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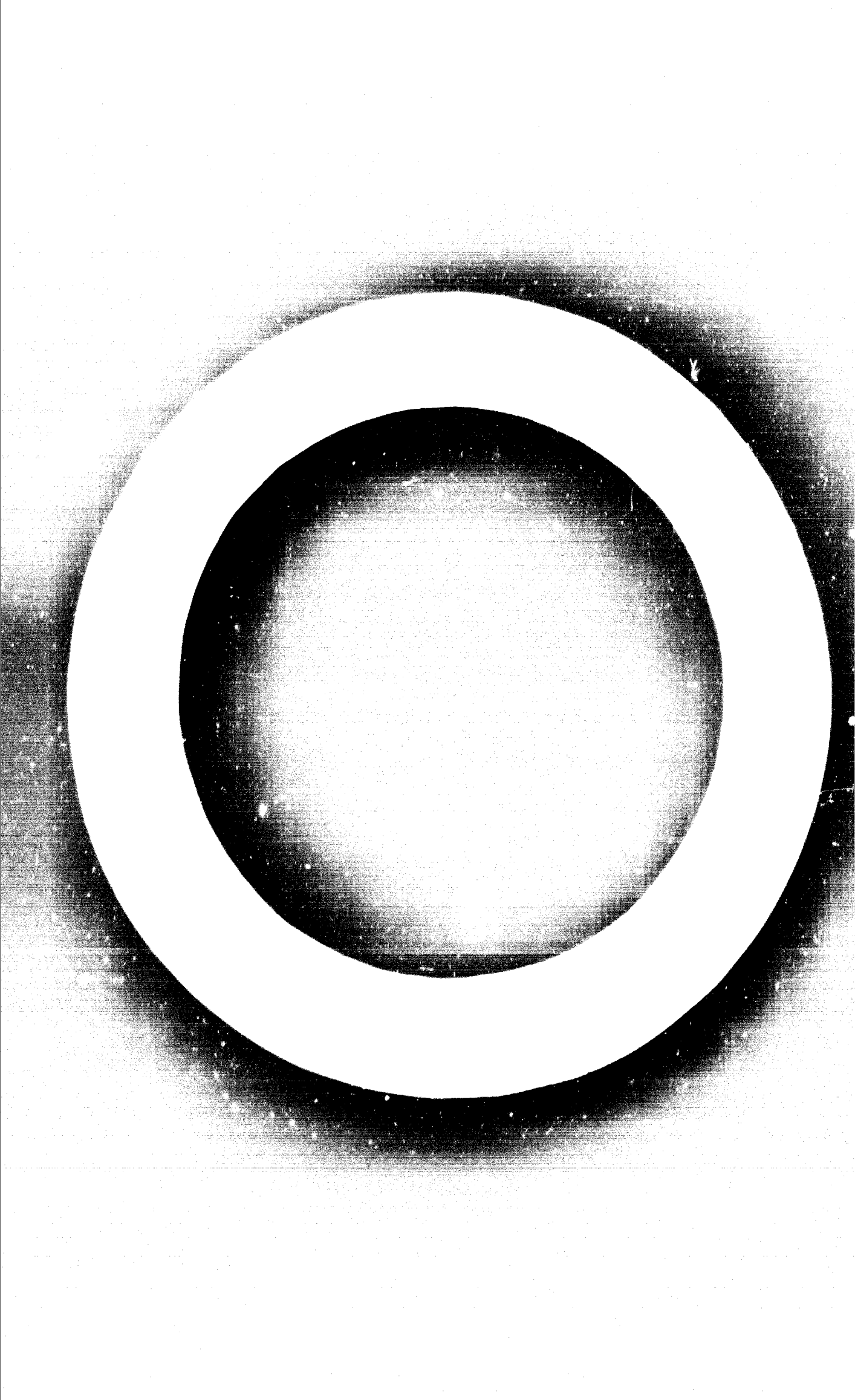
INDUSTRIAL EXCESS CAPACITY AND ITS UTILIZATION FOR EXPORT



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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INDUSTRIAL EXCESS CAPACITY AND ITS UTILIZATION FOR EXPORT

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In the course of economic development and industrialization developing countries often are confronted with an unexpected phenomenon - the impossibility of fully utilizing the productive capacity of their newly built industrial enterprises. Every developing country with a more or less significant process of industrialization knows the problem of excess capacity and seeks assistance to overcome it. In certain developing countries, underutilization of industrial capacity is becoming a major barrier to the entire process of further industrialization and, at the same time, threatens to make industrialization a burden to the economy. Without due regard to the possibilities of full or near economically sufficient utilization of a new industrial capacity, the industrialization of developing countries cannot obviously proceed normally.

Due to the specific conditions of the present economic position of developing countries, the problem of excess capacity (very different from the problem of excess capacity in major developed countries, especially in the United States) is primarily related to external, economic rather than to pure domestic matters. Imports constituting the process of industrialization of developing countries - beginning with capital equipment, financial resources, very often essential raw materials, spare parts and military supplies - come to developing countries from abroad. Correspondingly, the export trade becomes an integral part of the entire process, both because it is the only major way of paying for imported industrialization materials and because it provides an important outlet for the goods manufactured by the new industries.

In the United States, the problem of excess capacity, which recently has received great attention from American economists and public bodies, is a problem of American internal economy, connected with indigenous production of equipment, major raw materials, domestic market, labour supply and the general economic equilibrium of the country. The complex in which export trade plays a relatively small role, is best studied by corresponding institutions as one of the primary domestic economic problems of the country.

For developing countries, this approach is invalid. Though domestic economic conditions are of great importance, capacity utilization in developing countries cannot be dealt with unless the problems of external economic

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relations, which are so necessary for understanding the causes of excess capacity as well as for suggesting remedies for reducing or eliminating it are taken into account. For this reason, the problem of excess capacity in developing countries is being studied by the export industries section of UNIDO. The aim of the present study is to find a way of utilizing industrial excess capacity for export.

Despite the absence of reliable statistics on industrial capacity and its rate of utilization, and despite the lack of special comprehensive studies, the importance of this problem for developed countries was well recognized. For developing countries, however, the problems of excess capacity, until very recently, were considered non-existent. It was thought that, while experiencing deficiencies in all kinds of fixed assets of productive capacity in all industries, the developing countries could not suffer from the same ailment as industrially developed countries, inclined to the tragedy of waste. In the course of the past few years, however, both economic theory and practice related to the industrialization of developing countries have advanced the problem of excess capacity as one of the major economic problems of developing countries, hindering their growth and creating a tendency toward economic stagnation. Excess capacity implies a certain waste of investment capital, which is frozen in an unproductive capacity rather than being used more effectively elsewhere. Excess capacity not only creates a burden to the national economy but is a waste of capital, causing loss of efficiency and cost increase. In several developing countries under-utilization of industrial capacity already has become a serious economic problem. For example, a study of the Indian National Council of Applied Economic Research states that the continuing serious under-utilization of industrial productive capacity, built up partly with foreign aid, has been a matter of deep concern to the Government and public. This under-utilization has resulted in a waste of scarce resources which India, with its shortage of capital, cannot afford. It also has increased the chronic inflationary pressures on the economy. Better utilization of the existing capacity and satisfactory agricultural production helped to maintain price levels during the first five-year plan. During the second and third five-year plan periods, however, poorer utilization of existing capacity was largely responsible for the less satisfactory price situation.

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Although the scope of under-utilized capacity is much less in developing than in developed countries, the problem exerts a much stronger unfavourable influence on the economic balance of the former. The danger of further increase of the scope of under-utilized capacity is becoming more acute with the rapid development of industrialization in the developing countries. In developed and developing countries alike, the major factor leading to the inability to utilize fully all industrial capacity is the inadequacy of the market capacity to the production possibilities. In developing countries, the discrepancy between the market size and the production possibilities of the equipment is much more pronounced due to the fact that these countries are obliged to apply imported techniques and methods - developed and refined in the modern large markets of the United States and Western Europe - to their own small, often embryonic, markets.

The question of excess (under-utilized) capacity is now regarded by economists as a problem similar to that of chronic unemployment.[1/] Even in rich and industrially developed countries, excess capacity causes losses to the economy and impairs economic equilibrium. In certain periods an increase in the rate of excess capacity may result in an economic crisis and may sometimes lead to big losses for industrial companies and even to their bankruptcy. The problem of capacity utilization in developed countries, though different in nature and cause from that in developing countries, should also be studied to clarify many aspects of the possibilities of utilizing excess capacity in developing countries for export.

1/ A. Phillips, "Industrial Capacity An Appraisal of Measures of Capacity", American Economic Review, Vol. 53, 1963, p.275: "Both the number of unemployed and the volume of excess capacity indicate the extent to which society is failing to use...its resources".

The following order has been chosen for the presentation of the problem in the present paper:

- First, some statistical data are given to afford a general appreciation of the significance of the capacity under-utilization in developing countries, if such information is available.
- Second, a brief account of the unfavourable effects of capacity under-utilization for the industrialization of developing countries is put forward.
- Third, an analysis of the main causes for capacity under-utilization is given, seeking ways to eliminate or at least reduce it.
- Finally, some recommendations or trends and further steps for dealing with this problem are suggested. Special emphasis is laid on the statistical problems connected with the measurement of capacity and the evaluation of the actual level of capacity utilization.

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Information on capacity utilization in manufacturing industries is very scarce and fragmentary. Even when this information is available, it is not always reliable, though in many cases the rate of capacity utilization is reported with great accuracy - including tenths of per cent. More difficult is the problem of the comparison of this information which is derived from different sources and related to different countries. Despite all this, it is clear that, without additional capital investment, present industrial equipment is capable of producing much more manufactured goods, a good part of which could be exported.

The first part of this section deals with capacity utilization in India, which is by far the biggest developing country next to China (which constitutes a case by itself) with a comparatively large rapidly growing industry. The second part of this section presents statistics of capacity utilization in Latin American countries. All information given here was taken from published sources or from communications of various economic institutions to the UNIDO. The source material was assumed to be reliable; no corrections or verifications were made.

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INDIA*

No comprehensive estimates on capacity utilisation in developing countries are available. Even in India, where this problem receives serious attention by official governmental and planning bodies, only rough estimates exist. Production data are published occasionally in different documents and studies and very often the estimates contained in these studies differ widely. The report of the Import-Export Committee of the Government of India (1960/1961), for example, took the view that the extent of under-utilization of industrial capacity was limited to 10 per cent. The chemical, cement and sugar industries were running on full time, round-the-clock production and on the majority of cotton textile mills were on multi-shift. In short, according to this report, there was little room for improvement in industry, but the report optimistically pointed out that even this sector was improving. Another study, brought out at the same time by a different governmental organization - the Central Statistical Organization - indicated on the contrary, that only in 110 of 215 selected industries did the utilization of capacity exceed 75 per cent. Among the remaining 80 industries the proportion of utilization ranged from 65 to 75 per cent in 51 industries, and below 50 per cent in 7 industries, among the latter there were even cases of utilized capacity being less than 20 per cent.

In the autumn of 1966, the Indian National Council of Applied Economic Research published a special study of capacity under-utilization in Indian industry. Although 4,658 questionnaires were sent out to manufacturing units in 47 industry groups covering 176 industries only 1,036 replies were received; these served as the basis of the report. Out of the total of 176 industries only 140 have been covered by the various group indices of under-utilization. The results of the estimated under-utilization of industrial capacity in India during the years 1955-1964 are presented in the following table:

Table 1 Overall under-utilization of industrial capacity

(Percentage)

1955	- 11.3	1960	- 11.5
1956	- 11.0	1961	- 10.5
1957	- 10.3	1962	- 9.4
1958	- 13.2	1963	- 11.0
1959	- 13.6	1964	- 10.5

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These figures show the average capacity under-utilization on an annual basis taking into account capacity estimates as officially reported and based on the number of actual shifts worked (single shift for 102 of the 140 industries covered, double shift for 6, and three shifts for 32 industries with continuous production processes). This study, however, did not take into account the productive potential which could have been tapped if multiple shift working would have been able to be used. The index of capacity under-utilization conceals considerable disparity in capacity utilization between industries. The case of basic metals is cited by the study as an informative example. In the iron and steel group, the under-utilization varies from 0.1 to 16.3 per cent, in the non-ferrous metals group it runs from 16.9 to 35.0 per cent; while both groups are taken together, the extent of under-utilization is from 3.3 to 17.3 per cent. When industries are taken separately, a much greater degree of capacity under-utilization is revealed. Many major industrial groups have over 20 per cent of their capacity unutilized, and in some years unused capacity is as high as 50 per cent.

When calculations of the extent of under-utilization are made with reference to multiple shift working, which the Perspective Planning Division considered desirable, the result is a much greater percentage of under-utilization. On the basis of feasibility and continuity of production, the Perspective Planning Division envisaged double shift working for basic industries, 3-shift for 4, and double shift for the remaining 74. In all the proposed multi-shift working industries, including those not envisaged by the Perspective Planning Division, the technically relevant rate of under-utilization for the years 1961-1964 would be as follows:

Table [illegible] Extent of under-utilization of capacity
(Percentage)

Year	On present working schedules	On proposed working schedules
1961	10.7	18.6
1962	9..	17.6
1963	11.0	19.3
1964	10.5	17.7

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But even these figures (about 18 to 19 per cent of capacity under-utilization for all Indian manufacturing industries) do not show the real significance of the problem. These average figures conceal a greater rate of under-utilization in many important industries. Three major industries (textile products, basic metals and food products), contributing 37 per cent of the total value added by manufacturing, enjoy a comparatively higher rate of capacity utilization and work on a broader multi-shift basis than their industries. Their heavy weight in the statistics makes the overall average index of under-utilization rather low, though for many industries of primary importance for industrialization and economic development the problem of capacity under-utilization is of the most significance.

The following table contains data on capacity under-utilization in other than the above-mentioned three industries.

