6,650	2,250	2,550	2,850
17	7,000	2,400	2,700	3,000
18	7,350	2,550	2,850	3,150
19	7,700	2,650	3,000	3,300
20	8,750	3,000	3,350	3,750
21	9,800	3,400	3,800	4,200
22	11,200	3,850	4,300	4,800
23	12,600	4,300	4,850	5,400
24	14,000	4,800	5,400	6,000
25		5,300	5,950	6,600
26	16,800	5,800	6,500	7,200
27	18,200	6,000	6,900	7,800
28	19,600	6,800	7,600	8,400
29	21,000	7,200	8,100	9,000
30	22,400	7,700	8,650	9,600
31	23,800	8,200	9,200	10,200
32	25,200	8,600	9,700	10,800
33	26,600	9,200	10,300	11,400
34	28,000	9,600	10,800	12,000
35	29,400	10,000	11,300	12,600
36	30,800	10,600	11,900	13,200
37	32,200	11,100	12,500	13,800
38	33,600	11,600	13,000	14,400
39	35,000	12,000	13,500	15,000
40	36,400	12,500	14,000	15,600
41	37,100	12,700	14,300	15,900
42	37,450	12,850	14,450	16,050
43	37,800	13,000	14,600	16,200
44	38,150	13,100	14,700	16,350
45	38,500	13,200	14,850	16,500
46	38,850	13,300	14,950	16,650
47		13,500	15,100	16,800
48	39,550	13,600	15,250	16,950
49	39,900	13,700	15,400	17,100
50	40,250	13,800	15,500	17,250
51	40,600	14,000	15,700	17,400
52	40,950	14,100	15,800	17,550
53	41,300	14,200	15,950	17,700
54	41,650	14,300	16,050	17,850
55	42,000	14,400	16,200	18,000

Explanations about model wage system III

(1) This wage system was decided in February 1962. It shows an example of a manufacturer of electrical machinery and instruments (the number of whose employees being 30).

(2) The wages are made up of those according to seniority rule plus those of efficiency (any one of A, B and C).

(3) This system also serves as a standard list of regular salary raise once a year. For the same reason as the wage system II the amount of rise in pay during the period between the ages of 25 and 35 is made greater than that in other periods.

(4) The grades A, B and C of the wages according to efficiency are assessed every year on the basis of merit system.

(5) This wage system was decided through the fact-finding conducted by the Research Institute of Industrial Efficiency, Osaka Prefecture together with consultation with those in charge of personnel and compensation of the enterprise.

4. Japanese industrial standards

1. History of Industrial Standardization

The commencement of standardization work as an institution in Japan dates back to 1921, but with the close of the World War II, an attempt was made to reintroduce the venture under a new guide after the enactment of the Industrial Standardization Law in June 1949, which had firmly planted in the minds of authority the idea of industrial standardization to promote the development under unified control of the nation. The Japanese Industrial Standards Committee as the government inquiry agency was newly established and is serving to this day as the important function indispensable for the establishment of Japanese Industrial Standards.

2. Japanese Industrial Standards

JIS is the national standard established by the government based on Industrial Standardization Law, and for the establishment of the standards following a democratic procedure by reflecting in full, the opinion of manufacturers, vendors and consumers, and see that there shall be no forcing of any standard on the part of the government.

The standard once established shall have to be reinvestigated once every 3 years for revision, abolition or reaffirmation to meet the requirement of progressing technique of the industry in order to maintain the quality or rationality of standard.

(a) Scope of JIS

JIS is primarily the standard dealing with specification covering mining and industrial products, but certain of the products such as pharmaceuticals, agricultural chemicals, chemical fertilizer, silk yarn, foodstuffs and agricultural products which have the special system of standard of their own are excluded from the scope of JIS. Essentially JIS specifies items as given in the following:

i. Technical terms, symbols, numerical values etc.

ii. Kind of mineral and industrial products, shape, quality, function etc.

iii. Testing, analysis, inspection, method of testing etc.

iv. Design, construction, operation, method of packaging etc.

For the items and essence of the standard given above, JIS has 17 divisions, and each division is given with alphabetical symbols followed by 4 digits numerical figures as JIS A 1234.

Division	Symbol
Civil Engineering and Building Construction	A
Mechanical Engineering	B
Electrical Engineering	C
Automotive	D
Railway	E
Shipbuilding	F
Ferrous Materials and Metallurgy	G
Non-ferrous Materials and Metallurgy	H
Chemical Industry	K
Textiles	L
Mining	M
Pulp and Paper	P
Ceramics	R
Domestic Wares	S
Medical Equipments and Appliances	T
Aircrafts	W
Miscellaneous and General	Z

(b) Procedure for Establishment of JIS

As stated earlier, JIS being the national standard, when it is to

be established by the government, the competent Minister shall be required to obtain the prior resolution of the Japanese Industrial Standards Committee. The Committee is found within the Ministry of International Trade and Industry, composed of 240 regular members and a certain number of temporary members and technical experts who hold General Meeting, Standards Council, Sectional Councils and Technical Committees. There are 28 Sectional Councils on civil engineering, building and construction, machine tools and general machinery, machine parts, precision machinery, electrical engineering and materials, electronics, automobiles, railways, shipbuilding, ferrous and non-ferrous metals, chemistry, high polimer, textile, mining, ceramics, daily commodities, medical goods and appliances, aircrafts, packaging, welding, atomic power, ISO and IEC. The number of Technical Committees is over 1,500.

The members of JISC--regular members, temporary members and technical experts--are selected from the group of manufacturers, vendors, consumers, learned and experienced persons, government officials who can fairly represent each field they belong to (totalling about 13,000 men).

(c) Progress of JIS

The number of JIS established up to 1964, reaches to 6,116 and this divided into each section, the numbers are as given in the table.

