CHAPTER 3

DETERMINANTS OF UTILIZATION

3.1 Introduction:

The discussion in the preceding chapter focused on the alternative measures of capacity utilization. A number of empirical studies have also focused on identifying the major determinants of utilization rates. In this chapter the focus is on identifying the major determinants of utilization levels. It is not only important to obtain estimates of capacity utilization but once these estimates reveal significant underutilization of capacity as is the case in many developing countries it is necessary to identify the major determinants of underutilization of capacity. Given the significance of the manufacturing sector and given that there is existence and persistence of large underutilized capacities which developing countries can ill afford, identifying the major determinants of underutilization is of utmost concern. This can help policy makers in these countries to take timely corrective actions to help increase utilization levels and thereby increase output levels as well as savings, investment, employment etc.
Section 3.2 is a detailed discussion on the major determinants of utilization levels while Section 3.3 contains some concluding remarks.

3.2 Determinants of Utilization:

In recent years, the determinants of capital utilization as well as capacity utilization have received a lot of attention. In the determinants of capital both intended and unintended departures from frill time operation of capital stock are included. In developed countries, the focus is on intended capital idleness as highlighted by Marris (1964). In developing countries, it is unintended capital idleness that has received attention. The five major determinants of capital utilization are the wage rate, the price of capital, the size of the night shift wage premium, the capital intensity of the production process and the plant size. Higher the price of capital, bigger the plant size, more capital intensive the production process, lower the wage rate and less rhythmic the input prices, the higher is capital utilization. These and other determinants like market structure, import dependence of inputs, export dependence of final product etc. have been used in empirical studies by Winston (1971), LeCraw (1978), Lim (1976), Betancourt and Clague (1978) and Kim (1982).

As for capacity utilization, in developed countries, capacity utilization figures are watched closely as they reveal turns in the economy. Less than full capacity utilization is attributed to shortages of demand. In developing countries, excess capacity is attributed to a number of reasons. These include demand constraints as well as
supply bottlenecks like non-availability of essential input supplies (including both domestic and imported), shortages of power and transport, labor unrest etc. (Wangwe, 1977; Paul, 1974; NCAER, 1966; Goldar and Renganathan, 1991; Srinivasan, 1992, 1993 etc).

Since increased capacity utilization presents an important means of accelerating growth in capital scarce developing countries, unravelling the determinants of utilization is important for policy purposes. Since idleness may be both intended or unintended, the extent of these two and the reasons for them have important policy implications for governments in LDC's.

In figure 1 below, different levels of capacity utilization are shown. M is the maximum utilization; P is the profit maximizing or cost minimizing utilization; D is the desired utilization and A is actual utilization. M ≠ 8760 hours due to necessary plant shutdown time for maintenance. M, P, D and A are not necessarily in the order or at the level shown in the figure 1.

<table>
<thead>
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<th>8760 (hrs/year)</th>
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<tr>
<td>M = Maximum Utilization</td>
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<tr>
<td>P = Profit Maximizing Utilization</td>
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<tr>
<td>D = Desired Utilization</td>
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<td>A = Actual Utilization</td>
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Figure 1: Levels of utilization
M refers to a technical maximum output corresponding to the engineering notion of capacity. P on the other hand corresponds to an economic notion of capacity. Since bringing in economic cost considerations has the effect of lowering the efficient maximum output, P will in general be less than M. In continuous process industries like cement, steel etc. however the two utilization levels may be the same (due to high start up and shut off costs, plants are operated continuously). The profit maximizing level of capacity utilization, P should depend solely on the ‘economic’ variables incorporated in neoclassical production theory: the range of technology available to the firm and costs of all its factors of production. This neoclassical theory has several implications for the level of the profit maximizing rate of capacity utilization, P. P for a capital intensive production process will be higher than P for a more labor intensive production process since the cost of leaving the capital stock idle will be higher relative to the cost of workers needed to operate additional shifts. As the factor price ratio- wages/capital cost rises, P will decrease as the firm substitutes relatively cheap capital for more expensive labor. Similarly, P will decrease with an increasing shift differential as the cost of multishift labor increases relative to the cost of leaving the plant idle. P can also be influenced by the scale of operations of the firm. As the scale of operations increase, there may be fewer bottlenecks and the lumpiness of individual machines is more easily balanced thereby increasing the average capital utilization.

