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AN ANALYSIS OF THE CAUSES FOR SICKNESS OF A PRODUCTION UNIT - A CASE STUDY

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Abstract:

In this application paper, the causes for sickness in a fertilizer unit in India are discussed in detail. The concept of retention price, the methodology followed in fixing the retention price of fertilizer companies by Fertilizer Industry Co-ordination Committee (FICC) is explained. The importance of specific consumption norms of basic raw materials and its dependence on the capacity utilisation of the plant is discussed. The Total Productivity Measure (TPM) of this production unit, year wise, over a period of time is computed and presented. The capacity utilisation of the plant over a period of time is also presented. The reasons for low productivity and low capacity utilisation are discussed at length. Some measures are also suggested to improve the capacity utilization and consequently the productivity of the production unit.

1. **Introduction**:

It is an established fact that one of the primary objectives of any business is to earn profits. This principle applies to manufacturing organisations as well. The finished product from the manufacturing organisation is finally sold to the end users or consumers. In the process of producing the finished goods, the organisation incurs certain costs. In the process of selling the finished goods to the consumers, the organisation realises the sales revenue. The manufacturing concern is said to have made profits only when the sales revenue is more than the cost of production. The basic methods to earn profits are either to set the selling price above the cost of production or to reduce the cost of production below the selling price or both. However, there are certain practical problems in both the methods. For certain type of products like fertilizers (the product under present study), the selling price is set by the Government and the management of the manufacturing organisation producing the product do not have any control over it. Similarly reduction of the cost of production below a point may not be practicable due to certain technical and operational constraints under which the managements are required to carry out the operations.

The present study is undertaken in a manufacturing organisation producing a nitrogenous fertilizer “urea” which is facing the problem of severe financial losses due to the technology

adopted in the organisation and certain operational problems like shortage of basic raw materials like coal, power etc., The quality of the coal supplied by the nearby coal mines, is very poor which directly affects the healthiness of the production system. There are frequent voltage dips, power failures apart from power cut/ restriction imposed on the unit. These factors are external in nature and are beyond the control of the management responsible for the operations of the unit. It is also a well established fact that in a continuous production system whenever the capacity utilisation is low, the specific consumption (i.e. the consumption per one M.T of the output urea fertilizer) of raw materials will be high when compared to the norms prescribed.

In the case of the present company, the selling price (also known as consumer price to farmers) of the fertilizer "urea" is fixed by the Government. It is fixed at a very low level so as to encourage farmers to utilise the fertilizers to produce more and more of food grains. Thus the consumer price is very less when compared to the actual cost of production. To protect the manufactures of the fertilisers from losses, an apex body known as FICC (Fertiliser Industry Co-ordination Committee)at the Government of India level, fixes a price known as retention price based on the technology adopted by the manufacturer, the capacity utilisation of the production unit etc., This price varies from one production unit to an other. In case of the company under study, the retention price was originally fixed at an expected attainable capacity of 80%. Subsequently, several high power committees were setup by the Government to study the operational problems faced by the unit and to recommend the suitable changes required in the retention pricing policy of the unit. Based on the recommendations of these committees, the retention price was re-fixed ,in stages, at a derated capacity of 66%, 55% and finally 45%. Now the present retention price is based on 45% expected attainable capacity of the unit. FICC has fixed certain norms for the specific consumptions of the principal raw materials at the expected attainable capacity of 45% and the retention price is computed on the basis of these norms. However, in practice the actual capacity attained by the unit was much lower and as a result the actual specific consumptions are much more than the norms set by FICC. This has resulted in the cost of production much higher than the retention price set by FICC. Therefore, the unit has been incurring heavy financial losses year after year. Finally the unit has been declared "sick" and referred to Board for Industrial and Financial Reconstruction (BIFR) for examination of the viability of operations and to suggest the ways and means of revamping / restructuring of the unit. Presently the operations of the unit were suspended by a decision of the Government of India. It is under these circumstances the present study is undertaken with a view to scientifically analyse the problems faced by the unit and to offer some suggestions to improve the productivity of the unit. Though the suggestions are specific to the unit concerned, the broad philosophy may be of some interest to all continuous production systems.