3. Marking System

The marking system was established with the prime object of benefiting the users or consumers by the mark to indicate that the articles purchased are made to the standard quality conforming to the given specification. This system is almost common in the countries where standardization is in operation, but in the case of Japan, the government permits the manufacturer

of JIS commodities to exhibit the mark as illustrated to indicate that the product is made to JIS specification, and the article so marked is called JIS marked product, in other word, it is the mark that the quality has the government guarantee. The JIS marked articles explained above shall have been approved by JISC of their appropriateness and publicly announced.

Those manufacturers of designated commodities who desire to exhibit the JIS mark on their products, shall first be required to make application to the government who in turn will dispatch competent engineers to the applicant factory to investigate, before granting permission, to investigate the suitability of the factory in respect of manufacturing equipments, inspection facilities and inspection method, quality control system etc., necessary for the maintenance of appropriate producing condition. Not only that, but the factory must satisfy that it is capable of continuing the production of approved products.

After the permission has been granted, the manufacturer shall, on their own responsibility, place the mark on the article or the package and the government takes only a supervisory position by dispatching the engineers to the factory to check that the marking is done legitimately only on the articles satisfied the requirement.

When it is considered necessary, the permit can be cancelled or prohibit the sale of the article.

4. Standardization Work and International Relationship

Of international relationship of our industrial standardization, the mention should be made of ISO and IEC to both of which JISC had become a member in 1952 and 1953 respectively, and Japan is always well represented to take active part in the meetings, taking part as a member body of the Council (ISO) during 1956-1959, and in 1961 as a P-member for ISO TC 102 to take positive interest on ore sampling standard. Also, the facts that

Japan is represented as a technical committee in IEC, and JIS was taken in the draft of international standard, which had called the attention of countries interested in standardization, should here be added.

LIST OF ESTABLISHED JIS

(As of September 1964)

A	Civil and Architectural Engineering	217
B	Mechanical Engineering	801
C	Electrical Engineering	627
D	Automotive Engineering	195
E	Railway Engineering	128
F	Shipbuilding	438
G	Ferrous Materials and Metallurgy	210
H	Non-ferrous Materials and Metallurgy	293
K	Chemical Industry	1,488
L	Textile Industry	307
M	Mining	174
P	Pulp and Paper Industry	92
R	Ceramics	196
S	Domestic Wares	157
T	Medical Equipments and Appliances	127
W	Aircraft Industry	248
Z	Fundamental and General	
	Package	103
	Welding	65
	Fundamental	164
	Radioactivity	82
	Miscellaneous	4
		6,116

Information

All inquiries on Japanese Industrial Standards (JIS) are received at

Standards Division, Agency of Industrial Science and Technology,
Ministry of International Trade and Industry.
3-1, Kasumigaseki, Chiyoda-ku, Tokyo, Japan

The List of English Edition of Japanese Industrial Standards (JIS) is available at

Standards Division of Agency of Industrial Science and Technology,
or from any organization affiliated to International Organization for Standardization (ISO) in your country.

Complete set of English Edition of JIS is available at

Head Office, Japanese Standards Association
Kobiki-bekkan Building
6-1, Ginza-Higashi, Chuo-ku, Tokyo, Japan or
Osaka Branch Office of Japanese Standards Association,
Nomura Building, Azuchimachi, Higashi-ku, Osaka, Japan

Also obtainable from any of the 6 branch offices in Japan at Nagoya, Hiroshima, Fukuoka, Takamatsu City in Shikoku, Sendai and Sapporo.

How to Obtain

(a) Copies of English Edition of Japanese Industrial Standards (JIS) may be obtainable at the Head Office of Japanese Standards Association, or from any organization affiliated to International Organization for Standardization (ISO) in your country.

(b) Copies of Japanese Edition of JIS may be obtainable either from the Head Office of Japanese Standards Association in Tokyo, or any of its branch offices.

List of JIS (English Edition)

It may be obtainable free on request from the Head Office of the Association in Tokyo, or any of its branch offices.

Complete set of Japanese Industrial Standards are kept at Standards Division of Agency of Industrial Science and Technology or any of its district or branch offices in Sapporo, Sendai, Tokyo, Nagoya, Osaka, Hiroshima, Takamatsu City in Shikoku, and Fukuoka, and be available for inspection.

5. Small Industries Estate in Japan

1. Introduction

o The 'Small Industries Estate' in Japan made its first appearance in 1961 when the Central Government decided to grant financial aids to such estates. The term 'Small Industries Estate' we employ here involves the same idea as that mentioned in 1, Chapter V of the present report; it means not only an 'Industrial Estate' consisting of a number of small industries but the one which aims at the co-ordination in a high degree of such industries. The greatest feature of the small industries estate in Japan lies in the fact that the whole process of its construction is managed by the small industries themselves which are going to locate in the site; that is, beginning with the projecting, next performing the construction work and then managing the completed estate. In other words, those small industries which desire to get together in the estate organize a co-operative association which will be responsible for the project and its realization.

There are also in Japan, in addition to the above estate, other 'Industrial Estates' for small industries projected and constructed by local governments or autonomous bodies financed by local governments. The direct objects of such industrial estates consist in the removal of urban factories to the outskirts of the town, local development and planned use of land, which are somewhat different from those of the 'Small Industries Estate' whose idea is to promote the modernization of small industries. In reality, however, the former will result in the modernization of small industries, while the latter will sometimes contribute to the removal of urban factories, planned use of land, etc. Thus, when we take a wide view of the matter, we may say that both estates are aiming at the same thing.