In general, in theoretical analysis, P and D have been assumed to be the same and attention has been focussed on two types of
underutilization- undesired capacity under utilization (D-A or P-A) and desired capacity underutilization (M-D or M-P since P=D). Undesired capacity underutilization is then attributed to deficient demand, input shortages, technological failure etc. in developing countries. Government policy prescription to increase capacity utilization rates would then concentrate on (macroeconomic) tools to increase demand, eliminate bottlenecks in input availability of both domestic and imported inputs, removing technological gap etc. On the other hand, desired capacity underutilization could be decreased by government policies which change relative factor prices, their variation over the work period, the range of technology available to the firm etc.

However, as LeCraw (1978) points out, the empirical works by Winston (1971) and Kim (1969) supports the conclusion that firms in LDC’s do not maximize profits or minimize their costs of operation in their choice of their capacity utilization rates; i.e. D, the desired utilization rate and P, the profit maximizing rate are not necessarily the same. Other factors besides profit maximization have been shown to have a significant impact on the decisions of managers /owners of firms.

A number of non-neoclassical theories (Leibenstein, 1976; McCain, 1975 etc.) imply that desired capacity utilization will be a function of perceived risk, projected profits, ownership pattern, etc. as well as such ‘economic’ variables as the factor price, shift differential, capital intensity, scale of operation, growth in demand. Thus, firms are willing to trade off between profits and risk and to reduce profits if
risk can be avoided. Leibenstein’s theory of **X-efficiency** shows that most firms do not organize themselves to either maximize profits or minimize costs i.e. they operate with organizational inefficiency or X-inefficiency.

Degree of **X-efficiency** in a firm increases as internal motivation and as external pressure increase. Internal pressure increases as the separation between ownership and management decreases and when profits fall below acceptable limits. Profits provide both information and incentive. Low projected profits could goad managers to work harder while high profits could imply that managers couldn’t/will not identify inefficient areas of operations. Thus there is a need to introduce such factors as risk reduction preferences of managers/owners, search costs of finding the profit maximizing organization of production process, costs of supervision to ensure profit maximizing behaviour of employees etc. in the determinants of utilization rates. In traditional theories of the determinants of underutilization, the desired non-profit maximizing capacity underutilization is assumed not to exist or to be insignificant. The reason why P and D have not been differentiated in the literature is because the empirical support for these non neoclassical theories is quite slim since it is difficult to ascertain the profit maximizing mode of operations and compare it with the one chosen by the firm. Government policy for such non profit **maximizing** capacity underutilization should concentrate on reducing the scope for non profit maximizing managerial discretionary behaviour, increase the
information available to firms about multishift operations and try to decrease the real and perceived risk of such operations.

Thus, by making a distinction between alternative types of underutilization it is possible to focus more clearly on the major determinants of utilization and appropriate government policy measures can then be formulated to increase capacity utilization rates.

Another distinction in the literature is that between economic capacity and physical capacity as stressed by Harris and Taylor (1985). They distinguish between the excess capacity that could be utilized profitably at higher levels of monetary demand and excess capacity that could not be brought back profitably into production at higher levels of monetary demand. Thus as Robinson (1981) argues: "The general absence of orders which industrialists bemoan is an absence of orders at today's prices. It is at least possible that in some severely depressed industries orders would be forthcoming at lower prices, but for such orders to be profitable costs would also have to be reduced".

During periods when business activity is depressed, firms do not employ as many inputs as are available to them either because input prices are too high relative to output prices or because the quantity of goods demanded is depressed. The choice of output level in these periods of lower economic activity is again an economic decision about profitability, subject to the technological ‘blue print' embodied in the firm's production function. Spare capacity exists because it is not profitable to produce more output. This spare capacity is part of the economic capacity of the firm, provided the
available but unused factor inputs could be profitably brought back into production at the higher level of monetary demand.