Table 3 Approximate rate of capacity under-utilization in selected industries
(Percentage)

Industry group	Range of under-utilization on present working conditions (1955-1964)	Average under-utilization on proposed multi-shift working (1961-1964)
Leather and leather products	20-30	57
Chemicals and chemical products	20-35	56
Non-metallic mineral products	20-22	35
Metal products	20-40	56
Machinery (except electrical machines)	10-30	31
Electrical machinery and appliances	10-20	43
Transport equipment	10-33	42

In a serious study on the role of export in Indian economic development, the Indian economist K.K. Singh - at present secretary of the Engineering Export Promotion Council - gave his estimates of capacity utilization in Indian industry in 1961. At that time 18 engineering industries were utilizing less

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than 50 per cent of their capacity (showing varying degrees of idle capacity from 98 per cent in the case of arsenical copper rods to 55 per cent in the case of wire ropes), 14 industries had a capacity utilization of between 50 and 75 per cent (with 50 per cent of idle capacity in the case of railway wagons and 25 per cent in the case of coated abrasives - both these industries having export potential), 15 industries had a capacity utilization of between 75 and 100 per cent. In his book Prosperity through Export, Singh considers that "the existence of a high percentage of idle capacity is a serious problem before the engineering industries" (p.39).

The under-utilization of productive capacity in the Indian chemical and chemical products industry is also quite substantial. Other industries which also could make some contribution to export are working below their capacity.

According to Singh's study, of the 25 industries connected with the manufacture of rubber products, 17 have a high utilization of capacity (above 75 per cent), but their production can be increased if they work more than one or two shifts (excepting those which are already working three shifts). Four industries belonging to this group work from 75 to 65 per cent and even below 65 per cent of their capacity. Many of the industries have export potential and given increased production, they would be in a position to export.

Of 63 industries belonging to the chemical and pharmaceutical branch, 27 have a capacity utilization of above 75 per cent, 17 have between 74 and 50 per cent, and the remaining 19 work below 50 per cent of their capacity. It is important to note that the installed capacity is based in most cases on single shift work.

At the beginning of 1967, the Industrial Credit and Investment Corporation of India (ICICI) made an estimation of surplus capacity in Indian industry together with comparative Indian and world prices. The results of this estimation of surplus capacity for the year 1965/66 and for the future (1970/71) are systemized in Table 4.

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Table 4 Output, installed capacity and demand - present and anticipated for selected industries

Industry	Unit	Installed capacity (1965/66)	Output (1965/66)	Demand (1965/66)	Additional capacity likely to materialise by 1970/71	Total anticipated capacity by 1970/71	Anticipated demand by 1970/71
Steel castings	(000 tons)	123	61	60	204	327	270
Steel forgings	"	84	65	75	108	192	120
Cast iron pipes	"	309	240	225	325	634	650*
Steel pipes and tubes	"	361	258	260	413	744	600
Wire ropes	"	28	18	16	12	40	30
Electric motors	(Lac HP)	22.35	17.04	20.00	7.59	29.94	35.0
Diesel engines (stationary)	(000 nos.)	70	85	66	6	76	200
Power-driven pumps	"	185	202	200	5	190	400*
Ball and roller bearings	(Mill nos.)	12	9	12	9	21	30
Welding electrodes	(Mill k.gs.)	1093	703	1060	737	1830	1850
Domestic refrigerators	(000 nos.)	36	30	30	18	54	55
Room air conditioners	"	20	11	20	19	39	35
House service meters	(Lac nos.)	13	11	11	5	18	15
Particle boards	(000 tons)	25	12	10	129	154	-
Aluminium	(000 tons)	53.5	61.3	100	60	113.5	330*
Cables and wires (VIR & PVC)	(Mill Core yds.)	1011	450	850	86	1097	1000
Hand tools	(tons)	1220	1200	5000	7000	8220	10000
Tyres	(000 nos.)	30700	20476	20000	1783	32483	54000
Railway wagons	(nos.)	32734	24427	-	1000	33734	-
Pistons	(000 nos.)	1600	1075	1500	300	1900	2700
Brake linings	(tons)	2150	1330	1435	1130	3580	2600

* Domand estimated by the Indian Government

Table 4 is meant to give an idea of the industries in which either substantial idle capacity exists or in which the anticipated volume of production is expected to be in excess of the likely demand by 1970/71. In the compilation of this table, data on the present installed capacity and output were obtained from official published sources; present and anticipated demand are based primarily on ICICI studies except in those cases where Government estimates have been made (indicated in the table). Additional capacity likely to materialize by 1970/71 has been taken from ICICI studies and from data published by the Industries Ministry, and includes only that part of the capacity for which firm foreign exchange commitments have been made.

Industries included in Table 4 represent broadly three types: the first category (steel castings, cast iron pipes, wire ropes, diesel engines, stationary welding electrodes, etc.) represents items where surplus capacity already exists; the second category (steel forgings, electro-motors, ball and roller bearings, domestic refrigerators, room air conditioners, etc.) includes items where a surplus situation is expected to develop in the course of a few years; and the third category (house service meters, wire ropes, particle boards, etc.) includes those items whose present output is deliberately curtailed to keep in step with domestic demand. Mention must be made of the machine-tool industry where due to the heterogeneity of products it is impossible to qualify production capacity and demand data. It is known, however, that this industry has a large unutilised capacity at present and is expected to carry significant surplus capacity for some time. The items which may be considered as readily exportable include centre lathes, milling machines, gear shapers, press hoppers, horizontal boring machines, planing machines, power presses, etc. Also included in this list are items of which there has been a glut on the internal market e.g. wired glass or chemical products such as BHC formulations, copper chloride, phosphide, or paper items such as tissue, stencil and carbon papers.

In a personal letter which sent us the following data on capacity utilisation in Indian engineering industries for the years 1955, 1960 and 1965. It is evident that acute under-utilisation has been a permanent malady of certain industries during the ten-year period of study.

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Table 5. Under-utilization of capacity in Indian engineering industries

Industry/product	Production as per cent of capacity		
	1955	1960	1965
Acute cases of under-utilization of capacity (i.e. below 50 %)			
Bandsaw blades	7.8	32.9	23.2
Hydraulic metal	79.1	35.2	24.6
Wire cop. of conductors	30.3	55.2	24.6
Looms (hattoo, semi-automatic and automatic)	54.9	52.6	36.2
Stoves	47.2	97.3	48.2
Cases of substantial under-utilization of capacity (i.e. 50-75 %)			
Thermoflasks	31.2	41.5	53.8
Duplicators	33.5	56.0	54.5
Tungsten carbide (sintered)	-	74.4	56.8
Air conditioners	-	52.3	56.8
Wire rope	-	51.3	58.9
Rubber insulated cables and flexibles	99.2	87.4	60.7
Oil pressure pumps	64.8	51.7	61.8
Machine tools	8.5	30.9	62.0
Typewriters	28.1	52.3	62.3
Grinding wheels	94.1	103.3	63.2
Steel castings	100.1	83.5	67.4
Aluminium conductors	77.6	117.4	70.4
Paper insulated power cables	-	147.5	70.9
Ball bearings	134.4	188.8	71.3
Milling cutters	-	139.1	71.6
Power transformers	-	86.3	72.7
Cases of moderate under-utilization of capacity (i.e. 75 % and above)			
Road rollers	-	94.1	75.2
Water intakes	44.1	89.8	75.2
Arc welding electrodes	125.8	84.3	75.4
Locomotives	-	140.1	76.2
Machine screws	145.3	87.3	79.0
Winding wires	136.8	96.1	82.4
Lathe tools (tool bits)	-	115.4	84.3
Horizontal lenticulars	109.7	113.1	85.9

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Table 5 (contd.)

Industry/product	Production as per cent of capacity		
	1955	1960	1965
Grinding wheels	64.2	66.4	85.9
Steel files	15.8	66.3	87.8
Fluorescent lamp	108.5	127.2	92.8
House service meters	128.3	125.1	95.0
Million cutters	36.7	105.4	93.3
Electric fans	92.9	116.8	95.3
Plastic accessories, electric wiring	-	-	95.6
Sewing machines	244.5	220.3	95.4
Enamelware	52.4	47.2	96.3
Diesel engines, vehicular type	129.2	176.2	96.4
Miniature lamps	-	-	99.4

Source: R.K. Singh

* Capacity has been assessed on a double-shift basis (all others are based on single shift).

\- Denotes nil/not available.

Current statistics on capacity and production in Indian industry reflect the same situation with regard to capacity utilization. The rate of capacity utilization fluctuates from year to year and from one period to another within the year. This is not only because of changes in production, but also because the capacity estimations fluctuate. It is usually expected that the trend of capacity installed in developing countries be upward, but in the case of some Indian industries the capacity (at least capacity estimations reported by the official statistical authority) fluctuates upward and downward like production.

Capacity estimates fluctuate from year to year. In certain industries reported capacity can be significantly smaller one year than in the previous year without obvious changes in the real volume of the fixed assets. This is illustrated in the following table.

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Table 6 India, manufacture of transport equipment, estimated monthly installed production capacity of trailers (nos.)

1954	641	1965 January	762
1955	647	February	762
1956	591	March	762
1957	860	April	762
1958	533	May	762
1959	650	June	762
1960	643	July	762
1961	643	August	762
1962	655	September	526
1963	672	October	526
1964	671	November	526
		December	526

In January 1965, installed capacity was reported as 762 trailers per month; in September of the same year the estimation was drastically reduced to 526 though actual production in this month (666) exceeded the reported monthly capacity by more than 25 per cent.

It is not easy to say whether these fluctuations are the results of pure statistical operations, or whether they reflect actual changes in the volume and size of installed capital equipment. As statistical methods of estimating capacity improve, it is inevitable that such methods will be adopted which will give other results even if they are applied to the same material. The director of the Central Statistical Organization, K.L. Sarsena, informed us that it has recently been decided to express the capacities of industries along the basis of annual maximum utilization of plant and machinery. The concerned agencies responsible for the development of industries are taking steps to re-assess the capacities on this revised basis. From now on the official estimations of capacity will be different from those made previously, even when there is no change in the physical volume of the equipment. Comparisons with earlier years will be even more difficult to make.

As far as fluctuations of output are concerned, their influence on the rate of capacity is very important in certain industries. Without taking into consideration those industries with most variations of production (food processing, etc.), it is easy to discover many examples of drastically fluctuating output levels during the year. The production of bandsaw blades in India in 1965 may serve to illustrate this point.

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With an installed monthly capacity of 180,500 running metres of bandsaw blades in January 1965, the actual monthly production was:

Month	Actual production (running metres)	Capacity utilization (percentage)
January	28,878	16
February	15,141	8
March	21,830	12
April	21,789	12
May	19,979	11
June	36,414	20
July	89,781	49
August	80,192	45
September	19,260	11
October	17,558	10
November	107,785	60

With great fluctuations in production throughout the year (15,000 metres in January and 108,000 in November) the rate of capacity utilization changed very drastically. In January only about 8 per cent of capacity was utilized, in November 60 per cent.

The same situation can be observed also in other Indian industries. Although production is not seasonal great fluctuation in the rate of capacity utilization throughout the year is particularly evident in the plasticizer industry. With a capacity of 233.3 tons per month at the end of 1964, the production of plasticizers and capacity utilization in this industry in 1965 was:

Month	Production (tons)	Capacity utilization (percentage)
January	94.9	41
February	83.4	37
March	100.0	43
April	296.1	127
May	298.4	124
June	286.8	127
July	298.8	91
August	212.5	86
September	199.0	28
October	64.6	81
November	188.1	67
December	157.8	

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With the reported average monthly capacity of 672 trailers in 1963, actual monthly production was:

Year	Production (nos.)	Capacity utilization (percentage)
1963	282	42
1964	566	86
1964 December	156	24
1965 January	1,046	168

Under-utilization of capacity in the engineering industry of India is due in part to the shortage of the main raw material - steel. At the same time, however, the iron and steel industry of India is not utilizing its capacity fully; according to the information of the National Metallurgical Laboratory of India, under-utilization will continue in the iron and steel industry until at least 1970/71. Installed capacity and actual production of main metals and heavy equipment are reported by this laboratory as follows:

	1960/61			1970/71		
	Capacity	Production	Capacity Utilization (percentage)	Capacity	Production	Capacity Utilization (percentage)
Iron and steel:						
a) Steel ingots	5,000	3,100	79	14,600	11,500	89
b) Finished steel	6,600	5,300	80	11,000	10,000	92
c) Pig iron for sale	1,400	1,400	100	3,200	3,200	100
Alloy, tool and stainless steel	50	35	70	500	400	80
Aluminium	73	80	109	200	200	99
Machinery:						
Metallurgical and other equipment	30	15	50	100	60	60
Steel casting	170	60	35	300	250	84
Coal cutting and other mining machinery	75	12.5	17	60	45	73

In the early part of 1967 a special mission from UNIDO studied the main factors affecting India's export expansion. The mission came to the conclusion that the machine-tool industry in India has been in a slump for two years, and is operating only at present at 25 per cent of its capacity. The surplus of coal cutting machinery capacity could be utilized to design and build such new special purpose machinery that would be readily marketable. This industry specially

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could sell its machines at substantially lower prices than the United States and Europe. To take advantage of this opportunity, India's machine tool industries must be given more overseas marketing and credit financing flexibility.

The problem of excess capacity is growing in importance with the progress of industrialization. It is especially acute in larger developing countries where new industries are being established on a relatively wide scale. India presents the most evident case for the necessity and urgency of the solution to this problem. The growing concern of the Indian Government and the increasing pressure of economists resulted in a special research project being undertaken by a group of experts with an aim to explore this problem in all of its ramifications. In the summer of 1965, a special joint study of the extent of utilization of India's industry was launched by the Government of India in co-operation with the United States Agency for International Development.

This study was conducted in spite of the fact that India was the only country in the world which had officially published statistics of installed capacity. Nonetheless, many people in India believed that there was more potential capacity than that reflected in official statistics. Indeed, such a conclusion appears well founded if one studies the monthly production statistics of selected Indian industries in which the normal production figures for some goods are much higher than the installed capacity reported on the same basis (e.g. with an officially published monthly installed capacity rate of 15 spinning frames in 1964 the actual production was reported as 19 frames, in fact, [illegible] the estimated monthly average capacity, cf. p.117).

One of the aims of the study was to determine whether the data available to the Government of India in the Directorate General of Technical Development was sufficiently valid to permit its use in calculating the extent of utilization industrial plant in India and if not what might be done to improve the data available to the Directorate General of Technical Development if this was found necessary.

Results of the study confirm the fact that capacity [illegible] differs from that officially recognised and published. In the case of textiles, discounting the effective capacity, based on two working shifts, of the plants studied appeared to

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be substantially higher than that licensed under the Industries Development and Regulations Act and reported in the Directorate General of Technical Development statistics. Analysis of the data from various available sources indicated that the total existing capacity based on 2½ working shifts amounted to approximately 1250 million as compared to the published figure of about 1100 million running feet. A comparison of this estimation with production data shows a large amount of excess capacity. At the time the study was made (in the first half of 1965), the annual rate of production was 800 million running feet; thus the rate of capacity utilization was only 64 per cent and output could have been increased by 55 per cent with the existing installed capacity without taking into account the new capacity which had to be introduced shortly afterwards.