So far as their formation is concerned, we cannot help thinking that

there is a wide difference between them; the former is constructed by someone outside the locating small industries whose lines of business are not limited, while the latter is constructed by the locating industries themselves which are in principle limited to be of the same line.

note: Co-ordination between enterprises cannot be effective unless they belong to the same line, which means that a high-degree co-ordination and limitation of the business of the members to the same line are one and same thing.

o In short, the aims of the Small Industries Estate is as follows:-

i) Effective realization of high-degree co-ordination between industries.

ii) Rationalization of plant layout.

Such factories as located in the centre of town often find it difficult to enlarge their equipment due to the scarcity of land, which often makes it impossible for them to realize the reasonable layout. It often happens that they are inconveniently located in view of the railway and road transport. These problems could not be solved until the construction of the small industries estate.

iii) Prevention of public nuisance in town.

Factories in the centre of town often cause fires or such public nuisances as noise, smoke, sewage, etc. Removal of such factories to the estate which is outside the town will settle the problems radically.

iv) Contribution to local development.

The construction of small industries estates will contribute to the promotion of the small industries in the locality and, further, to the development of the industry in general. That is to say, this is an extremely effective means of local development.

2. Aid to Small Industries Estate.

o As we stated above, the subject of construction of the small industries estate are the locating small industries themselves whose work is aided both by the central and local Governments in the following manner:- i) financing of construction fund without interest; ii) advice and suggestion regarding the project and its realization.

o Outline of loaning is as follows:-

(i) Loaner :	Local Governments
(ii) Fund of loan :	1/2 of the necessary fund is a loan without interest from the Central Government and the remainder, Local Government's own fund.
(iii) Object of loan :	Land, building and common facilities.
(iv) Loanee :	Cooperative associations or medium and small scale enterprises (with employees less than 300).
(v) Maximum of loan :	Less than 50% of the fund necessary for common facilities, buildings and land. 50% means the maximum rate within which loaning is so operated as to apply a higher rate to smaller enterprises and a lower rate to larger ones.
(vi) Interest on loan :	free of interest
(vii) Maturity :	7 years, of which 3 years are the period of deferment.
(viii) Others :	As for machinery equipments, there is another way of financing, which is a loaning without interest by the Local Governments. However, the application of this financing is limited in principle to small enterprises with employees

less than 100 in number. Furthermore, there are such special financial establishments as the Central Bank for Commercial and Industrial Associations and the Finance Corporation for Small Enterprises which may be also utilized.
As for the housing and welfare facilities there are also different means of financing.

o Advice and suggestion concerning project.

Prior to the realization of the project it is inspected by a team of men of learning and experience who are entrusted by the Local Government, as a result of which the team will give advice and suggestion concerning the project. The expenses of such procedure are borne by the Local Government which is subsidized by the Central Government by half as much as the expenses. The concentration plan of the small enterprises will have to be naturally revised in accordance with such advice and suggestion.

o Conditions of aid.

The small industries estate which applies for the above-said financial aid free of interest must meet the following conditions:-

(i) The construction of the estate must be conducted according to the project formulated by a co-operative association organized by such enterprises as wish to concentrate in the estate.

(ii) The small industries to locate in the estate must be not less than 20 in number. Participation of large industries in the co-operative association will not disqualify it for the financial aid, but it can still apply for the aid if other conditions are fulfilled. However, the large industries themselves cannot enjoy such aid.

(iii) All of such enterprises as locate in the estate must belong to the same or closely correlated lines of industry. In the case of a united estate consisting of more than one line of industry, each of which containing more than ten enterprises, it is considered qualified for the aid.

(iv) Proper facilities which are common to all members must be built in the estate.

(v) The site of the estate must be in the zone favourable to the location of factories. (see note)

(vi) The layout of factories in the estate must be properly designed.

(vii) The structure of factories must be safe and durable.

(viii) Most of the enterprises must move to the estate.

In short the qualification for financial other aid consists in the feasibility of effective co-ordination (conditions (i) - (iv) and the exemplary character of the estate (conditions (iv) - (vii).

note: The Local Governments are conducting, at the request of the Central Government, investigations of the conditions of location of factories. The zone which is considered favourable to the location of factories as a result of the investigation is the 'Factory zone'. The related data of investigation which are kept in the Ministry of International Trade and Industry and the Bureaus of International Trade and Industry are available for use by enterprises in general.

o Others.

The construction period is, in principle, three-years. Financing free of interest is effected for the land and common facilities acquired and buildings built during the period; accordingly loaning of fund extends over a period of three years. To give an example, in a certain estate which commenced its construction work in 1961 necessary land of about 9,240,000m^2

was acquired and construction of factories belonging to twelve enterprises together with common facilities (electric power receiving room) realized in the same year, in the next year factories belonging to 63 enterprises were built, and in 1963 the remaining common facilities were completed.

3. Present situation of small industries estate,

o Governmental aid of the small industries estate was commenced in 1961. On the basis of this aid the construction of the estate was started as follows:- 10 estates in 1961, 20 in 1962, 25 in 1963 and 26 in 1964. The first 10 estates which were started in 1961 have been already completed, and the second 20 ones which were started in 1962 are expected to be completed in March 1965. The number of new estates which are expected to commence construction under the aid will be 25 - 30.

o The outline of such estates is tabulated in Table 5-1 - 5-4. The summary of the conclusion derived from these Tables is as follows:-

(i) Average area of estate : 170,000m^2

(ii) Average number of enterprises per estate : 34

(iii) Average cost of construction per estate : ¥720 (million)
(US$2 million)

(iv) Line and number of industry

Metallic engineering :	46	
Timber processing :	18	
Fabrics :	12	(including dyeing)
Others :	11	
total (see note)	87	

note: There are three united estates consisting of different lines of industry. If each of their components is counted as a unit, the total

number of the lines amounts to 87.