Explanations of capacity underutilization that are typically given in LDC’s are the variability of demand conditions coupled with the observation that capital investments are irreversible decisions. Such reasons are however valid in explaining variability in capacity utilization but are inadequate in explaining the ‘persistence’ of excess capacity over time. Sahay (1990) shows that persistence of excess capacity over time is a natural outcome under certain trade regimes irrespective of demand conditions or the reversibility of capital decisions. Her study thus provides a direct link between input quotas and excess capacity in developing economies. Capacity underutilization is a natural outcome when quotas are based on installed capacity. Many governments in developing countries issue licences for imported inputs on the basis of installed capacity and not actual production undertaken. A number of studies have shown that firms often invest in additional capacity not to produce output but because it provides a basis for obtaining a more generous allocation of imported inputs. Thus, restrictive trade policy regimes result in substantial economic costs including creation of excess capacity. This creation of idle capacity exacerbates the problem of capital shortages in developing countries.

In addition many markets in manufacturing sectors of developing countries are imperfectly competitive. The possibility of excess capacity as a means of deterring entry has been well documented in the literature on industrial organisation. Because investments in capital are irreversible decisions and represent pre-
emptive commitments to the industry they can be used to discourage entry. An empirical implication would be to expect concentrated industries to have lower capacity utilization.

In many developing countries, manufacturing industries are protected by prohibitive tariffs on imports of final output but face a quota on imports of scarce factor inputs. The justification for quotas is to encourage the growth of domestic industries by protecting their final output from foreign competition but permitting limited imports of technology-embodied inputs. Thus the existence of excess capacity in manufacturing industries of developing countries is explained in terms of quantitative restrictions on imported inputs.

It is also argued that low levels of capacity utilization in the private sector (Chaudhuri, 1978) are caused by low levels of public demand (assuming export inelasticity of demand for private sector output). Recent low levels of public sector development expenditure are caused largely by the absence of resource surpluses through the failure to mobilise resources at home and through the large losses suffered by the public sector enterprises induced by low levels of capacity utilization.

Thus, generally speaking the existence of capacity underutilization can be rationalized by demand or supply arguments. Of the latter, an incompatibility or complete absence of inputs to the production process is most common although labor troubles and resistance to multi-shift working have been shown to be important.

In the context of the Indian economy whilst the earlier years of planning were characterized by shortages of skilled and technical personnel the more recent problems relate to shortfalls in maintenance
imports and/or power supplies. From these considerations it appears that future levels of capacity utilization and hence industrial performance will be strongly influenced by the technical relationships that exist between inputs. That is, in the presence of foreign exchange and domestic resource constraints and with the absence of changes in product technology only allocative redistributions in response to shifts in relative prices can achieve improvements in productivity and utilization. Evidence on such technical relationships is therefore essential for any accurate assessment of future industrial performance relating to capacity underutilization. Lynk (1982-83) finds evidence of capital-energy substitutability and capital-materials complementary. This implies that future growth may not be constrained by high priced energy and may be facilitated by offsetting price-induced substitutions. The likely long run constraint to development will be shortage of materials operating most likely through the absence of maintenance imports and characterized as a foreign exchange constraint and underutilized capacity.

That the framework used to obtain estimates of capacity utilization and explain levels of utilization is important is also clear from the results that have emerged in recent years in studies on economic measures of CU. CU measures obtained in a cost minimization framework dropped proportionately more after the energy crisis of 1973 as compared to traditional measures. This larger movement in economic CU measures is attributed by Berndt and Hesse (1986) to the fact that economic CU measures depend explicitly on input prices while the traditional measures do not. Their study also
shows that electricity and fuel price increases had smaller impacts on
capacity output relative to the prices of labor or capital.

Thus, economic estimates of CU obtained for DCs proved to be very useful in capturing the effect of energy price shocks of the 1970's. In particular the impact of the two energy price hikes of the early 70's and late 70's is reflected in lower levels of CU during the 1970's. Also, the theoretical framework can be used to assess the impact of variable input prices and output demand on CU. Excess capacity or overutilization of capacity can be attributed to changing economic circumstances in the form of changing output demand and input price variations.

33 Concluding Remarks:

The discussion in this chapter shows that in order to identify the factors causing underutilization of capacity it is also important to understand the framework in which estimates of CU have been obtained. Distinguishing between different types of under-utilization is important as it has important inferences for the different determinants of capacity underutilization. In developing countries identifying the determinants of utilization has an important role to play in industrial policy. This can lead to the adoption of appropriate remedial measures to increase utilization levels in capital scarce economies. Since the real cost of capital is high, investing in creating capacity and not utilizing it is a costly proposition. Capacity installed must be used to the maximum possible.