3. **Capacity Utilisation of the Production Unit**:

In the structure of retention price, the variable cost takes the major share i.e. more than 70% of the value of retention price. While fixing the retention price, FICC fixes the reasonable specific consumption norms for the major inputs (raw materials) to the production process. Capacity Utilisation is one of the critical parameters determining the profitability of any continuous production system. The specific consumption norms are fixed on the basis of level of attainable capacity of the plant. For the plant under study, the retention price was initially fixed at 80% of the installed capacity of 1500 MT of urea per day. However, several high power committees have been set up by the Government to study the various problems encountered during the actual operations of the unit and to recommend the attainable capacity of the unit. The retention price was subsequently revised by FICC on the basis of derated capacity of the plant as recommended by these committees. The sequential derating of the plant capacity is presented in table—(1).

Table – (1) Sequential derating of the plant capacity

Sl. No.	Date of derating	Derated capacity
1	01—04—1982	66%
2	01—11—1990	55%
3	01—09—1992	45%

The attainable capacity of the plant has been derated based on various problems faced by the unit during its operation over a period of time since its inception. The actual capacity utilisation of the unit achieved over a period of time is presented in the table—(2).

Table—(2) Actual Capacity Utilisation of the production Unit

Year	Production (MT)	Percentage capacity utilization
1981—82	128006	25.86
1982—83	162664	32.86
1983—84	175068	35.37
1984—85	203090	41.03
1985—86	120140	24.27
1986—87	246105	49.72

1987—88	117255	23.69
1988—89	154160	31.14
1989—90	113875	23.01
1990—91	78280	15.81
1991—92	191860	38.76
1992—93	126025	25.46
1993—94	193015	38.99
1994—95	76495	15.45
1995—96	107385	21.69

Except during one financial year (1986—87), it may be seen that the actual capacity utilisation of the unit is far less than the attainable capacity of 45% as fixed by FICC for the purpose of computing the retention price. As a result, the actual specific consumption of the inputs (raw materials) consumed are much higher than those fixed by FICC. This has resulted in the higher cost of production than the retention price set by FICC. This has ultimately lead to heavy financial losses of the unit and consequently the unit became "Sick". Now it has been referred to the Board for Industrial and Financial Reconstruction (BIFR) for analysing the viability of operations and examining the revamping measures.

5. Total Productivity Measure (TPM) of the Production Unit:

The various productivity indices such as Labour Productivity, Equipment Productivity, Material Productivity, Other Inputs Productivity and the Total Productivity Measure (TPM) are computed, year wise, for several years of operations of the unit,

The Productivity Indices, thus computed, are presented in the table – (3).

Table – (3). Productivity Indices of the Production Unit

Year	Labour Productivity	Equipment Productivity	Material Productivity	Other Inputs Productivity	Total Productivity Measure	Capacity Utilisation in %
1984—85	23.58	3.27	1.86	8.36	0.9940	41.03
1985—86	13.63	2.03	1.52	4.62	0.6951	24.27
1986—87	18.63	4.42	1.91	6.34	1.0400	49.72
1987—88	13.66	1.96	1.51	3.02	0.6100	23.69
1988—89	13.59	2.65	1.65	3.46	0.7430	31.14
1989—90	9.90	2.27	1.50	2.75	0.6362	23.01
1990—91	6.23	3.09	1.06	1.56	0.4834	15.81
1991—92	12.92	10.64	1.50	2.15	0.7672	38.76

1992—93	10.20	8.84	1.17	1.74	0.6096	25.46
1993—94	16.27	15.89	1.29	2.17	0.7350	38.99
1994—95	6.44	5.54	0.88	0.91	0.3889	15.45
1995—96	8.75	8.47	0.90	1.01	0.4285	21.69

In continuous production systems, the more the capacity utilization the more will be the Total Productivity Measure (TPM). This is evident from the table - (3). Having established that low capacity utilization is one of the main reasons for the sickness of the production unit, letus now analyse the reasons for such a low capacity.

6. **Reasons for Losses of the Production Unit**:

From the table—(3), one may observe that except during one year (i.e. 1986—87), the Total Productivity Measure (TPM) of the Unit is less than 1, indicating "LOSS" from the operations of the unit. The main reason for the losses is the low capacity utilisation of the unit which is mainly due to the following reasons.

* Irregular and poor supplies of coal, which is the major raw material, from the coal mines.

* Poor quality of Coal.