(v) Local distribution of estates

As is shown in Fig 5-5 the estates are concentrated in the belt area along the Pacific coast and in the bases of local development.

o The amount of loan is as follows:-

(unit: million Yen; ¥365 = US$1.00)

	10 estates which started in 1961	20 estates which started in 1962	25 estates which started in 1963	26 estates which started in 1964	Total
1961	600				600 (10 estates)
1962	538	1,200			1,738 (30 estates)
1963	390	850	1,330		2,570 (55 estates)
1964		1,015	1,015	1,125	3,155 (71 estates)
Total	1,528	3,065	2,345	1,125	8,063 (81 estates)
Average	153	153	-	-	-

note 2: The Local Governments have been financed by the Central Government by the amount corresponding to one half of the above-said loan.

note 3: Reimbursement from the estate is again appropriated for the funds of loan, so the net expenditure of the Central and Local Governments are less than those shown in the above Table.

note 1: The estate is constructed under a 3-year plan, and the loan is made every year for the construction of the year.

o The sources of the funds are as follows:- (However, this shows an average tendency and some estates are raising the funds from different sources.)

Own funds 25 - 30%

Loan free of interest from Local Governments 15 - 25% (note)

Loan from Government financial establishments (Central Bank for Commercial and Industrial Associations and Finance Corporation for Small Enterprises)	30 - 35%
City bank	10 - 15%
Others	5 - 10%

note: The rate of loan varies with the scale of enterprises, so there is a wide range in the percentage. (Loaning operation is based on the principle that the smaller the enterprise is the higher is the rate of loan.)

Table 5-1 Table of estates in 1961

No. of map	Name of co-operative association managing the estate	No. of enter-prise	Line of industry	Principal products	Area	Funds(unit: thousand yen)
1	Sapporo Wood-working Centre	30	Wood-working	Furniture & fittings	169,307m^2	469,195
2	Funabashi Union of Association	86	Machinery and metallic, chemical fabrics, lumber, foodstuff	Gear, bolt, nut, parts-machining, lumber, slating, furniture, foodstuff	143,550	324,840
3	Osawatari Union of Association	20	Transport Machinery	Parts of light motor-bicycle painting and coating	86,790	679,770
4	Shizuoka Union of Association	32	Metallic engineering	Wood-working machinery steel frame, casting, can manufacturing, motorcar parts	116,985	525,084
5	Gifu Union of Association	76	Metallic engineering	Wood-working machinery, parts of vehicles, pattern steel frame hardware of buildings	297,000	716,519
6	Toyoda Association	23	Transport machinery	Motorcar parts, sheet metal working	200,006	717,572
7	Toyama Metallic Engineering Centre	36	Metallic engineering	Bearing, boiler-plate working machine tools, precision machines	123,796	780,839
8	Osaka Ready-made Suits Association	52	Ready-made suits	Sack-coats, trousers, overcoats	431,640	2,601,948
9	Okayama Iron-working Centre	33	Machinery, instruments and boiler plate working	Bearing, vehicle parts, boiler-plate working, agricultural machinery	123,156	390,563

10 Kitakyushu Association		21	Metallic engineering	Steel frame, boiler-plate working, casting, machinery	191,456	615,968
Total 10 Estates		407			1,883,686	8,872,298