The study discovered two main reasons for the high rate of capacity underutilization. First, the domestic demand for regular mild steel electrodes was fully met by the current production. No additional demand could be expected unless the electrodes could be exported to other countries. Second, there was a shortage of special electrodes which were produced on the same equipment. An increase in the production of special electrodes in order to satisfy the market demand would have increased the rate of capacity utilization and would have contributed to better results in the industries consuming this scarce product, but the lack of an adequate supply of special steels restricted the production of these electrodes.

Similar discrepancies were observed in the manufacture of leaf springs where actual capacity exceeded that which was officially recorded. An analysis of the available data indicated that the total existing capacity amounted to approximately 45,000 tons on a 2-shift basis as compared to the Directorate General of Technical Development figures of approximately 5[illegible],000 tons.

In the manufacture of galvanized pipes and tubes total capacity proved to be 406,000 tons on a 3-shift basis as compared to the Directorate General of Technical Development figures of approximately 290,000 tons.

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Table 7 Estimation of capacity utilization in selected Indian manufacturing industries (1964)

Industry	Unit	Capacity	Production	Average number of shifts	Capacity Utilization on 1-shift basis	Capacity Utilization on 2-shift basis
Automobile (all types)	nos.	58,000	66,741	2	115	57
Diesel engines	nos.	77,740	74,735	1.68	97	48
Power driven pumps	nos.	160,909	161,131	1.31	100	50
Air compressors	nos.	5,938	2,928	2.03	59	30
Transformers	th.kwt	2,071	3,126	1	150	75
Electric motors	th.H.P.	1,390	1,318	1	94	47
Electric fans	th.nos.	1,474	1,050	2	71	36
Storage batteries	th.nos.	660	748	2	118	59
Dry batteries	ml.nos.	296	283	2	95	47
Railway wagons	nos.	35,534	23,616	2	-	66
Cranes and hoists	M/T	17,000	10,000	1	59	30
Structural fabrication	M/T	575,000	300,000	1	52	26
Pulp & paper making plants	M.Rs	55	17.3	1.56	31	16
Building and construction machinery	M.Rs	72	20	1.33	28	14
Bicycles complete	th.nos.	1,679	1,421	1.1	84	42
Sewing machines	th.nos.	445	192	1.38	43	22

Source: Compiled from a preliminary study on the Effects of Import Liberalization on Increased Utilization of Industrial Plant Capacity and Related Economic Problems and Benefits.

Table 8 Manufacture of chemicals and chemical products

Product	Unit	Period studied	Capacity	Production	Capacity utilization (percentage)
Benzene	th.litres	1963	2,943	1,765	59
Acetylene	th.cubic metres	Aug. 1965	909.7	434.5	47
Acetic acid	th.kgs.	April 1965	1,123	422	38
Ethyl alcohol	th.litres	1963	6,331	2,110	34
Rectified spirit	th.litres	July 1965	27,297	16,224	60
Acetic anhydride	tons	1963	304	285	94
Acetone	tons	1961	58	63	108
Ethyl acetate	tons	Jan. 1965	253	183	71
Yeast	tons	1964	74	33	45
Sulphuric acid	tons	Aug. 1965	90,192	45,060	50
Caustic soda	tons	Sept. 1965	22,384	17,946	82
Soda ash	tons	May 1965	27,433	24,988	93
Chlorine liquid	tons	Nov. 1965	5,532	4,232	76
Bleaching powder	tons	1962	1,080	560	55

Latin America

All countries of Latin America report heavy under-utilization of industrial capacity. In 1962 the degree of capacity utilization in Central American countries was.

Nicaragua - 82 per cent
Guatemala - 74 per cent
El Salvador - 73 per cent
Costa Rica - 72 per cent
Honduras - 68 per cent

Surveys taken in Ecuador in 1959 and 1961 show that in this country only 41 per cent of the manufacturing capacity is utilized. In Argentina, different industries have a different degree of capacity utilization, but not one industry

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utilizes more than 88 per cent of its capacity and some industries as little as 43 per cent (1961-1967). A paper presented for the ECLA Regional Symposium on industrialization states that it may be broadly concluded that installed capacity was not being fully utilized in most of the branches of Colombian industry.

A significant degree of under-utilization is reported in Chile. In 1957 large-scale industry in this country utilized 55.2 per cent of its theoretical maximum capacity, medium-scale industry - 33.1 per cent, small-scale industry - 50.3 per cent. These estimates differ, however, from the somewhat higher estimates made by the industrialists canvassed (which are not always in keeping with the maximum employment periods given). For the manufacturing industry as a whole, the official estimate of capacity utilization calculated as percentage of maximum theoretical capacity is 45.7 per cent as above against the estimate of the industrialists - 64.6 per cent. Maximum capacity in this case is maximum output during three eight-hour shifts in large-scale industry, two shifts in medium-scale industry and one shift in small-scale industry, with some exceptions where special working conditions determine the number of shifts.

In Venezuela, according to the estimates of CORDIPLAN, there are divisions in each major industrial group which use less than 50 per cent of their capacity, while other divisions use between 50 and 75 per cent. Among the industries utilizing less than 50 per cent of their capacity, the following have export potential: canned and shell-fish, chocolate and confectionery, fruit juices (food industry); knitted fabrics and rope (textile industry); wearing apparel (clothing industry); wooden furniture, special types of paper, fur, sulphuric acid, aluminium products, etc.

As in India, the average rate of capacity utilization in Latin American countries conceals a much higher degree of excess capacity in certain smaller branches and in some enterprises within a single branch. For example, the textile industry of Honduras in 1962 used 74 per cent of its capacity, but the rate of capacity utilization in textile enterprises having between 20 and 49 workers was only 9 per cent (larger units with more than 100 workers worked with a higher degree of capacity utilization, i.e. 78 per cent). With 74 per cent of capacity utilization for total industry in Guatemala (1962), the timber and cork

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industry utilized only 59 per cent, the furniture industry - 53 per cent, and the metalworking industry - 61 per cent of capacity. These estimates, made on the basis of statements of industrialists, are somewhat different from the Central American Bank's official estimates of theoretical capacity.

Detailed information is available on production cost variation dependent upon capacity utilization for the food processing industry in Brazil in 1963. According to a study undertaken by the Institute Brasileiro de Economia, the degree of capacity utilization varies greatly within a single industry. Whereas some enterprises work with full capacity utilization (100 per cent as reported by the enterprises) other enterprises use only 32 per cent of their capacity. A smaller enterprise in the meat canning industry reported only 10 per cent of capacity utilization.

In the case of the Brazilian food processing industry the dependence of capacity utilization on the size of the plant appears to be of certain interest. Although some enterprises reported 100 per cent capacity utilization, there were no large enterprises in the corresponding industrial group; usually they were middle-sized, sometimes smaller enterprises. The capacity utilization of larger plants is generally neither the lowest nor the highest within their industrial group. The highest degree of capacity utilization is reported by middle-sized (rarely smaller) enterprises. In the bakery and biscuit industry, larger enterprises (those with a capacity of 120,000 tons per year) utilized 70, 90 and 100 per cent of their capacity, smaller enterprises (2,000 tons per year) presented a somewhat mixed picture with capacity utilization of 44 and 90 per cent.

II. UNFAVOURABLE EFFECTS OF CAPACITY UNDER-UTILIZATION

In developing countries capacity under-utilization, which is partially the result of economic disequilibrium, aggravates the situation and makes the disequilibrium more intense. Under-utilization of industrial capacity endangers the very process of industrialization, and may cause industrialization to become detrimental rather than helpful to the solution of economic problems and to the furtherance of fast and progressive development.

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Under-utilization of capacity in developing countries causes the investment-output ratio to rise and in so doing reduces the economic efficiency of production. As investments in developing countries have a very high import component, the import-output ratio in new industries is rising. These and other factors impede the general progress of industrialization.

Under-utilization of industrial capacity results in a fall of the profit rate and in losses of investment fund (both for gross investment and for net capital formation).

Under-utilization of capacity induces further concentration within the existing industries and acts as a strong deterrent against entry by outside firms, thus increasing the rigidity of the monopolistic structure and preventing its transformation by barring the introduction of more efficient techniques.

If a company or enterprise has a high rate of under-utilization of productive capacity, there are no incentives for introducing further technical innovations which demand additional investment for they promise to cause even greater under-utilization of capacity. On the other hand, if the utilization of installed capital equipment were more intense in developing than in developed countries (e.g. double- or triple-shift work with equipment usually used by one-shift in developed countries; or supplying, where it is economically justified, more labour to the unit of equipment) it would greatly contribute to economic development, industrialization and to the solution of economic, social and human problems.

Fuller utilization of plant capacity creates additional jobs and brings overall expansion into the economy of developing countries. It contributes to the growth of the market and to the increase of national income in other sectors.

Lack of capital and shortage of foreign exchange are the primary factors hindering the desirable process of industrialization in the developing countries. If existing fixed assets can be made to yield greater output, developing countries will be able to produce a larger total output, to facilitate the process of industrialization, to increase both national wealth and personal income and to improve the economic efficiency of their productive mechanism.

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Better utilization of installed capacity would mean great gains for the economy of developing countries. The volume of industrial production would increase, and the rate of development would be much higher. The cost of production would be lower, the competitive power of the product on the world market would be stronger. Employment would increase and income (including plant profits and workers' wages) would rise.

All this is well understood by the governments and business people of many developing countries. Consequently plans often provide for better plant utilization, though these provisions are formulated far too schematically. They are seldom backed with appropriate financial, technical and organizational measures.

The second plan of India's economic development gives special attention to the necessity of fuller utilization of the existing industrial capacities. It is a basic principle of planned development that capital resources which are scarce in relation to competing demands should be conserved and that additional production should be achieved to the maximum extent possible through greater use of idle capacity.

The cost structure of industrial products in developing countries makes an intensive use of plant facilities especially valuable as compared with developed countries. In most developing countries, capital is scarce as compared to manpower, and the price of equipment is unrealistically high in relation to the economic situation of the country. Classical research work by Harry J. Solomon shows the differences in the relative importance of machinery and manpower in terms of cost formation in India and the United States. He expresses the value of machinery by monthly capital charges and computes the ratio of this monthly value to the monthly remuneration of the operator. The ratios for a specific machine used both in India and the United States are startling as can be shown in the following comparison.

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Monthly costs of a specific machine in India and the United States

Country	Monthly rental value (depreciation, interest and maintenance	Monthly remuneration of operator	Ratio of rental value to operator remuneration
India	Rs 2,[illegible]	Rs 150	14.7
U.S.A.	[illegible] 46	[illegible] 300	1.8

Given the same efficiency of men in India and the United States the differences in cost structures would make it advantageous to have three men for two machines in India where such an arrangement would not be profitable in the United States. As the productivity per man is lower in India, the advantages of multi-shift operation become even more pronounced.

For developing countries, much more than for developed, full capacity utilization is a necessary prerequisite for any further expansion of capacity. In achieving full capacity utilization, exports must play a major role due to the specific dependence of the industrialization of developing countries on the outside world.

There are two main aspects to the problem of utilizing excess manufacturing capacity for export. Both of these aspects are very closely interrelated and therefore should be discussed together. One aspect is related to the various technical, economic, managerial and social difficulties which should be solved in order to achieve better utilization of installed capacity at each enterprise and in the industry as a whole. This aspect of the problem is very important and UNIDO can provide substantial assistance to the developing countries in finding ways of solving the difficulties. Studies in this field have been made both in developed and developing countries and can provide information which may be useful to other countries and industries. Certain difficulties can be eliminated through improvement in management, better planning and economic co-ordination as well as through additional investments which, in the frame of the existing market structure and pattern of demand, may be very small in comparison with the potential gains, including a better utilization of the population

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The second aspect is connected with the limits imposed upon production by market structure, pattern of demand and the restricted possibilities of selling additional output on the domestic or world market. This aspect is no less important than the first one, for economic and social difficulties are much more difficult to overcome without serious changes in both the socio-economic structure of the developing countries and in international economic arrangements. If no market exists for additional commodities produced through better utilization of capacity in developing countries, neither any period-to-period planning improvement nor the introduction of new methods will increase the rate of capacity utilization. On the contrary, an increase in the productive potential may contribute to a yet greater under-utilization of capacity with all its familiar consequences.

III. [illegible] CAUSES OF EXCESS CAPACITY

Broadly speaking, there are three major causes for the existence of excess capacity: (1) in building ahead of demand the indivisibility of plant must always lead to a certain degree of temporary under-utilization of capacity; (2) an oligopolistic or monopolistic market structure, which leads to a production level below that of minimum average cost and less than physical capacity; (3) supply bottlenecks of various kinds. Some other causes are often met with in practice. (The obsolescence of certain lines of production represents a misinvestment and is different from excess capacity proper.)

All these causes are often found in combination and in practice are difficult to disentangle from one another, although analytically they are distinct. To a certain degree the first two causes of excess capacity are inevitable concomitants of growth; the first, because technology determines that the establishment of plants for a given increase of payment can proceed only by discontinuous jumps, and the second, because the transplantation of modern techniques to limited markets often has the result that only a small number of firms can be sustained by such a market. Because these two causes of under-utilization of capacity are largely technically determined, they cannot therefore be done away with, at best they may be mitigated by various policy measures.

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The third cause of excess capacity has to do with the unbalanced growth of various sectors in a developing economy and with balance of payment difficulties which create supply bottlenecks and thus reduce output below the level it could otherwise attain. In countries such as India, for example, this problem assumes major proportions. In fact, a recent study of the problem of capacity under-utilization[2/] deals exclusively with these causes as the factors responsible for under-utilization. It states that the following causes are responsible for under-utilization (in so far as the respondent firms were concerned): (1) shortage of raw materials, (2) shortage of foreign exchange, and (3) labour troubles (i.e. shortage of skilled manpower). Many of the firms which returned the questionnaire mentioned lack of demand for the product or other market difficulties. But this does not mean that the market problem does not exist. Much depends upon the composition of the questionnaire sent to such firms and preoccupation of people answering the questionnaire. The three causes studied in the study are easier to ascertain and hence easier to remedy. They could probably be dealt with through existing international aid facilities whereby such aid would have a multiple effect in the sense that the elimination of certain critical supply bottlenecks would increase output by far more than the usual capital-output ratio of foreign aid.