* Inadequate / irregular power supplies from the State Electricity Board.

* Poor quality of power supply (frequent voltage dips / power failures).

* Design deficiencies and equipment mis-match in the unit leading to frequent break-down of the equipments.

The percentage loss of production on account of various causes mentioned above have been computed and presented in table –(4).

Table – (4) Cause wise production loss in percentage

Cause	1991—92	1992—93	1993—94	1994—95	1995—96	Average
Power problem	49.83	9.17	24.09	12.26	46.47	28.36
Coal shortage	12.49	27.47	26.48	45.71	25.21	27.47
Equipment breakdowns	31.71	15.74	20.87	6.53	11.13	17.20

Process problem	1.87	4.65	8.69	0.45	1.59	3.46
Planned shutdown	4.20	27.96	12.36	26.60	6.23	15.47
Other reasons	0.00	15.01	7.51	8.45	9.37	8.06
Total	100.00	100.00	100.00	100.00	100.00	100.00

7. **Analysis of the Problems faced by the Unit**:

The various causes leading to lower capacity utilisation of the production unit are discussed in detail in the subsequent paragraphs.

(a). **Coal Problems**: The Coal Collieries from which the coal linkage is established is required to supply coal, which is the principal raw material for the unit, @ 3000 MT per day. However, due to frequent strikes and industrial unrest in the coal mines and other operational problems, the agency was unable to keep up its commitment and unable to supply the coal in required quantity. Many a time, the production unit load was to be reduced so as to match the coal supplies and at times the unit was to be taken forced shut down. Of late in the recent past, the problem became very acute. The norm of having a minimum closing stock of 1 lakh MT of coal in the coal yard was never achieved.

As per the agreement the mining agency was supposed to supply the coal of quality 8% moisture content and around 20% ash content. However, the quality of coal started deteriorating since 1987, increasing the ash content from 20% to 30%, causing frequent neck chocking in the gasifiers (heart of the entire fertilizer unit) and finally resulting in frequent shutdowns of the plant & production limitation. The higher ash content in the coal results in

- Higher wear & tear of the equipment leading to frequent breakdown of the equipments and low capacity utilisation.
- Higher specific consumption of coal.
- Higher specific consumption of lime stone. (limestone is added to the coal for reducing the fusion temperature of ash there by increasing its fluidity).
- Higher cost of production due to lower capacity utilisation.

From the table—(5), one may observe that, the loss of production due to shortage of coal is quite significant and is even alarming during recent years. During the year 1994—95, the loss of production due to shortage of coal is as high as 46%. That is, of the total loss of production, nearly 50% is due to coal shortage. This is an irreparable problem since the technology itself is "coal based" technology & coal is the principal raw material. The coal linkage is from the nearby coal mines which is one of the primary factors for the location of this coal based fertilizer plant in

that area. Any attempt to get coal from some other source, results in huge transportation costs and the operation of the unit will be uneconomical.

(b). **Power problems**: The production unit, under study, is the highest power consumer of the State Electricity Board . The power requirement is as high as 55MW. Power problem for this production unit started from 1987—88 onwards. The details of power cut imposed on this unit from time to time is presented in the table—(6).

Table – (6). Details of the power cut imposed on the Production Unit

Year	Period of power cut	Percentage cut in energy
1987—88	11—04—87 to 15—07—87	100
	16—11—87 to 10—03—88	40
	11—03—88 to 31—03—88	100
1988—89	01—04—88 to 30—07—88	100
	28—11—88 to 24—12—88	30
	25—12—88 to 31—03—89	40
1989—90	12—04—89 to 21—07—89	100
	22—07—89 to 31—07—89	40
	01—08—89 to 31—08—89	20
	27—12—89 to 31—03—90	40
1990—91	01—04—90 to 15—06—90	100
	16—06—90 to 07—07—90	20
	08—01—90 to 31—03—91	40
1991—92	01—04—91 to 23—04—91	35
	24—04—91 to 23—05—91	100
	24—05—91 to 23—06—91	25
	06—01—92 to 31—03—92	40
1992—93	01—04—92 to 23—06—92	45
	24—06—92 to 23—08—92	60
	24—08—92 to 06—09—92	45
	23—01—93 to 31—03—93	40
1993—94	01—04—93 to 23—08—93	40
	10—02—94 to 31—03—94	40
1994—95	01—04—94 to 23—04—94	40
	24—04—94 to 08—07—94	60
	08—07—94 to 23—07—94	40
	23—01—95 to 31—03—95	40
1995—96	31—03—95 to 29—12—95	40
	29—12—95 to 31—03—96	60

It may be observed from tables (5) & (6) that the percentage loss of production due to power problem is quite alarming. The percentage loss of production due to power problem alone is as high as 47% during the year 1995—96.