Fig 5-1 Distribution of Small Industries Estates in 1961

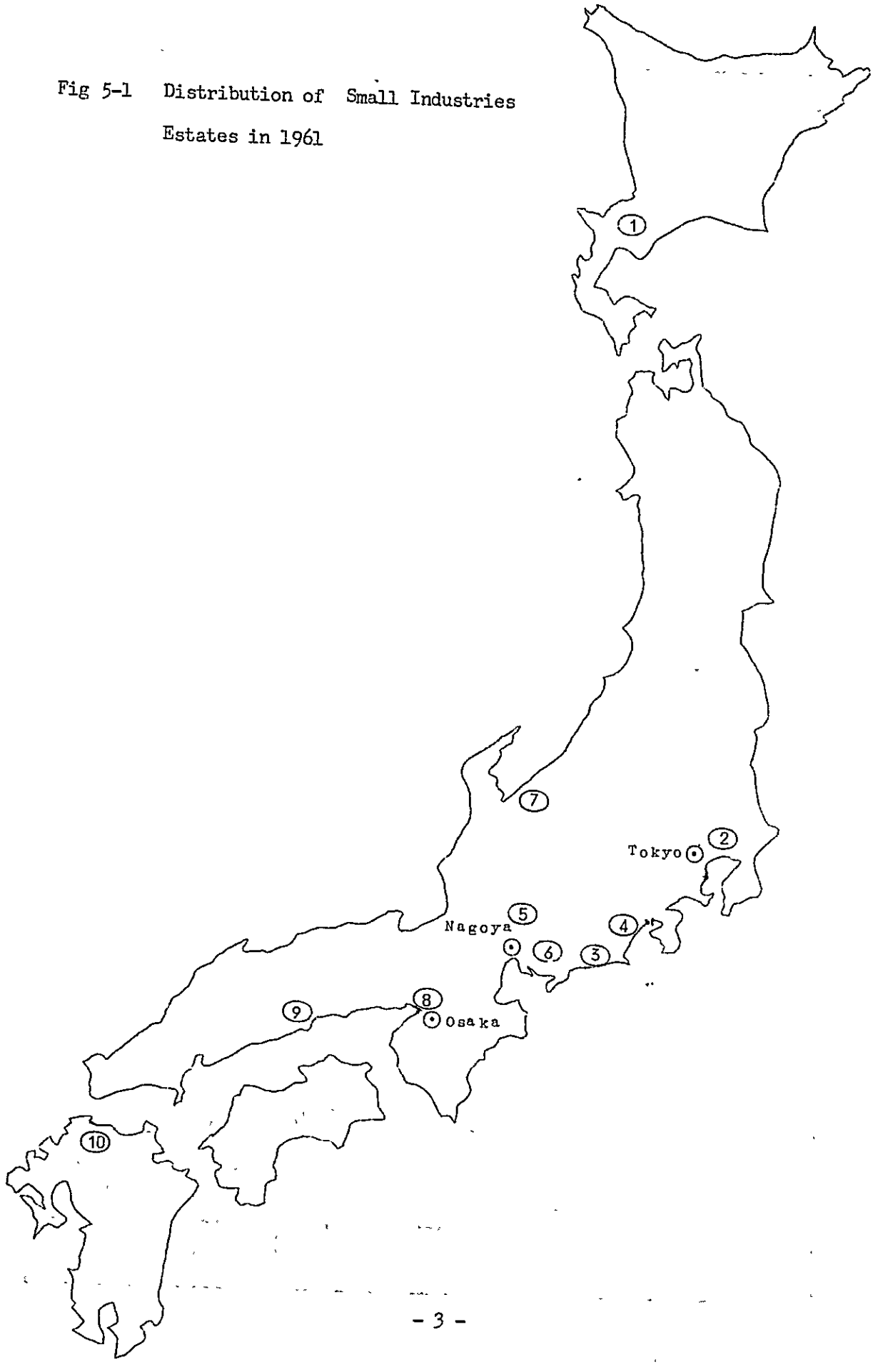


Table 5-2 Table of estates in 1962

No. of map	Name of co-operative association managing the estate	No. of enterprise	Line of industry	Principal products	Area	Funds (unit: thousand yen)
1	Synthetic Estate	54	Ferrous and non-ferrous products, machinery	Sheet metal working, steel crate, casting, transport machinery and parts, gear	705,681m^2	2,760,623
2	Sadatoshi Tricot Association	21	Tricot fabrics	Tricot products	204,831	433,895
3	Ibaragi Distributing Panel Estate	21	Distributing panel	Distributing panels (electrical measuring instruments)	139,375	792,920
4	Kashiwazaki Association	36	Metallic engineering	Motorcar parts, forging, casting, agricultural implements, piston-rings	140,200	586,979
5	Hamamatsu Association	30	Metallic engineering	Industrial Machinery, machine tools, musical instruments, weaving machinery	165,000	687,535
6	Shimizu Port Lumber Association	23	Lumber and wooden boxes	Lumber and wooden boxes	148,500	668,379
7	Daiichi Precision Industrial Association	30	Precision Industry	Parts of optical machinery, parts of precision machinery, music boxes	206,580	709,300
8	Nagano Wood-working Association	28	Wood-working	Furniture and fittings	99,000	209,955
9	Kanagawa-josai Association	24	Metallic engineering	Agricultural implements, transport machinery, instruments and parts, electrical parts, parts of machinery	55,060	448,554

10	Nagoya Ready-made Suits Association	20	Ready-made suits	Ready-made suits	99,000	502,110
11	Yokkaichi Association	26	Metallic engineering	Casting, boiler-plate working, industrial machinery, motor parts	177,969	925,548
12	Sabae Union of Association	53	Dyeing and spectacle frame	Printing of cloth, spectacle frames	1,271,622	3,431,746
13	Osaka Dress and Juvenile clothing Association	70	Ready-made clothing	Dress and juvenile clothing	165,396	2,251,428
14	Tomo Association	84	Steel working	Rivets, re-rolling, wooden-ship nails	172,148	908,788
15	Kochi Wood-working Association	29	Wood-working	Sawn wood, furniture, fittings, chips	448,404	852,426
16	Kokura-Higashitani Association	21	Iron working	High-pressure valves tools, vehicles and parts, marine machinery and parts	196,020	601,032
17	Oita Association	25	Iron working	Sashes, earth work machinery, coal-mine machinery	62,535	362,360
18	Saga Association	24	Metallic engineering	Hardware of ships, coal-mine machinery and instruments and parts of machine tools	99,000	470,746
19	Nagasaki Prefecture Association	27	Metallic engineering	Marine machinery and instruments, boiler-plate working, construction machinery	165,000	777,720

20	Sasebo Association	20	Metallic engineering	Marine machinery and parts, agricultural implements, coal-mine machinery	69,960	451,690
Total	20 Estates	666			4,791,281	18,933,734