Among the supply bottlenecks which result in under-utilization of installed capacity, one must distinguish between those which involve investment and are therefore of a long-term nature (for example, insufficient supply of electric power which can be provided only by the establishment of new power plants) and those which relate to expendables and are essentially of short-term nature (e.g. lack of critical raw materials of adequate quality).

It is very difficult to distinguish excess capacity resulting from a malfunctioning of the economic mechanism, from the technically unavoidable excess capacity that always accompanies growth. But for the practical purpose of reducing excess capacity and utilizing the additional output for export, such a

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2/ National Council of Applied Economic Research, Under-utilization of Industrial Capacity, New Delhi, Oct. 1966.

distinction is necessary. Building ahead of demand when modern and effective equipment is not fully utilised can provide for a surplus of products which could be exported. An oligopolistic or monopolistic market structure, on the other hand, can prevent fuller utilisation of capacity even when there is a local demand for the product, not to speak of the difficult and costly attempts to find export outlets. Supply bottlenecks present another problem.

In order to make a quantitative analysis of some of the main factors contributing to capacity under-utilisation, it will be necessary to combine pastoral studies involving market research, cost analysis, company structure research, etc. At present, however, only various kinds of supply bottlenecks have been studied with qualitative thoroughness, and other causes of under-utilisation are left for more comprehensive analyses in the future.

Only occasional remarks by persons conducting research studies are available regarding the market difficulties as important determinants of capacity under-utilisation. These remarks tend to support the conclusions reached by pure theoretical speculations on the limits and obstacles to the economic growth of developing countries in the present world economic structure. Thus, in a special report submitted by F.J. Glover to the United Nations Centre for Industrial Development in December 1965, limitation of market demand is stated as the first of a number of reasons for low capacity utilisation in the Chilean wood-working industry. In the opinion of A.K. Singh, a substantial part of under-utilisation of capacity in the Indian manufacturing industry may be due to the dwindling market for the goods produced.

Short supply of [illegible] and utility supplies

Inadequate supply of raw materials and other inputs are important causes of under-utilisation of capacity in many cases where the market demand could permit a higher rate of utilisation. In several cases where the actual capacity is well in excess of market demand, the actual capacity utilisation is even lower than the market demand. A study on capacity utilisation in the Indian tin containers manufacturing industry discovered that although installed capacity was in excess of demand, production was short of demand by the equivalent of some

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15,000 tons of timplate for 1964/65, according to estimates of the National Box Company. Other firms in this industry studied by the research group also were convinced that demand for all types of containers was well in excess of their ability to produce, due to restrictions in the availability of timplate.

Many manufacturing enterprises established in developing countries suffer from the shortage of raw materials with which becomes there are no indigenous sources of these materials or because the indigenous sources are insufficiently developed. There is a widespread productive capacity in industry is not being fully utilized because of the lack of raw materials, and at the same time raw materials producing industries are not utilizing their capacities. The Indian metallurgical industry is not utilizing to capacity because of inadequate supply of basic steel ingots. At the same time there is a need to ensure that the capacity of the steel industry is not fully utilized. A certain degree of underutilization of capacity in this industry is predicted for the future as the following statistics show.

Table 2. Capacity, production and capacity utilization of steel industry

(thousand tons)

	1962/63			1970/71		
	Capacity	Production	Rate of capacity utilization (percentage)	Capacity	Production	Rate of capacity utilization (percentage)
Steel ingots	8,900	7,100	80	14,600	13,000	90
Finished steel	5,600	5,300	90	11,200	10,000	90
Pig iron for sale	1,200	1,200	100	3,200	3,200	100

Source: National Metallurgical Laboratory Report (Survey), Nov. 1965.

As is at 20 per cent of steel ingots and finished steel capacity was not utilized in 1962/63. A similar percentage of capacity under-utilization is expected for the future.

A study conducted by the Indian Institute shows that shortage of raw materials is at present seriously holding up production and preventing the full

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utilization of the nation's industrial capacity. Out of a total of 129 returns, [illegible] units reported the shortage of raw materials as one of the major bottlenecks of production. Raw material scarcity is a simple factor; it is caused by a number of different reasons and exerts various influences on the economy. It is possible to classify general raw material shortage into the following types, each with its specific problems:

(1) shortage of imported raw materials due to lack of foreign exchange and the maximum import [illegible] problems restrictions;

(2) uncertain deliveries of raw materials due to poor supply and/or transport organization and to communication difficulties, etc.;

(3) high cost of raw materials;

(4) inferior quality of raw materials;

(5) variations in raw material quality and lack of standardization;

(6) inadequate supply of indigenous materials;

(7) local unavailability of certain materials which cannot be imported without difficulty;

(8) comparatively high cost of raw material transportation.

In Turkey, according to the reply of the Turkish Government to United Nations questionnaires, the shortage of imported raw materials and spare parts has resulted in substantial excess capacity. The same situation is prevalent in the food-processing industry in Brazil. Fifty-four per cent of all replies to the query concerning the main reasons for capacity under-utilization named difficulties in obtaining raw materials (25 per cent complained of insufficient demand and 21 per cent complained of lack of working capital).

Raw material quality

The inferior quality of raw materials directly affects the degree of industrial capacity utilization. Two independent studies of two very different industries in two distinct countries state that the inferior quality of raw material supply is a very serious factor in this respect. A study on capacity utilization in the building electrode industry in India reports that the electrode manufacturers state that in spite of a quality premium being charged by the mills there is a high percentage of rejections. The major electrode manufacturers tested a very large percentage of the newly-delivered steel supply and had

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extensive consultations with the mills with regard to improving the quality of the steel. A vast amount of time and energy was devoted to securing the right quality of steel and even so, considerable quantities of the steel supply and, on occasions, even the finished product had to be scrapped. When equipment is employed to manufacture products out of raw materials of inferior quality, the result is complete spoilage; the capacity is utilized to produce waste. From the viewpoint of working-hours, the capacity is utilized, but from the point of view of real output - which is the final aim of capacity utilization - it is not.

A study on capacity utilization in the food processing industry of Brazil confirms this conclusion. Twenty-five of the 136 enterprises which reported information on capacity utilization related to the raw material supply stated that the main reason for the difficulties they experienced in this respect was due to the inferior quality of their raw material supplies.

Several companies producing tin containers in India and visited by the research group studying the problem of excess capacity in this industry gave information very similar to that obtained from the food-processing industry in Brazil. They stated that sometimes sub-standard tinplate had to be enamelled at considerable expense and then used for such products as talcum powder containers or serving trays. Owing to the inferior quality of raw material, steel sheets and scarce tin could not be used for the intended purposes and were thus either wasted or the processing industries had to bear the cost of reworking the material for other uses. From the viewpoint of capacity utilization this results in a reduction of the actual rate of utilization in terms of final output though the equipment may be used full time doing double work - first to produce waste, then to rework it into other (cheaper) products.

Several Indian enterprises reported significant production losses due to non-standardized or inferior quality raw materials. Six out of 129 units which replied to a National Council of Applied Economic Research questionnaire, reported as much as 20-40 per cent loss in production due to this reason; other units reported losses of up to 40 per cent.

Table 10 gives a more detailed idea of losses in production due to the poor quality of raw materials.

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Table 10 Main causes of material loss

Products	Type of material	Nature of defects	Extent of loss (percentage)
Machine-tools, flour mills, auto-jacks, railway jacks	Castings	Presence of blow holes	25
Fabricated structurals	Raw steel materials (plates, sheets, sections, pig iron)	Twisted and bent sections and poor quality of pig iron	25
Power-driven pumps	Pig iron	Poor quality	20
Cast-iron castings	Pig iron	Grade II or III presence of stones in scraps	10-20
Bicycle rims	Steel	Poor quality	8-20
Radio receivers	Components	Poor quality	5-10
Machine-tools, diesel engines, P.D. pumps, textile machinery, electro motors	Mild steel	Poor quality	5-75
Hurricane lanterns	Tin and wire	Poor quality	2-4
Metal containers	Steel lamination	Overgauge, offsize holes	1

The major problem concerning indigenous steel is one of quality. Poor quality not only imposes an altogether disproportionate burden on the processing industry but also results in considerable waste of raw steel. Greater attention should be given to quality, if necessary through the import of certain inputs and an upward adjustment of billet prices. A similar situation exists in the tin container industry in India. The principal raw material of this industry is tinplate. As in the welding electrode industry, two types of raw materials are utilized - indigenous hot-dipped tinplate and imported high quality materials. Indigenous hot-dipped tinplate is employed in the production of those goods for which imported electrolitic tinplate is used. These two types of raw material are not interchangeable; indigenous tinplate cannot be substituted for imported tinplate as hot-dipped tinplate is not sufficiently uniform to be used in the automatic

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body makers which produce food cans. The automatic body makers are essential for the production of food cans which must meet the quality requirements for food processing. Even though indigenous tinplate is used almost entirely for non-food purposes the quality is not of the proper grade.

In many cases the extent of raw material shortage is greatly exaggerated, due to some system of raw material allocation. Even when the supply is only a little less than the demand, a strict system of allocation can lead to an even greater supply shortage. The amount of insufficient supply is usually much greater than the actual need, as each producer attempt to secure more resources than he really requires. The most perfect system of allocation cannot prevent the accumulation of excess inventories of some raw materials in some enterprises and of even greater shortages of these items elsewhere. Where one of the causes the increase in material supplies would result in a balance of supply and demand. A good market system of raising the capital would [illegible] observation needs to be checked [illegible] of one, but will be studied in the [illegible] material returns [illegible] to flow its validity.

The lack of spare parts for many types of modern equipment can be quite often prevents full utilization of the most [illegible] equipment. In China, for example, this is the case in several industries [illegible] many of the machines used in the dyeing of fabrics, paper [illegible] of the [illegible] will cause a stop in the products industry, power [illegible] and lifting [illegible] equipment in the timber industry, special cutting [illegible] pressing tools in the metal transformation industry.

Balance of payment [illegible]

Shortages of foreign exchange and balance of payment difficulties are often [illegible] important factors affecting the rate of capacity utilization. Imports are often the only source for those items which are in short supply locally. For developing countries it is [illegible] with regard to imports beginning with industrial equipment and spare parts, [illegible] a variety of raw materials, must be imported in order to effect general economic development and permanent continuous processes of industrial production. At the same time, the balance of payments is the most sensitive spot of the economy in all developing countries and the foreign exchange needed to pay for the imports is the scarcest

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economic commodity. The results are foreign trade restrictions and exchange control, and hence a discouragement of imports. Because of their lack of significant non-trade foreign exchange income, the developing countries are obliged to rely mainly on export and foreign credits. But these countries find that the development of export becomes increasingly difficult due both to the inadequate commodity structure of their export trade as well as to the low efficiency which results in low competitiveness. Export then becomes more and more unprofitable due to the long-term unfavourable trend in terms of trade. Foreign credit also becomes more difficult to obtain and is more expensive, for in the course of time the larger part of previously received credits must be repaid together with interest and other expenses. In this situation the problem is how limited foreign exchange can be used most efficiently to find a way out of this vicious circle. More and more research studies are coming to the conclusion that a certain re-orientation of priorities is needed in which maintenance imports required for full utilization of installed equipment receive greater attention.

At present, top priority (excluding armament and military supplies) is given to the import of capital equipment because it constitutes the basis of industrialization and economic development and cannot be produced locally. But from the viewpoint of short-run efficiency and, in the long run, of the progress of industrialization, it is more important to achieve fuller utilization of installed equipment than to import new equipment which may be under-utilized. This is extremely important because fuller utilization of installed equipment might well be the factor which breaks the vicious circle.

Under-utilization of capacity is one of the most important factors affecting competitiveness and cost structure in developing countries. Fuller utilization may help to bring costs down to the world market and to increase exports while providing a better basis for industrialization than continued new industrial construction without fully utilizing the capacity added during the course of the construction. At present, unfortunately, the needs of developing countries for maintenance imports are much too great.

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Complaints regarding the shortage of foreign exchange are frequent. Many firms questioned about the factors responsible for under-utilization mentioned foreign exchange difficulties. Eleven units complained of foreign exchange shortage ranging from 40 to 90 per cent of their needs.

In India needs for maintenance imports proved to be so high during the third five-year plan that they could not be covered with foreign trade gains. The plan had to accept the inevitability of a cert in degree of industrial capacity under-utilization.

For the years 1961/66 it was estimated that the needs of Indian economy in imported raw materials, components, spare parts, etc. were about Rs.3,800 crores. The third five-year plan's provisions for the import of these goods was only Rs.3,650 crores. The plan admitted: "this means that some under-utilization of capacity will have to be tolerated (p.11). For India, maintenance import is equal to approximately 60 per cent of the capital goods import for both public and private sectors.

The Indian Institute made its own estimation of foreign exchange required for the import of raw material in addition to that which was allotted to the manufacturing industry as a whole.

Table 11 Industry-wise allocation of foreign exchange and estimated additional requirements for the import of raw materials

(1963)

	Amount of foreign exchange allotted Rs.(crores)	Additional foreign exchange required Rs.(crores)
Metal products	6.37	1.93
Machinery (except electrical machines)	8.49	8.69
Electrical machinery and appliances	21.07	10.25
Transport equipment	24.61	14.57
Chemicals and chemical products	29.83	10.38

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It is not easy to determine the amount of foreign exchange needed to achieve full utilization of installed capacity. One study of under-utilization in Indian industry states that on the basis of available data no further analysis is possible to make any firm estimates of total foreign exchange requirements to enable the units in these industries even to operate to their full existing capacity on their existing shift arrangements. It is even more difficult to make an estimate of what the requirements will be for the utilization of capacity, when the capacity has reference not to possible shifts.

A special study on the estimation of foreign exchange requirements for fuller utilization of Indian manufacturing capacity arrived at some important conclusions:

(i) increased production activity by existing Indian engineering and construction establishments would require some 70 million dollars worth of maintenance imports;

(ii) the imported components, raw materials, etc. would account for one-fifth of the value of industrial production;

(iii) that the value of production resulting from an increase of imports would be 4,8 million dollars and the value added, 3,0 million dollars.