(c) **Design Deficiencies & Equipment mismatch**: The coal gasification technology developed for the production unit under study was not fully established on large scale capacity (of 1500MT per day of urea) plants. This technology was tested else-where on plants of lower capacity (500 MT per day). The same technology was adopted for a much higher capacity plant of 1500 MT per day in the production unit under study. In many critical sections like Gasification, Rectisol, Ammonia Synthesis, Air Seperation Unit, Steam Generation etc., of this production complex, there are no standby equipments. Also, most of the equipments were designed for a coal quality of ash content less than 20%. But the quality of coal supplied by the mines is of the order of more than 30% of ash content. As a result, frequent equipment breakdowns in the plants are taking place, leading to low capacity utilisation of this production unit.

From the table—(5), it may be observed that the percentage loss of production on account of equipment breakdown is ranging from 7% to 32%.

8. **Effect on Specific Consumptions**:

Various problems discussed in section (7) have direct impact on the specific consumption of raw materials incurred in the production unit. The actual specific consumption of raw materials achieved in the production unit over a period of time is presented in table—(7).

Table – (7) Actual specific consumptions achieved in the unit

Year	Coal for process (MT)	Coal for steam (MT)	Power (MWH)	Fuel Oil (KL)	LDO (KL)	Capacity utilization in %
1981—82	1.7591	2.1303	1.7367	0.1134	0.0201	25.86
1982—83	1.5755	2.1226	1.4995	0.1440	0.0150	32.86
1983—84	1.7083	1.9746	1.4000	0.1192	0.0165	35.37
1984—85	1.6193	1.8517	1.3152	0.0885	0.0096	41.03
1985—86	1.6492	2.0358	1.5865	0.1038	0.0150	24.27
1986—87	1.4671	1.6658	1.2092	0.0774	0.0077	49.72
1987—88	1.6585	2.2646	1.5677	0.1285	0.0200	23.69
1988—89	1.6499	1.5932	1.1467	0.0840	0.0089	31.14
1989—90	1.7032	2.1000	1.3640	0.1112	0.0113	23.01
1990—91	1.7648	3.0854	1.6941	0.1755	0.0161	15.81
1991—92	1.6645	1.8469	1.1768	0.0848	0.0096	38.76

1992—93	1.8579	2.7317	1.5903	0.1067	0.0069	25.46
1993—94	1.8546	2.2592	1.3712	0.0614	0.0069	38.99
1994—95	2.2152	3.0119	1.9287	0.0826	0.0113	15.45
1995—96	2.0065	2.9168	1.5656	0.0858	0.0101	21.69

The dependence of specific consumptions on capacity utilisation of the unit is clearly brought-out in table – (7). It is evident from the above table that the specific consumption of raw materials are on the higher side whenever the capacity utilisation of the unit is low.

9. **Conclusions**:

From the above made discussions, one may observe that the causes mentioned above are of external in nature and are to be tackled through a very systematic approach. In the year 1995—96, the percentage loss of production due to above causes is as high as 83% which is very alarming in nature.

Hence, there is a need to have a close look at the problems faced by the unit. To tackle the coal problem, probably, a Memorandum of Understanding (MoU) between the mining agency and the production unit is a must. The MoU should clearly state that the agency should supply a pre-determined quality and quantity of coal on regular basis. Any deviation from this should attract penal charges on the part of the mining agency. To tackle the power problem, a captive power plant may be required to be installed. However, the financial implications such as cost-benefit analysis need to be worked out. To tackle frequent failures of the equipment, a sound preventive and predictive maintenance policy for all critical equipments of the plant need to be worked out. On a selective basis, redundant units may be installed for certain critical equipments. Once, the above mentioned steps are taken, it is hoped that the capacity utilization of the unit will certainly improve thereby achieving significant improvement in the specific consumption of raw materials and consequently productivity of the unit.

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