Fig 5-2

Distribution of Small Industries Estates in 1962

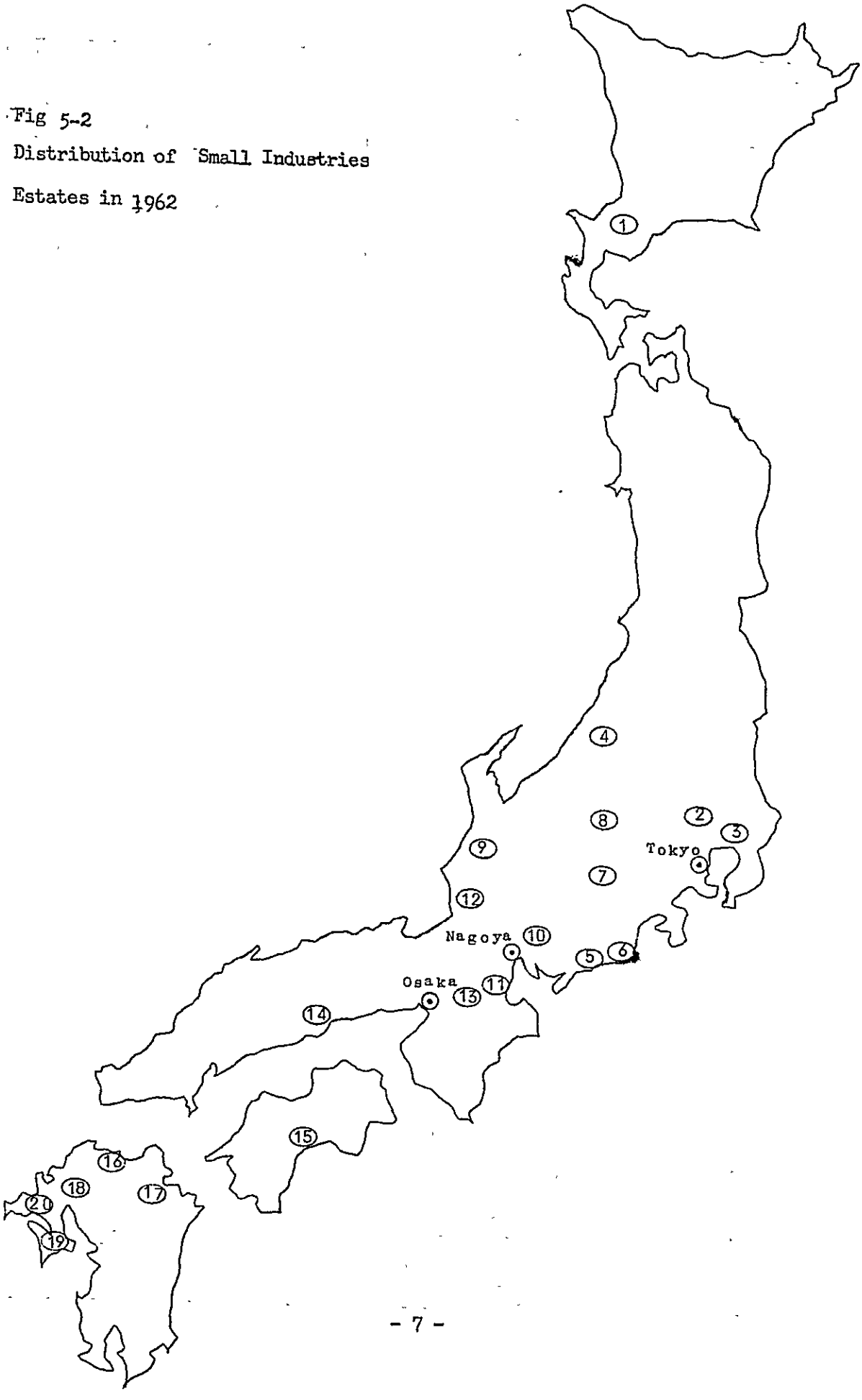


Table 5-3 Table of estates in 1963

No. of map	Name of co-operative association managing the estate	No. of enter-prise	Line of industry	Principal products	Area	Funds(unit: thousand yen)
1	Hirosaki Centre	20	Iron working	Metal products for building works, cutlery, agricultural machinery and implements, hand tools	64,742$^{m^2}$	172,712
2	Akita Electric Bulb for Export Association	22	Electric bulbs for Christmas	Various kinds of Christmas bulbs	79,200	455,034
3	Kitagami Association	24	Iron working	Steel frame, boiler-plate working, piping, steel frameworks, agricultural implements	56,712	166,396
4	Sendai Association	25	Metallic engineering	Steel frame for construction, gears, surveying instruments, jigs, tools, casting	73,524	352,451
5	Ishinomaki Association	21	Metallic engineering	Marine internal combustion engines, steel-frame building, boiler-plate working, parts of heavy electrical machinery, repairing and machining of machinery	93,512	256,931
6	Aizu Lacquer Association	68	Lacquer work	Plastic tableware, lacquer boxes, trays, smoker's sets	93,373	227,671
7	Toys for Export Association	67	Metal toys	Metal toys and correlated goods (coating, working of rubber parts, small-sized gears)	944,394	1,684,234
8	Tokyo-made Association	24	Ready-made suits	Ready-made suits	221,067	618,766

9	Kanuma Wood-working Association	54	Wood-working	Lumber, furniture, fittings, panels, prefabricated houses	369,217	595,286
10	Kuji Iron-working Association	21	Metallic engineering	Parts of electrical attachments of motorcar, parts of electrical measuring instruments, parts electrical instrument	72,112	343,532
11	Chiba Association	23	Metallic engineering	Motorcar parts, steel frames, forgings	273,422	1,281,125
12	Niigata Wood-working Centre	20	Wood-working	Wooden goods, plywood, lumber, coating and painting	70,155	278,941
13	Fujimiya Association	21	Metallic engineering	Motorcar parts, motorcar maintenance machinery, steel frames, industrial machinery	106,095	423,419
14	Shizuoka Furniture Association	23	Furniture	Various kinds of furniture	800,846	276,926
15	Tokai Electronics Association	25	Magnetic recorder	Tape-recorder and parts	178,309	666,416
16	Miyoshi Union of Association	39	Wood-working and construction machinery	Various kinds of furniture and belt-coveyors, power-winches, machining of parts	146,101	1,153,108
17	Ichinomiya Sewing Association	30	Sewing	Various kinds of clothing	82,814	277,279
18	Osaka Lumber Association	47	Lumber	Lumber for assembling use	679,265	2,670,118
19	Sakurai Wood-working Association	20	Wood sawing	Sawn wood, furniture	177,540	396,026

20	Wakayama Wood-working Centre	46	Fittings	Fittings, lumber	100,617	347,372
21	Himeji Association	31	Metallic engineering	Parts of industrial machinery and machine tools, communication machinery, steel frame, boiler-plate working	170,306	861,165
22	Okayama Association	22	Iron working	Machinery parts, press-working welding, iron casting	99,858	1,135,337
23	Mizushima Association	23	Metallic engineering	Motorcar parts, bearing, boiler-plate working	256,483	1,232,359
24	Yonago Association	24	Metallic engineering	Machining of parts, agricultural implements, steel frame, casting	130,548	518,234
25	Matsue Association	22	Metallic engineering	Agricultural machinery and implements, steel frame, boiler-plate working	101,884	410,696
Total	25 Estates	762			4,722,316	16,801,534