This study suggested that substantial changes were needed in the pattern of foreign exchange allocation for instance, re-direction of import resources from imports of new capacity equipment to maintenance and spare parts in order to achieve full utilization of existing industrial capacity. An analysis of the import statistics revealed that some 800 million dollars worth of machinery and transport equipment was imported, possibly 400 million of this was for new capacity represented by capital goods, or projects in the pipeline. The balance (640 million dollars) may well have been for the replacement. If 400 million dollars of additional non-project maintenance imports, together with 270 million dollars given from the 640 to maintenance imports, it would be possible to meet the estimated need of 670 million dollars for maintenance imports while still providing some 370 million dollars for fuller utilization of capacity.

A paper on the post-action review on the attempts at liberalization in Pakistan stated that at the time when restrictions on imports and exports were introduced capacity utilization was low. Utilization of manufacturing capacity in Pakistan from July to December 1958 was 53 per cent during the period from January to March 1960 it was 64 per cent.

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The paper stated that Pakistan's interest in industrialization had meant a policy of emphasis on the import of capital goods. Raw material imports had not been encouraged as strongly as capital imports. Raw material import licenses were on the basis of one-shift operations. This encouraged overbuilding of capacity rather than the intensive use of existing capacity. Because of the necessity of raw material, firms were compelled to run on one-shift operations. In order to get raw material import licenses and to expand current firms tended to overbuild their capacity. Industrial firms thus operated at 50 per cent of their capacity. From 1960/61 to 1964/65, capital goods imports rose 50 per cent while raw material imports remained almost constant. All the needed raw materials could not be obtained locally, thus a block was developed and idle capacity continued.

In India, as in Pakistan, there was an under-utilization of capacity due to the lack of needed raw material imports. Capacity under-utilization before devaluation was estimated at 15 to 20 per cent. Firms tended to overbuild capacity so as to get needed raw material import licenses.

The shortage of foreign exchange for the import of components, raw materials and spare parts was one of the most important factors limiting the full utilization of manufacturing capacity.

The demand for final products in many Indian manufacturing industries is, at the present time, substantially less than full capacity output in the technical sense. It appears as though all industries have experienced years of short supply and this is proved by studies of their capacities well beyond the limits indicated by the Industries Act licenses. This was possible due to numerous factors that would block the import of new Indian versus equipment that would be required with the licenses. The difficulty of defining the capacity of any particular plant or equipment gave the enabling willingness of the Director General of Technical Development (DGTD) to permit the import of new foreign machinery even if it exceeded capacity as was provided by the Industries Act licenses; and the inability of the officers of the DGTD, because of their other duties, to visit the factories more than once every two or three years.

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The firms concerned were prepared to invest in new plants even though the existing capacity was not fully utilized, because the individual firms were not aware of the true extent of expansions undertaken by others. Apart from the very large firms in each industry, little interest has been shown in marketing problems because of the current existence of a seller's market; few attempts have been made to analyze carefully the demand for the products of the industry as a whole over the coming years.

In many industries the share of imported material is small in relation to the value of the finished product, and there would be significant gains to the economy if an adequate supply of imported materials were made available. In the case of welding electrodes (India), lack of the right type of electrodes due to the inadequacy of imported materials resulted in a great waste of scarce metals which also had to be imported.

In the case of tin containers manufacturing industry, the value of imported tin plate in the total value of products packaged in tin containers is relatively small. The retail sales value of items packed per 1,000 tons of tinplate, which costs about Rs.10,000,000 is as follows.

Table 12 Value of imported tinplate in the total value of tinned products

Product	Retail sales value of product	Cost of tinplate (percentage of product value)
Milk and allied products	Rs.33,000,000	3.6
Vanaspati and edible oils	Rs.44,000,000	2.3
Cashew	Rs.61,000,000	2.0
Paint and varnish	Rs.76,000,000	1.3
Lubricants and greases	Rs.26,000,000	5.0

Shortages of key imported items of small value appear to result in disproportionate production losses. It should be possible to alleviate this situation without additional outlay of foreign exchange. It would be desirable to rationalize the pattern of export assistance by establishing a proper price for the supply of indigenous steel and by reducing the quantities of the import entitlement.

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The above-mentioned study in India found that during the period under study, production of steel billet for welding electrodes had to be suspended in one case because the company had been unable to obtain graphite electrodes. Since in this case a large investment had been made in a modern plant to produce both billet and wire, the decline to be expected in the output of finished electrodes was altogether disproportionate to the foreign exchange involved to import the needed graphite electrodes.

The same study found that a shortage of rutile, which is used to cover metal rods during the manufacture of welding electrodes led to production stoppages. Referring to a specific period which it considered the study confirms that when the lower level of domestic production in recent months seriously affected the availability of rutile for electrode plants, production of electrodes was certain to be affected too. The cost in foreign exchange of rutile was about 3 per cent of the value of finished electrodes, thus a relatively small supply of requirement of small value often has significant restraint on production.

The third kind of material in short supply which, according to the study, affected the production of welding electrodes was special and alloy steels. In so far as special electrodes are concerned the requirements of special and alloy steels are not being adequately met. The present shortfall amounts to some 10 million running feet, requiring 2,0 tons of special steel valued at Rs.2,[illegible]. This relatively small value of special steel has assumed significance since in the absence of special electrodes certain cost-saving and critical welding techniques cannot be accomplished.

Table 13 Overall estimates of the increase in foreign exchange allocations required to meet current welding production demands

	Rs.
Special steels and non-ferrous wires	2,000,000
Rutile	400,000
Ferro- alloys	60,000
Other chemicals	20,000
Spare parts	10,000
Total	2,790,000

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This amount, equal to US $600,000, is relatively small as compared to the production losses suffered by the industry as a result of the above cited shortages.

This comparatively small but typical section of Indian industry producing welding electrodes suffers from a deficiency of at least five major raw materials. The deficiency affects the production and increases the burden of under-utilised capacity. In each case, the expenditure of foreign exchange required to import scarce raw materials is relatively small compared with the losses of the industry due to the lack of these materials. Since these raw materials are meant to be produced locally, measures are needed for long term improvements for maintenance imports. If, however, there is only a limited domestic demand the desirability of building capacities for the production of these materials should be studied.

The inferior quality and the lack of some raw materials affect the rate of capacity utilisation directly (relatively limited production despite the high demand) and indirectly (reduced demand due to the inferior quality of the manufactured goods).

The above-mentioned study on the tin container industry in India can serve as an example. Short term maximum results with a limited supply of tinplate to larger sized cans than previously were produced. While customers' demand would normally call for a mix of convenient sizes of individual consumer (1 kilo or even 5 kilo) products in packages of smaller sizes. While this process saved tinplate, it frequently led to the almost total consumption resulting from already opened cans. This results with increased opportunities for food adulteration and product spoilage and to increased expenditures. In a situation where tinplate is not freely available, experience all over the world shows that the demand for smaller sizes of cans increases.

In the tin container manufacturing industry the estimated increase in foreign exchange allocation is required to meet current demand is:

for tinplate	-	Rs.[illegible]
for operating costs	-	Rs.[illegible]
total		Rs.[illegible]

This amount is very small compared with losses arising from the low level of installed capacity utilisation.

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In evaluating the tin container export, both direct and indirect exports have to be considered. For example, the Metal Box Company has a direct export of about $m. 3,200,000, but the value of indirect exports of such products as canned meat, preserves and biscuits is several times this figure.

Metal Box reported that they need a steady annual supply of about 1300 tons of imported electrolytic tinplate to maintain their present rate of export built up over the last seven or eight years.

Labour

One of the important factors hindering production in developing countries and preventing better utilization of the industrial capacity is the labour problem. This problem has two aspects.

(1) general shortage of skilled labour and acute shortage of special skills,

(2) labour troubles caused by dissatisfaction of the skilled workers with present living and working conditions, work stoppages and absenteeism.

Difficulties in recruiting enough suitably qualified and trained labour were stressed as major reasons for the low capacity utilization in the timber, the textile and the metal industries of Chile.

The Indian study on industrial capacity under-utilization mentioned the lack of certain skills and a general shortage of skilled labour among the main causes delaying fuller utilization of capacity. It listed various types of skilled labour, which are scarcest in the industries strongly affected by the capacity under-utilization. In the metal products industry these are: tool and die-makers, designers, turners, fitters and setters. In machinery production: toolroom and maintenance staff, turners, fitters, moulders, millers, grinders, borers and other machinists. In electrical machinery and appliances production: toolroom fitters, die-makers, welders, machine shop operators. In transport equipment production: tool cutter, grinder, machine tool and millwright fitters. In chemical industry and industries using chemicals: tinsmiths, blacksmiths, varnish makers, and colour matchers, laboratory assistants and analytical chemists for drugs and pharmaceutical production.

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Developing countries have only a short tradition in training labour if compared with developed countries, where often many generations of the same family worked in the same trade, while in developing countries illiterate peasants are called to become modern industrial workers. The training of a skilled worker needs more time than in t required to build a modern industrial enterprise and proves very expensive. Therefore, the problem of labour planning and labour training is given much attention by the national authorities and the international organizations. Many specialists, however, are not satisfied with the present methods.

The Indian Institute complained about the neglect of this problem both by the authorities and by the business community. According to A.K. Singh labour discontent and absenteeism are causes of capacity under-utilization in a number of cases.

Work stoppages and absenteeism are undoubtedly reasons for capacity under-utilization in those countries and industries where labour relations are a source of dispute. Labour troubles reduce capacity utilization which often cannot be compensated for by overtime work at a later date. In many cases labour disputes decreased not only the capacity utilization of one particular enterprise where work had been ceased, but also that of other enterprises which ran short of materials as a result of work stoppages at their suppliers. An example for this is given in the study on the capacity utilization in the welding electrodes industry of India.[3/] The main chemical required to produce electrodes is rutile, used in the flux coating on the electrode. Though indigenous supplies were available from Kerala, the production of rutile had been reduced significantly in recent months due to labour trouble. The gap between indigenous production and actual requirement was only met in part through imports. The low level of domestic production thus affected the availability of rutile at electrode plants, the production of electrodes and the capacity utilization of these plants.

3/ V.K. Ramaswami and D.G. Pfoutz, Utilization of Industrial Capacity, New Dehli, 1965.

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Need for better planning and management

Modern industrial production and the structure of market demand are so complex that even in developed countries internal disproportions occur. In developing countries these disproportions are more acute and more difficult to deal with because of the lack of industrial reserves, less diversified production, a weaker economic infra-structure and less developed economic services. Hence there exists capacity under-utilization side by side with unsatisfied demand. If the excess capacity is slightly different from that needed at the moment the demand cannot be met by production.

An example of this kind can be found in a special study on excess capacity in selected Indian industries. On the whole, the installed capacity of the galvanized pipes and tubes manufacturing industry in India slightly exceeds the current domestic demand. At present, however, the demand for the smaller sizes (one-half and three-quarters of an inch) cannot be met while the demand for the larger sizes (1 inch and more) seems to be decreasing.

From the economic point of view idle capacity in one type of operation may be quite compatible with unfulfilled orders in another sector of an industry. An absolute balance between capacity and production is not feasible, but the degree of disproportions can be significantly reduced through careful economic planning. It is no exaggeration to say that the existence of excess capacity is an evil emerging from either lack of planning and poor project evaluation at the time when the capacity was installed, or from some unfavourable economic developments like the failure of market expansion, shortage of production material, etc.

Fluctuations of demand which cannot be foreseen are serious causes of the low level of capacity utilization, especially during certain periods. In some instances these fluctuations can result from governmental economic policy. When the government is the main consumer of the industrial goods in question, a reduction of the government orders, which cannot be easily replaced by orders from other industries, may become a major cause of a drastic increase in the level of unused capacity and a general economic setback. Some Indian economists believe that a situation such as this was experienced in India at the beginning

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of 1967 due to the slackness in Government demand and an acute shortage of rupee finance. Lack of demand, particularly from the railway sector, had seriously affected not only the wagon building industry, structural fabrication and steel castings, but also a host of ancillary industries. The situation was so serious that many of these industries - mostly in the eastern part of India - were working only 40 to 30 per cent of their capacity and have been keeping idle labour on their payrolls, thereby adding to their expenses. Unless the Government's demand will be revived very quickly, some Indian economists believe that an important sector of the Indian engineering industry will face a crisis, which would have disastrous effects on the future development of the country.

In certain cases some capacities can be installed deliberately in excess of market demand. Such decisions are justifiable if

(1) the technological conditions do not permit the construction of an enterprise of a smaller size;

(2) a smaller enterprise is not economical;

(3) the acting authority believes in the future growth of the demand and plans are being made for reserve capacity.

There is, however, no justification if the excess capacity is installed with speculative aims to gain some advantages and privileges arising from the mere fact of possessing a large capacity without fully utilizing it.

Some Indian economists believe that in many Indian industries a substantial part of capacity underutilization is due to the indiscriminate licensing of larger capacity installations than required by the normal demand for the products. R.K. Sinha claims that in the industries with acute cases of capacity underutilization (production of handwheelbarrows, expanded metal, bare copper conductors, semi-automatic and automatic stoves, cotton looms) the capacity installed at the end of 1955 was adequate to meet the levels of the 1960 and 1965 production, yet the capacity was continuously increased since 1955.

One of the causes of excess capacity in the manufacturing industry of developing countries is the inadequate development of the economic mechanism servicing the modern process of production (e.g. mechanized distribution, credit system, and so on). In developed countries technical progress, concentration of production and growth of industrial modern mass production

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based on a thorough division of labour and specialization were accompanied by a corresponding development of the economic services such as banking and insurance, the wholesale and retail trade and the system of transport and communication. Many developing countries introducing the modern production methods from developed countries lack the corresponding economic services and are thus unable to fully utilize their installed productive capacity.

There is evidence that the newly built sugar factories in some parts of Brazil cannot utilize their productive capacity although the farmers of these regions produce enough sugar cane. Due to the lack of cash circulating capital the factories are unable to buy the crops. The farmers cannot sell their crops, the factories cannot buy the raw material. In this particular case there is no credit system available for bridging the gap between sellers and buyers. A similar example is reported from Chile. In a special report submitted to the United Nations Centre for Industrial Development, F.J. Glover considers the shortage of credit for the purchases of raw materials and for carrying stocks of finished goods an important cause of capacity under-utilization in Chile.

An underdeveloped economy may have a deficiency of demand together with continuous inflation. It seems difficult to explain otherwise the persistence of substantial excess capacity despite an almost permanent inflation.

A major non-import bottleneck preventing full capacity utilization is the shortage of electric power supply. This bottleneck cannot be eliminated rapidly as long as at least three years are needed to build a new thermal power plant, for which some of the essential equipment has to be imported. But there is the possibility of using electric power during the slack hours if the manufacturing enterprises work night shifts. Estimations by the Gujarat State Electricity Board in India for the Gujarat power system in 1966/67 show that an increase in electricity consumption of nearly 100 per cent could be accommodated between 9 p.m. and 8 a.m. before the peak loading capacity of the system would be exceeded.

Shortage of electric power becomes a serious problem when new plants are erected or additions to plant capacity considered, which would increase the peak load requirements for electricity.

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Lack of skilled manpower

A preliminary study by experts of the United States Agency for International Development states that

"while the unemployment rate is high in India, nevertheless a 96 per cent increase in output by a sizeable block of manufacturing industries would threaten bottlenecks in hiring or training of skilled manpower.

To achieve a fuller utilization of capacity by an increase of 96 per cent in the output of existing firms might entail some economies in scale in the utilization of manpower so that perhaps on the order of 700,000 workers would need to be added. And of the latter perhaps about 200,000 would represent the sort of skills that could be in scarce supply and, hence, pose a risk of bottlenecks developing to retard the rate of expanded production in certain industries in certain regions.

[illegible] skills by training programs, more efficient management to increase worker productivities and perhaps a modicum of increased mechanization especially where the latter would significantly elevate the productivities of the scarcer types of skills. Colleges, trade schools and secondary public education would also have a vital role to play." 4/

There are three main aspects to the solution of the problem of utilizing excess capacity for export.

(1) The technological and organizational aspect which includes different measures necessary for achieving higher rates of capacity utilization, including fuller utilization of equipment and manpower, improvements of the supply system and of transport facilities, etc. Such measures can either be applied to the individual enterprise or on a grand scale, to all industries of a country.

(2) The market aspect which is based on the analysis of the balance between supply and demand for each product on the domestic market or on the international market. Through these analyses the utilization of excess capacity for export can be quantitatively estimated.

(3) The aspect which deals with the economic performance of potential export industries with a substantial capacity under-utilization. This aspect is crucial to the solution of this problem.

The goods which may be produced by using excess capacity and for which there is a high demand on foreign markets can be exported only if their prices are

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4/ D.C. Pfautz and H.B. Spangler, A Preliminary Study of the Effects of Import Liberalization on Increased Utilization of Industrial Plant Capacity and Related Economic Problems and Benefits, New Delhi, 1965. pp.23,24.

competitive and their quality adequate. This aspect of the problem draws our attention to the cost and price formation. When prices are not competitive and goods cannot be exported, the rate of capacity utilization decreases. But with a lower degree of capacity utilization, costs tend to rise. Economic theory establishes a direct dependence of costs on the rate of capacity utilization. Special studies of certain industries in developing countries, which are regrettfully very rare, prove this point. A recent study on the food-processing industry in Brazil[5/] shows that there is a close relation between the degree of capacity utilization and the cost structure of the industry. The report on the food-processing industry of Brazil states that in cases with less diversified production, the rate of capacity utilization influences the cost of the unit of production [illegible] the enterprise. A milk pasteurizing enterprise with a capacity of 80,000 tons per year operating at 66 per cent of its capacity shows higher production costs per ton of milk than an enterprise with a capacity of 50,000 tons per year operating at 80 per cent of its capacity. In the case of butter production, a factory producing 1,00 tons per year appeared to be more economical working at full capacity with lower costs per unit of production than another factory with a capacity of 5,000 tons operating only 60 per cent of its capacity.

Comparative world prices and internal costs of production are in many instances very unfavourable for the developing countries. This could be changed through fuller capacity utilization. Table 14 lists world prices and internal costs of production for some Indian metal products. World (import CIF) prices and internal prices have been computed from ICICI data. In view of the post-devaluation situation some data on production costs had to be brought up-to-date. The cost of production figures include interest and depreciation charges. CIF prices were also adjusted. This statement is, at the same time, indicative of the lines of production (steel forgings, hand tools, welding electrodes, brake-linings) in which India has relative cost advantages after the devaluation and of those industries (steel pipes and tubes, wire ropes) where some initial measure of help may be needed to make them competitive on the world market.

5/ A indústria de alimentos no Brazil, Fundação Getúlio Vargas, Rio de Janeiro 1966.

Table 14 Comparative CIF and internal costs of production prices for selected items

Industry	CIF Prices (post-devaluation) in Rs. per ton	Indian cost of production (post-devaluation) in Rs. per ton
Steel castings	..	2,740
Steel forgings	4,500	4,200
Steel pipes and tubes	1,478	1,450
Wire ropes	3,700	3,650
Welding electrodes	110 per 100 R ft	100 per 100 R ft
Hand tools	11,500	8,500
Brake-linings	10,000	9,875

Source: Note on Surplus Capacity in Indian Industry and Comparative Indian and International Prices, Communication sent to UNIDO from ICICI, India, February 1967.

N.B.: In addition to material, labour and utility charges, cost of production also includes interest and depreciation charges

According to the study undertaken jointly by a group of experts of the United States Agency for International Development and the Indian Government, the possibilities of the utilization of excess capacity in welding electrodes industry for export are very low because of the specific price structure in India which is different from the price structure on the world market. The price of domestic core wire, which is the main raw material, is very high; export prices for the final product are very low. In the absence of properly considered export incentives this Indian industry cannot compete on the export market.

The same problem arises when there is a possibility to increase export at the expense of profitability. Since capacity is often such as the output produced at minimum average total costs, the physical (technical) capacity is usually larger than this capacity and sometimes the enterprise works with a capacity utilization of more than 100 per cent. In such a case the costs per unit of output increase while the profitability of the enterprise decreases. But sometimes a country is ready to accept higher costs per unit of output to gain badly needed foreign exchange for its economy. In such circumstances, the higher-than-100 per cent utilization of capacity can prove profitable. In comparing levels of profitability, expressed in local often non-convertible money units with probable gain of foreign exchange as the result of the above-100-per-cent utilization of productive capacity, the official rate of exchange should not be used, especially if there exist a much higher unofficial rate of exchange (which is usually illegally). Individual enterprises, on the other hand, are not interested in excess utilization of their productive capacity if this event all increases in the cost per unit ratio, even if the additional output is to be sold on the world market for foreign exchange. For the promotion of export the state, as the receiver of foreign exchange earned on the world market, should therefore provide some sort of incentives for these enterprises.

Summary

Causes of excess capacity in developing countries are in most cases different from those in developed countries. This difference is twofold. First, the excess capacity is mostly connected with the imbalances of external economic

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relations (e.g. short supplies of imported raw materials, spare parts, etc. or inadequate domestic markets and the greater import needs of export markets). Second, the excess capacity in developing countries is also connected with the absence of certain prerequisites in their economic structure, preventing the full integration of the industrial enterprise with the economy as a whole. The gradual growth of industrial technology in developed countries either anticipated or was accompanied by corresponding developments in all inter-connected industries and in other economic fields (marketing and credit, banking, foreign trade, means of transport and communication, labour training etc.). In developing countries, however, imported technology often cannot be utilized effectively due to inadequate (or complete lack of) corresponding economic and social conditions. Modern technology - imported by developing countries in the process of their industrialization - is based on the principles of mass production for a market much larger than the market in the least developing country. However, modern industrial enterprise cannot function in a vacuum. It can only be effectively utilized once it has become an integral part of the economic community which supplies the enterprise with the necessary inputs and absorbs its products. The country, that does not possess all inputs necessary for its industries, is also unable to absorb their products and depends on the world market. The typically high percentage of industrial enterprises in developing countries can utilize their production capacity only if the world market supplies the materials needed for production and absorbs the goods produced in excess of domestic demand.

Erecting one or a number of industrial enterprises in a developing country, especially in a smaller one, introduces a new powerful economic element. If efficiently operated the new enterprise may be advantageous for the economy as a whole, otherwise it may just become an additional burden. Each non-industrial enterprise established in a developing country creates a problem of corresponding adjustment for all other economic sectors. If this adjustment was successful, the new enterprise can function normally and efficiently; but if these adjustments go wrong, the new enterprise may prove inefficient. It may work with a high degree of capacity utilization and still add to the economic shortages of the country. Thus there is an indispensable need for action-wise economic planning

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in developing countries, which should evaluate all economic proportions and lay down the necessary provision for the most efficient utilization of newly installed industrial capacity. With regard to the specific conditions of industrialization in developing countries, national planning should also take the necessary measures in the field of external economic relations, especially provide export outlets for the products of newly installed industrial capacity.

IV. CONCLUSIONS AND RECOMMENDATIONS

Capacity under-utilization is a major economic problem in the developing countries, which leads to low efficiency in industry, economic difficulties and bottlenecks. The importance of this problem increases with the progress of industrialization. The degree of capacity under-utilization can reach such a level that industrialization which is rightly considered the main road to economic development may become the main source of economic difficulties. It is necessary to pay special attention to the problem of capacity utilization in overall economic plans (as in India's third five-year plan) and in each industrial project. Ways should exist in developing countries in solving this problem of capacity utilization.

Necessity of improved statistics

Reliable data on the present rate of capacity utilization and a precise knowledge of the reasons for capacity under-utilization are necessary for setting up programmes of technical assistance. These programmes should help developing countries to use the excess capacity in some of their manufacturing industries or, on a small scale, in individual production units. Available data, however, are incomplete and unreliable, in some cases non-existent.

Under-utilization of industrial capacity is a major economic problem in developing countries. There are no comprehensive statistics on capacity measurement or no estimations of the degree of its utilization. For better and more efficient utilization a maximum capital replacement comprehensive information on the installed productive capacities and their use is needed. The difficulty in studying the problem of excess capacity lies in the scarcity of statistical

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date. No country, including the United States publishes in its detailed statistics on the production of a wide range of manufactured goods, comprehensive enough information on the actual utilization of productive capacity, nor on the level of present capacity, which could be compared with the volume of production. Some developing countries extend their statistics on capacity and capacity utilization a bit further than the developed countries did. Estimates on the annual capacity in different industries can be found in the statistical publications of India, Brazil and Argentina. These data are often vague and incomparable (due to the lack of definitions, proper methodology and standardized definitions). Every attempt, however, to estimate the rate of capacity utilization in any country is to be considered by all means as the highlight in the evaluation and of capacity utilization and the methodological problems connected with capacity measurement. The experience of developed countries with regard to excess capacity may also be useful in developing countries.

Different methods for measuring capacity were developed in the United States. There are no general solutions to the problem, not even in the country where they originated from, nor can they easily be applied to developing countries. But the experience gained by economists and statisticians conducting these studies is of great value for working out methods and techniques for the measurement of capacity and the rate of capacity utilization in the developing countries.

For instance, India includes special information on the current level of industrial capacity in its monthly economic statistics. But even in India, the problem of statistics on capacity and capacity utilization has not yet been solved, though the need for better capacity utilization has been recognized for some time. The Indian Import and Export Policy Committee recommended that the development wing should be concerned with the responsibility of constantly reviewing the problem of under-utilization of industrial capacity and of recommending remedial measures. It was suggested that the results of such reviews should be published annually, but unfortunately this recommendation made in early 1962 has not been followed up.

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In India the capacity of a majority of industries is calculated on single shift basis. Only for the following industries the full utilization of capacity is estimated on multi-shift basis. Three shifts - sulphuric acid, caustic soda, soda ash, chlorine liquid, bleaching powder, bicromates, superphosphate, ammonium sulphate, paper and paper board, tyres and tubes, alcohol, cement; two shifts - paints and varnishes, cording engines, rim, spinning frames, railway wagons, re welding electrodes, wire ropes, steel pipes and tubes, cigarettes.

But some industries for which capacity is measured on the one-shift basis, often work two shifts, or at least multi-shifts for a certain period of time. In the statistics this is reflected in more than 100 percent rate of capacity utilization.

The following data on installed capacity, production and the rate of capacity utilization were calculated from the monthly statistics of the production of selected industries in India for December 1965. They illustrate the gap between actual production and estimated installed capacity.

Table 15 Production of house service electric motors (average monthly figures)

Year	Installed capacity	Production
1960	34,000	40,036
1961	37,000	52,663
1962	47,000	73,145
1963	84,166	99,469
1964	96,666	101,311

This gap is also evident in the radio and fluorescent lamp industries.

Table 16 Production of radio receivers (average monthly figures)

Year	Installed capacity	Production
1962	27,692	20,607
1963	32,589	34,955
1965 June	34,626	44,321

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Table 17 Production of fluorescent lamps (average monthly numbers in thousands)

Year	Installed capacity	Production
1960	100	127.2
1962	250	262
1963	275	303
1965 June	375	366

Similar data are available for the production of dry cells, storage, electric batteries, winding wires, electric meters and refrigerators. The most striking example is the production of transformers. The 1965 production (throughout the year) was nearly twice as high as the installed capacity reported in the official statistical publication.

Table 18 Production of transformers (average monthly figures)

1965	Installed capacity	Production
January	176.8	369.9
February	176.8	339.6
March	176.8	376.3
April	176.8	293.3
May	176.8	345.6
June	176.8	363.6
July	176.8	360.0
August	176.8	339.3
September	176.8	347.7
October	176.8	376.7
November	176.8	415.8

In some cases estimations for installed capacity were changed from year to year for no obvious reason. It is natural that installed capacity changes in the course of time, mostly showing a upward trend. Under special circumstances new investments may also reduce installed capacity. But this can hardly be the case with some Indian manufacturing industries where within a few months installed capacity was drastically reduced. In December 1964 the reported installed capacity of the production of cording of tires (revolving 21 hours) was 213, in June 1965 it fell to 90, actual production was 145 in June 1965.