Fig 5-3 Distribution of Small Industries Estates in 1963

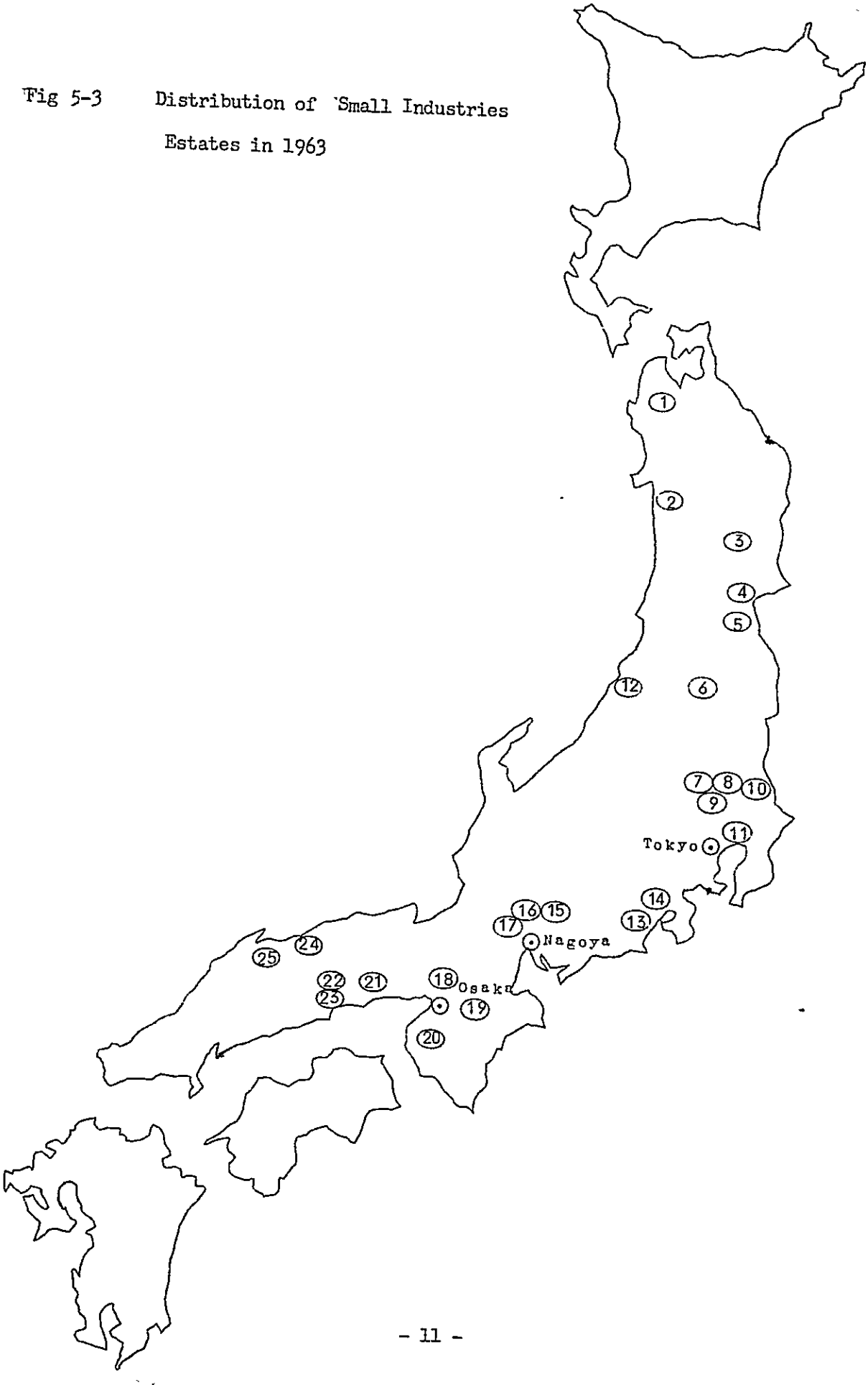


Table 5-4 Table estates in 1964

No. of map	Name of co-operative, association managing the estate	No. of enter-prise	Line of industry	Principal products	Area	Funds(unit: thousand yen)
1	Aomori Wood-working Association	24	Wood-working	Furniture and fittings	35,904m^2	194,361
2	Hachinoe Motorcar Maintenance Association	25	Motorcar maintenance	Motorcar maintenance	54,252	174,212
3	Akita City Association	39	Metallic engineering	Machining, casting, boiler-plate working, sheet metal working	219,727	766,446
4	Sendai Printing Association	27	Printing	Printing, bookbinding, plate making, polyethylene printing and processing	54,450	460,350
5	Yamagata Association	21	Metallic engineering	Oil pressure machinery, motorcar parts, machinery parts	103,587	484,917
6	Kashiwa Association	20	Metallic engineering	Press working and machining	44,778	204,697
7	Mishima Association	30	Metallic engineering	Wood-working machinery, agricultural machinery and implements, pumps, die casting	74,250	358,394
8	Okazaki Stone Products Association	41	Stone products	Stone-made dedicatory and garden lanterns, stone monuments, stone carvings, building stone	70,785	173,795
9	Fuwa Association	22	Metallic engineering	Boiler-plate working, castings, press, iron-working	66,611	335,143