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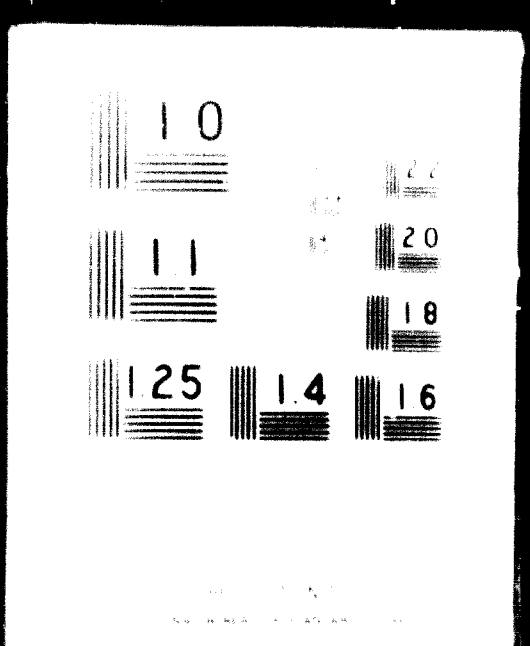

Similar data are available for the production of complete ring spinning frames (installed capacity in 1964 - 313, in June 1965 - 140; production in June 1965 - 182), and the production of semi-automatic and automatic calico looms (installed capacity in March 1965 - 1,360, in June 1965 - 783 with production increasing correspondingly from 190 to 449).

These examples show that officially estimated and published data on industrial capacity may vary from actual capacity. But there is no guarantee that when actual production figures are lower than the installed capacity figures the latter reflect the actual capacity. For many years there were strong incentives in India to overestimate capacity, yet capacity was often underestimated.

For many reasons installed capacity figures are less exact and reliable than production figures. For instance when installing additional imported equipment Indian companies receive special industrial licenses which also give estimations on the productive capacity of the new equipment. If, however, the capacity increases without the installment of additional imported equipment the government statistical organizations receive no information on the increase in capacity. In addition, the share of locally produced new equipment for Indian industry continuously increases and sometimes the machinery, purchased either abroad or at home, has a much higher capacity than it rated capacity as stated in the licenses. The capacity of the equipment can be secretly increased with minor additions of equipment or with improvements at the spot. All these circumstances are not reflected in the statistics on capacity.

Since statistics on installed capacity are not very reliable - partly because of the irregularity of information submitted to the statistical organizations (e.g. the Directorate General of Technical Development in India) - rates of capacity utilization are estimated by comparing the data of current output with the obsolete data of capacity. If Indian statistics state an installed capacity refer to the close of a period. The longer this period lasts the greater will be the rate of capacity under-utilization, especially if the growth of the capacity is significant. If there is any growth of the capacity within the period the statistical report compiled on this basis will never register full

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utilization even in the case of actual full utilization. For the same reason it is impossible to refer capacity to the beginning of the period, but attempts to calculate the average capacity during the period make the task of capacity measurement even more complex.

For many types of equipment statistical publications do not give any estimation of capacity as they are produced not regularly, but to individual orders (e.g. all types of textile machinery, sugar machinery, and so on).

In certain circumstances government authorities are interested in deliberate under-estimation of officially reported industrial capacity. For example, the Directorate General of Technical Development of India was unwilling to recognize the increase of installed capacity of some plants producing welding electrodes because the allocations of scarce foreign exchange are to some extent based on capacity, to recognize an increase would imply a commitment to authorize larger allocations of foreign exchange.

The real maximum production potential of a plant or industry is usually much higher than the officially reported capacity. For instance, official statistical publications have estimated production in the sugar industry of India as low as 60 per cent of the capacity. At the same time, N.J. Salomon, who studied the problem of capacity utilization in India insists that there is a chance to improve the many Indian plants can increase their output up to 300 per cent with relatively small increases of investment in fixed plant.[2]

Users of capacity statistics find the available data inadequate for their purposes because of: (1) lack of consistent definitions and rules of measurement; (2) insufficient coverage; (3) lack of detail in existing data; (4) lack of periodic reports on capacity increases; (5) lack of integration with other statistical programs (output, employment, etc.) at both the aggregate and detailed industry and product levels.

The Indian National Council of Applied Economic Research considers that too much reliance is placed on the process information in the capacity utilization. They argue that capacity figures are not available for 15 industries for the years 1964 and 1965 and industries, which have [illegible] the

[2] [illegible], Sol [illegible], The Planning of Steel Capacity - A Blueprint for a Study, Asia Publishing House, 1963, p.1.

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weights to be assigned to various products (the weights used in the construction of the industrial production index) are not available for about 0 per cent of shifts worked. A number of industries show excess utilization for the obvious reason that they work more than one shift although the published data from governmental sources indicate that they work one shift only.

Need for standard definitions and measurements

The term "capacity" in present economic literature and in statistical publications has been given various kinds of meanings. In general this term refers to the quantity of output produced per unit of time with a given supply of plant and equipment. Usually it is assumed that labour and materials are available in the necessary quantities and qualities, and that the limiting factors are stock of plant and equipment, and operating standards.

The absence of generally recognized concepts and definitions of capacity cause a wide variety of capacity estimations which cannot be compared or related to other economic indicators. Except for a few individual industries, there are no set rules on the measurement of capacity. This explains the present unsatisfactory state of measuring capacity, the different methods of measuring and the confusion in the interpretation of existing (official and unofficial) data.

In general, definitions of capacity can be divided into two categories, the "engineering" and the "economic" concepts. The engineer's concept is physical, denoting the maximum physical output produced per unit of time with a given fixed stock of capacity facilities. This capacity rate of output is the maximum that can be produced with an uninterrupted flow of variable inputs and without actual breakdown of the equipment or some explicitly or implicitly assumed "exceptionally high" marginal costs of operation.

The economic concept also refers to output, but not always to maximum output. It takes the cost element into account. According to this concept capacity is the rate of output produced at a minimum average total cost per unit of output. According to the economic concept the capacity of the enterprise depends not only on its stock of plant and equipment but also on the market conditions - wage rates (including overtime), price fluctuations, and so on. Capacity

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...ment becomes an economic-mathematical problem; to find out the rate of ... which under given conditions provides the maximum profit for the enter-... This capacity is ... also been called rational capacity, effective ..., desired capacity, and so on.

... is "economic" capacity is only one part of the engineering capacity. ... it takes into account all possible reserves which can be used if there is ... for their application. However, under the influence of changing market ...itions the rate of "economic" capacity can fluctuate without any changes in ... fixed assets.

...economists and business people working with problems of capacity measurement ... be ... aware of the ... between the actually installed capacity and ... profit. "Theoretical capacity estimations take into account ... facilities, ... uninterrupted flow of variable inputs (labour and ...) and ... normal ... organization of production. They may or may not in... influence of ... seasonal fluctuations in output and ... unavoidable shut-...

When measuring the capacity, the following factors are usually recognized: ... work ... for ... and maintenance of the equipment, setting and ... the equipment ... production of specific items, normal speed of ... or intensity of productive ... process, average number of shifts normally ... in the industry and number of working days in the week, month, year ... other ... which may vary in different countries even within the ... industry or different industries within the same country.

... is no universally adopted definition ... capacity or excess capacity. ... company ... defines ... and measurements following ... common sense ... maximum capacity ... maximum output under normal work schedules. The ... of this is multiple ... definitions ... one company measures its ... capacity ... different volumes ... different conditions ... recession capacity, ... capacity, ... capacity, and so on. This method of measurement does ... exactly ... what ... company reports ... it is working on the level of ... per cent capacity.

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The British economists W.A.H. Godley and J.R. Shepherd give the following definition of capacity from the point of view of labour supply: "Capacity (or productive potential) is the level of output, at any one point of time which would make equilibrium employment equal to the labour supply."1

The capacity of separate pieces of equipment taken in aggregate will never equal the total capacity of the enterprise. The capacity of an enterprise with a given stock of equipment can vary depending on the type of product produced within a given time period. The capacity of a single industry cannot be defined very accurately either, because an enterprise can produce goods classified under different sections. Capacity of the manufacturing industry as a whole is still more difficult to define and to measure.

Excess capacity existing at each individual enterprise can be calculated more or less accurately, but the total sum up of excess capacity of all individual enterprises not always equals the excess capacity of the industry. As M.J. Solomon has shown in his book "Better Plant Utilization in India" (1963), the problem of plant utilization from the viewpoint of the individual enterprise and from the viewpoint of the economy as a whole is different and should be discussed separately.

The concept of capacity is also misleading when considered for an industry as a whole, because the products of individual firms differ so much in quality. A low quality and cheap product may of course satisfy a felt demand admirably. While a high precision bolt, for instance, is essential for structural work or vehicle manufacture, a lower quality bolt may be quite adequate for other purposes. One category of consumers may want a high quality product while another category may be satisfied with lesser quality for the same purpose. The car automobile manufacturers, for example, apply very high quality standards to leaf springs and nuts; in the replacement market, however, lower quality and cheaper products find ready sales.

1/ W.A.H. Godley and J.R. Shepherd, National Institute Economic Review No.29, Aug. 1964, p.37.

The measurement of capacity and production in high tensile nuts and bolts is difficult since it depends to a large extent on the size of the product. With small size nuts and bolts tonnage drops while numbers rise and vice versa. When the products include special fasteners requiring grinding or other operations, capacity in tons drops while value of the product rises. There are a great many products like these, and the capacities of individual enterprises will vary depending on the quality.

Capacity should be measured in the same units as production. Rate of capacity utilization which is expressed in per cent of total capacity may be measured by two different methods. The first method compares installed capacity with actual output. The result expressed in per cent shows the rate of capacity utilization. This is the simplest method, but it has certain limitations. First of all, it is necessary to know the capacity, but the concept of capacity is not yet clear. Practically no statistics of capacity exist since capacity cannot be measured in terms of physical output for a great number of equipment. Any measurement of capacity is inevitably at the level of cost in principle and the measurement of capacity as average capacity for certain period is even more intangible. The comparison of capacity thus reduces to the comparison of something highly subjective and not very exact with definite and exactly measured quantity.

The second method consists in direct measurement of the time of effective use of equipment regardless the volume of output. By this method the rate of capacity utilization is expressed without comparing installed capacity with production, even without capacity measurement. The number of shifts taken as normal duration, the time of production determines the degree of capacity utilization with the given actual time of production.

For certain industries capacity measurements should be made on the multi-shift basis, i.e. three or two shifts. This is obvious for industries with continuous character of production. For other industries the multi-shift basis should be applied in all cases but there is no technological reason for one-shift operations. If social economic, political or any other problems prevent multi-shift operations in the industry, all these problems should be dealt with adequately, thus, installed output of equipment can be efficiently used. With rare exceptions manufacturing enterprises in developing countries work on a one-shift basis.

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For example, in India, the majority of engineering industries work single shifts, except for mining machines, machine tools, engines, electrodes, wire ropes, pipes and tubes enterprises which work on two-shift basis.

Installed capacities of different industries are computed on using different duration of working throughout the year (different number of working days and different number of shifts every day). For the following industries 330 working days with three shifts every day formed the basis for capacity estimation: sulphuric acid, caustic soda, soda ash, ophthalmic lenses, electroning powder, bichromates.

In cases where the capacity of equipment cannot be expressed in terms of possible output some other units of measurement should be used. In Indian statistics specific units for capacity measurement are used for the textile industry, the hand-made paper board industry, and so on.

For the manufacture of textiles, the installed capacity data are related only to the number of spindles and looms installed without any reference to the volume of output possible in terms of yarn or fabric. On the other hand, production data show the quantity of yarn and fabric produced with detailed information on the type and quality of the product. Hence comparison of capacity with actual production seems impossible. For the manufacturing of hand board, installed capacity is expressed in terms of metric tons while production is quoted in thousand square metres. Here again, no comparison of capacity with production is possible.

In certain cases statistics compilers prefer complex work to estimate productive capacity of an industry. The Indian sugar industry is a good example for this. The production potential of an individual sugar factory depends on three main factors: (1) daily crushing capacity, (2) number of actual working days, and (3) average percentage recovery of sugar from cane. In Indian statistical publications the daily cane crushing capacity is related to the capacity of the major items of plant and equipment in individual factories registered or licensed under the 1951 Industries Development and Regulation Act. Additional capacity of substantial expansion, licensed and materialized later on is also taken into account. Capacity of closed factories, being ineffective, is not included. The installed capacity of the sugar industry is estimated on the

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volume of production potential of the factories which may vary depending on per-
centage recovery figures from cane. With the available crushing capacity
the actual number of working days and the output of the factory can vary if
the average percentage recovery of sugar from cane fluctuates.

As the number of actual crushing days and the average percentage recovery of
sugar from cane presumably fluctuate in response to various environmental
factors within the same season, sugar factories in the different areas are grouped
into three broad regions in order to establish relationships between factors
affecting the sugar output. The three regions comprise, United Provinces, Bihar, Punjab, West Bengal, Assam,
Orissa, Andhra-Pradesh and Rajasthan, (2) Bombay State, (3) southern region com-
prising Madras, Kerala, Andhra-Pradesh and Mysore. Based on information on two
seasons (1967/68 and 1968/69) the average number of working days was estimated at
[illegible] days in the northern region, 150 days for Bombay and 160 days for the southern
region. Similarly the percentage recovery of sugar was estimated at 9.7, 10.3
and 10.3 respectively for the three regions. The available crushing capacity of
individual factories was aggregated for each region and multiplied by the product
of average number of working days and the percentage of recovery of sugar in the
region. The capacity thus determined on regional basis was added up to
arrive at the installed capacity of the industry as a whole.

Even more complex is the problem of measuring capacity and capacity utilization
of industries which - unlike the sugar industry - produce a variety of products.
On the basis of its main product an enterprise belongs to a certain section of the
food-processing industry. But the part of its production may well belong to some
other section. For example, enterprises listed in the section of crushing,
curing and grinding of fish products also produce seed oils which normally
should be listed in another section of food production. Available studies on the
food-processing industry, especially those recently conducted in Brazil, do not
attempt to provide more accurate classifications of capacity than according to the
official distribution of enterprises between sections of an industry.

It may be useful to define capacity not only for a particular end product,
but also in more general way so as to point out possible scopes for adjusting
the output pattern according to changing demand conditions. Capacity could, for

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example, be expressed in terms of metal tonnage that can be converted into fabricated light engineering products, or other raw materials that can be consumed (as in the case of petrochemical industries).

In firms depending more on human labour than on technical equipment the concept of capacity is particularly ambiguous. The productive potential of such an enterprise may increase by employing additional manpower without any changes in the fixed assets.