10	Kanagawa Wood-work Centre	28	Wood-working	Various kinds of furniture	165,000	510,740
11	Yamanaka Lacquer Association	121	Lacquer	Lacquerware	42,900	394,728
12	Kaga-yamanaka Lacquer Association	161	Lacquer	Lacquerware	82,880	387,455
13	Uotsu Metallic Engineering Centre	22	Metallic engineering	Bearings, chemical machinery, boiler-plate working	69,300	308,516
14	Toyama Wood-work Centre	22	Wood-work	Furniture and fittings	33,000	214,526
15	Kuze Association	22	Machinery	Physico-chemical machinery, springs, medical machinery, meters and gauges	61,380	343,575
16	Nihon Carpet and Rug Association	24	Carpet and rug	Carpet, rug, mattings	217,800	1,233,722
17	Osaka Clothing Association	20	Clothing	Working clothes, student uniforms, overalls	66,000	991,043
18	Himeji Wood-work Centre	30	Wood-work	Furniture, fittings, lumber	72,600	429,833
19	Harima Fabric Centre	23	Fabric	Cotton cloth, synthetic fibre, sewing	79,596	782,278
20	Okayama Wood-work Association	21	Sawing	Sawn wood for buildings and boxes	102,878	714,725
21	Kojima Sewing Centre	20	Clothing	Student uniforms, working clothes	138,600	307,500
22	Innoshima Association	25	Iron-working	Parts of marine machinery	90,040	449,386

23	Kochi Food Industry Association	24	Food	Food	89,960	446,831
24	Kagawa Wood-work Association	20	Sawing and correlated lines	Lumber for buildings and furniture, plywood	219,450	1,148,270
25	Tokushima Association	24	Metallic engineering	Machine tools, iron castings, machining of parts	118,800	898,000
26	Chikugo Association	21	Iron-working	Agricultural Machinery, implements and parts	33,000	281,668
Total	20 Estates	877			2,387,528	12,998,112

Fig 5-5 Local Distribution of Estates

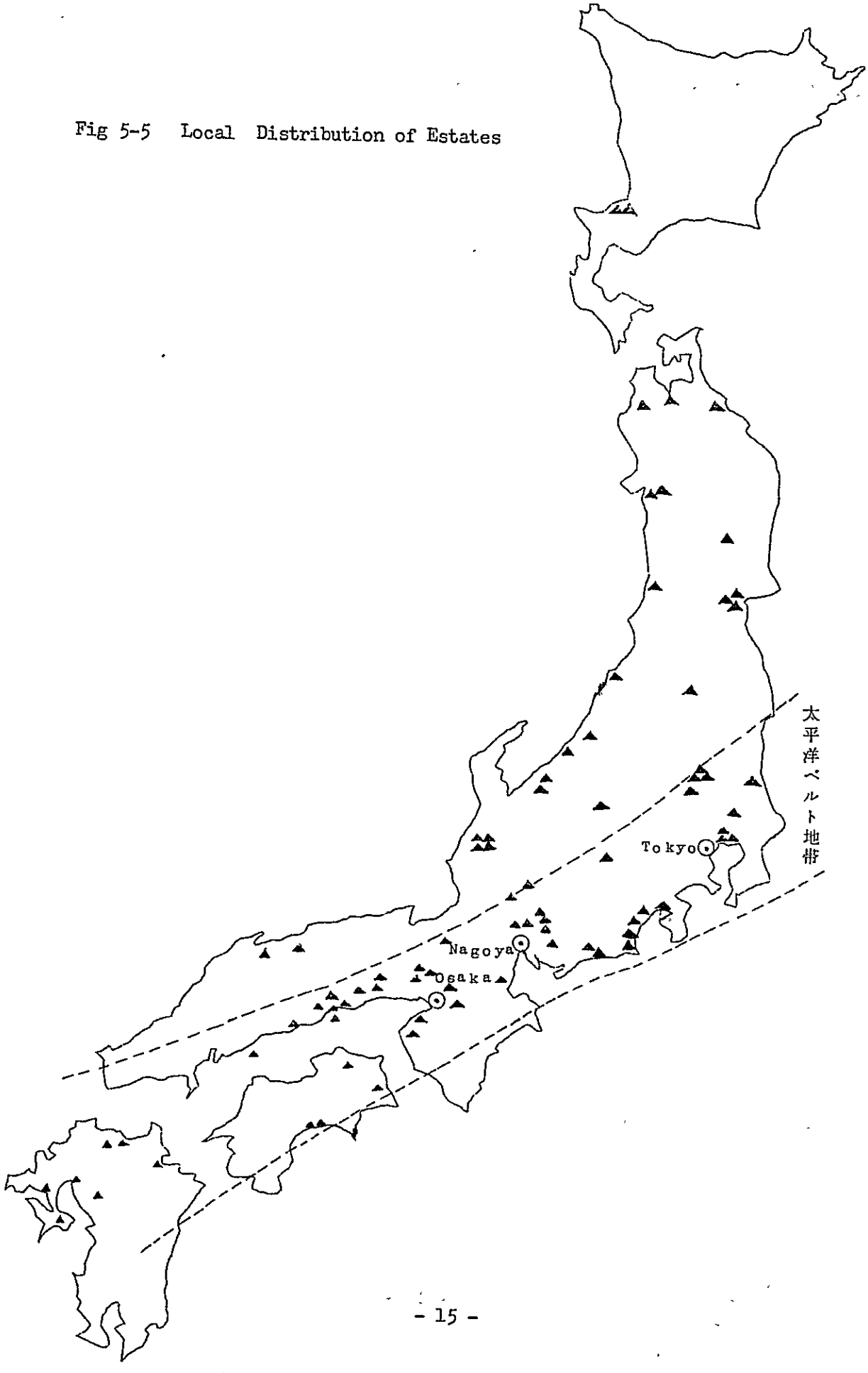


Fig 5-4 Distribution of Small Industries Estates in 1964