Capacity of closed factories, being ineffective, should be treated differently. This capacity can be used under certain conditions even if its technical efficiency does not change. These factories can become effective again if demand grows, prices rise or import restrictions are imposed. Their capacity can be regarded as the industrial reserve capacity of the nation. Leaving these factories represents a certain investment of the nation's capital investment which lies idle and causes net losses to the economy. There are some cases in developed economies where ineffective industrial plants were shut down and their obsolete equipment demolished. Millions of pounds were spent recently in Great Britain to reconstruct its cotton textile industry. During this process of reconstruction many factories were closed permanently, their equipment demolished and the overall efficiency of the industry rose. Further to this the same process can be observed in the iron and steel industry of many developed countries. Though the necessity of demolishing obsolete and ineffective equipment may also arise in industries of the developing countries, the total situation there is different from that in developed countries.

First, developing countries do not suffer from the same degree of industrial over-production which is present in developed countries. The main goal for developing countries is to increase their per capita production of almost any industrial product. The gap between man's needs for manufactured goods and its market demand is much wider in developing countries than in developed countries. One of the most desirable directions in filling this gap is to increase market demand (i.e. the purchasing power of the consumers) through increased production. This becomes more and more difficult because of artificial obstacles created by the market structure and certain restrictive practices in the field of production,

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the wholesale and retail trade and investments which are more or less openly observed in many developing countries. Thus the criteria of efficiency which in the reconstruction of the manufacturing industry in developed countries cannot be applied to all developing countries.

Second, developing countries do not possess the reserves of capital funds in the form of convertible money, having as potential equipment production which would ensure early and fast reconstruction of old industries or the erection of new industries.

It is possible that under current market conditions a factory where production is needed by a developing country becomes ineffective and has to be closed down. The problem of the criteria of economic efficiency in respect to the profitability for the individual company and the actual needs of a nation is not the same in developing and developed countries. Even in the United States some industrial projects with low profitability are considered to be of vital importance to the nation and are financially supported by public authorities. In developing countries the divergence between individual profitability and the actual needs of a nation is much greater in many fields of production.

Unless a closed factory is scheduled for demolition or complete reconstruction, its capacity, as a rule, should be included in the aggregate capacity of the industry and should be counted as excess capacity which needs to be utilized. The capacity of closed factories, being ineffective, is not included in the capacity estimations published by the Central Statistical Organization of India. So the existence of closed factories (and one factory is closed while it is efficient under the current market conditions) does not influence the officially registered rate of excess capacity. In India, however, the rate of capacity utilization of the equipment is calculated without taking capacity measurement into account. Moreover, capacity measurement is practically impossible for separate pieces of equipment which do not produce a final product or are used occasionally for different performances. Time is the natural unit of measurement of the rate of capacity utilization for this kind of equipment. There are studies which measure the exact time of operation of each piece of equipment and even analyze the idle time of the equipment during one shift. These studies, while not showing

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capacity utilization as compared with output, permit to find out the average rate of capacity utilization of the enterprise. They also help to reveal the main causes of under-utilization mainly emerging within an enterprise in the field of technical, organizational or managerial deficiencies and to show up bottlenecks and internal difficulties. This aspect of the estimation of the rate of capacity utilization can be helpful for capacity measurement of the enterprise as a whole.

Advisability of introducing multi-shift work

For fuller utilization of existing capital equipment it is necessary to study the possibilities and desirabilities of introducing shift work. Measures to be taken depend on the supply of raw materials, skilled manpower, management and market demand which vary according to country and industry. But other factors being equal, multi-shift work in capital intensive industries leads to higher efficiency, cost reduction, increased gross output and a higher rate of industrial development. The possibilities of selling additional goods produced through multi-shift work on the external market should be analyzed separately for each country and each product. The introduction of multi-shift work can help to export the goods not only because of the growing volume of output, but also because of reduced production costs and a corresponding increase of their competitivity on the world market.

From the viewpoint of the economic efficiency of production, full machine utilization is an important factor. Ideally equipment should be in operation continuously all the time after its installment until its replacement with short intervals needed for maintenance, cleaning, repair, adjustment, etc.

Switching to multi-shift operation immediately increases production and improves the utilization of capital equipment. Multi-shift operation is a major reserve for better utilization of productive capacities, especially in those industries where enterprises mainly work single shifts and only occasionally multi shifts.

Multi-shift operation is extremely profitable in many developing countries. M.J. Solomon in his study sponsored by the Indian Statistical Institute 8/ dealt

8/ Better Plant Utilization in India - A Blueprint for Action, Indian Statistical Institute, 1963.

with the profitability of multi-shift operations in Indian manufacturing industries. [illegible] in earning from introducing a second and a third shift can be substantial [illegible] of the productivity per man or machine is lower during the night shift. An additional advantage of multi-shift operation is the possibility of using electric power during the odd hours when the overall loads are lower. Multi-shift operations help to offset the [illegible] shortages of energy by evening out contrasts and contribute towards fuller utilization of electric plant capacity and increase of electric power output.

[illegible] Solomon advocates a seven-day operation of manufacturing enterprises. According to his calculations the financial result to be expected from a seven-day operation instead of five will be amazing. With an existing profit of [illegible].25 lakhs the introduction of one additional working day would bring additional profit to the tune of Rs. 5 lakhs with a substantial increase in output. H.J. Solomon points out that the Indian companies that switched over to seven-day operation [illegible] involving all the changes, problems and difficulties connected with an uninterrupted process of production.

In June 1964 the Productivity Engineering Team of the Japan Productivity Centre [illegible] on the benefits of multi-shift working. It was stated that maximum productivity and optimum [illegible] could be achieved only if work is carried on round the clock.

The industrialized countries of the West [illegible] multi-shift work in their capital intensive industries. The [illegible] of two [illegible] is almost a fetish to the [illegible] shift working is necessary to the maximum with [illegible]. Japan, [illegible] industrialized after World War II [illegible] intensively using shift [illegible] by extensive planning, [illegible] countries where the [illegible] shift working is the rule, and the [illegible] developed rapidly after World War II [illegible] with less intensive shift working.

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[illegible]

[illegible] second or third shifts often need [illegible] the night-shift premium. The latter [illegible] production planning, quality control, hiring [illegible]. [illegible] overtime premium over the normal rate.

[illegible] which part-time shift [illegible] multiple-shift plants. This is due to reasons [illegible] actual pro- [illegible] selected industries of

[illegible]

[illegible] equipment may be saved through a more [illegible] time. The following table shows the [illegible] this time.

[illegible]

[illegible]	[illegible] time premium
[illegible]	4).1
[illegible]	4.4
[illegible]	8.[illegible]
[illegible]	2.1
[illegible]	1.9
[illegible]	1.9
[illegible]	8.3
[illegible]	0.4
[illegible]	3.1
[illegible]	0.1
[illegible]	-
[illegible]	1.0
[illegible]	8.2
[illegible]	1.[illegible]
[illegible]	0.8
[illegible]	0.4
[illegible]	3.8
[illegible]	7.6
[illegible]	3.4

[illegible] premium is [illegible] a measure for

More than 40 per cent of the time when the machines should have been in operation they were idle waiting for resetting, repair, etc. Through efficient work scheduling machine waiting time can be reduced without any additional investments.

Many categories of machine waiting time can also be eliminated through additional training of the workers (operators, setters, re-setters) or through changes in the composition of the staff. Other technical and organizational improvements are mentioned in N.J. Solomon's study on "Better Plant Utilization in India", and in other special studies more or less known to the specialists in each corresponding industry. Experience both in developed and developing countries shows that although it is impossible to achieve a 100-per-cent machine working time, one cannot determine the maximum limit for it is time in a certain part of the working day - this limit is always overcome. When measuring present installed capacity of the equipment the basis can only be the actual machine working time. All improvements mentioned above should lead to the increase of capacity.

At first glance, excess capacity in the manufacturing industry of developing countries seems to be a major reserve of production for export. If it becomes possible to use this excess capacity for producing manufactured goods for export, two of the most problems of industrialization will be easier to solve. First, the higher rate of capacity utilization will increase the possibilities for economic development. Second, the export of additional manufactured goods will ease the lack of foreign exchange and increase imports of equipment necessary for the economic progress of these countries. But the utilization of excess capacity for export is not an easy and simple task. Not all excess capacity can be utilized for this purpose. Development of production for export demands the adoption of a series of complicated measures in the production sector (improvement of quality and management, reduction of costs, introduction of world-wide recognized standardizations, export trade promotion, etc.).

Multi-shift operation always increases the efficiency of equipment utilization. But before taking a decision on introducing multi-shift work the advantages and limitations of this step should be reviewed first.

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The following data are necessary for calculating the economic efficiency of introducing multi-shift work: (1) the maintenance costs of equipment and the rate of depreciation for fixed assets per unit of output on multi-shift work as compared with one-shift work (depending on technological conditions, the ratio may be lower than one); (2) labour costs taking into account higher wages for night work; (3) cost of raw materials, fuel, power, etc. per unit of production and wear of capital per unit production; (4) increased rate of growth of output and of value added as the result of switching to multi-shift work; (5) shortening of the time of recoupment of fixed assets and possibilities of the replacement of installed equipment by modern and more efficient machinery taking into account the interest rate on capital invested.

In addition to these financial data the following factors should also be evaluated: (1) demand for the additional product and export possibilities and (2) availability of additional power and material supply (including purchase of supply reserves).

All this information is not easily obtainable from regular statistical publications. It is therefore necessary to work out recommendations for the inclusion of additional data into these publications. A series of special studies (including case studies) on multi-shift operation in selected developing countries would also help to increase the sources of information.

In cases where installed capacity is measured on a one-shift basis but production is organized on a multi-shift basis, the comparison of plan capacity with the plan production does not give adequate information on the rate of capacity utilization. In order to estimate the actual rate of capacity utilization, officially published data on capacity have to be compared with the output produced during each shift. This information, however, is rarely available on a national scale, therefore it is not difficult to make the corresponding calculations for individual enterprises.

Flexible control over import and foreign investments

When the domestic market is not large enough to permit full capacity utilization, the competition of foreign goods imported into the country and of foreign enterprises acting in the country can prove harmful.

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Despite their high rates of capacity under-utilization developing countries continue to import goods which could be substituted by products manufactured from existing capacity. For instance the import of textiles by Latin American countries is substantial (Ecuador - over 45 million per year, Argentina - 130 to 140 million, Columbia - about 17 million, Chile - about 20 million pesos etc), at the same time, their own textile industry is under-utilized. Despite their interest to utilize their capacity, owing to severe competition from imported goods, the industry of developing countries cannot always take part in this competition due to their low rate of capacity utilization. This vicious circle can be broken only through fuller utilization of the productive capacity now by deliberate curtailment of imports of competitive foreign goods. Governments and economic planning agencies of developing countries can regulate their foreign trade which influences the rate of capacity utilization in their countries in many ways.

Foreign companies often erect enterprises in developing countries which are not of vital importance to the economy of these countries, or which create a higher productive capacity than needed. Thus industrial structure of foreign investments is not always favourable for the fast industrialization of developing countries. For example, the main part of private investments made by American companies in the engineering industry in Latin American countries (Brazil, Argentina, Mexico and Uruguay, is directed into the motor industry and other producing durable household goods (electrical appliances, radio and television sets, etc.). The result is that these countries experience a acute scarcity of capital for the most important industries, but however their industrial plant have a significant excess capacity in the above listed industries which are of secondary importance to their economy.

Private foreign capital has been invested into textile industries (which utilizes about 50 per cent of its capacity in Ecuador, 60 to 80 per cent in Argentina (1961/64), about 50 per cent in Venezuela, etc.), into processing agricultural products and the petroleum industries. In investing capital in the industry of developing countries, foreign companies do not follow the real interest of these countries, but seek the most profitable outlets for their resources. Therefore enterprises built by foreign companies are usually not

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[illegible]

(a) [illegible] efficient and profitable utilisation of capacity (including excess capacity [illegible] capacity) may result [illegible] switching the use of equipment from the production [illegible]. [illegible] main difficulties of this [illegible] the direction of the switch and to [illegible] (ii) to establish an effective [illegible] this body [illegible] both economic incentives and [illegible].

[illegible]

(b) [illegible]

[illegible]

[illegible]

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raw materials. Special calculations should be made to compare the relative profitability of alternative spendings of the foreign exchange in case not all needs for imported goods can be met. Priority should be given to expenditures for maintenance imports permitting fuller utilization of installed industrial capacity. But under certain conditions the imports of new capital equipment may have to be given first priority.

The needs for maintenance materials are proportional to the degree of industrialization. Developing countries facing excess capacity - due to shortage of imports, auxiliary materials, scarce raw materials - should therefore try to substitute maintenance imports through local products. Investments (including investments in imported equipment) for developing the local production of maintenance imports should enjoy top priority in view of their profitability to overall industrialization.

There is no guarantee that the actual flow of capital, material and labour resources in each developing country will take the lines recommended here as most effective and profitable for its industrial development in the unrestricted laissez-faire economy. Certain forms of public planning, the main measures for implementing the desired planned processes, may become necessary for achieving optimal utilization of industrial capacity. It is in this field that the services of UNIDO may play an important role.

[illegible] with regard to fuller capacity utilization priority should be given to [illegible] the improvement of effective demand. Improvements in the organization of the production process of the plant and the material-technical supply [illegible] to the best possible utilization of effective demand [illegible] productive capacities. An effective demand stimulating the [illegible] of existing capacity for export. The [illegible] from the point of view of practical [illegible] under dynamic market conditions.

[illegible] study should be [illegible] to the [illegible] present. Current trend should be [illegible] with [illegible] to [illegible] the [illegible] of

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(c) This paper is only the first step towards studying the problem of industrial excess capacity and its utilization for export. We plan to continue the work in this field in some projects. Having completed the initial study on the main problems concerning the utilization of manufacturing capacity in developing countries for exports, the right time has come to offer technical assistance to these countries. For this purpose, upon receipt of government requests experts should be sent to relevant developing countries in order to analyze the actual degree of, the reasons for capacity under-utilization in the relevant enterprises or industries, to study the market demand (both domestic and external) and the possibilities for increasing sales, and to recommend detailed technical, managerial and marketing measures. Detailed lists of recommendations for the better use of installed capacity for export production should be presented to governments, industrial organizations and international agencies.

The results of this investigation together with other studies still to be commissioned should be discussed at a meeting of experts. The aim of this meeting should be to work out recommendations for the utilization of excess capacity for export. These recommendations should deal with the following questions:

(1) methods of capacity measurement;

(2) standardization of national statistics on capacity and capacity utilization

(3) analyses of the main causes of capacity under-utilization;

(4) measures to be taken to achieve better utilization of capacity through export promotion; and

(5) the planning of further studies of this problem.

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