

265

WP : 265

Working Paper

WP265



WP

1978/265

IIM
WP-265



विद्याविनियोगाद्विकासः

IIM
AHMEDABAD

**INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD**

ENTERPRISE LEVEL FACTORS
INFLUENCING PRODUCTIVITY IN PSEs

by

M G. Korgaonker

W P No. 265
Dec. 1978

WP265
I INSTITUTE OF MANAGEMENT AND ADMINISTRATION
WP
1978
(265)

* The main objective of the working paper series *
* of the IIMA is to help faculty members to *
* test out their research findings *
* at the pre-publication stage. *

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD

ACKNOWLEDGEMENTS

I take this opportunity to express my sincere thanks to Mr. B.S.R. Murthy, Research Assistant, who assisted me extensively both in data collection as well as in taking several computer runs required for the study.

I also thank the Research Committee of IIMA, for supporting the study with a financial grant.

Last but not the least, my thanks are due to Mr. P. Rajagopalan for his competent typing of the manuscript.

December 21-12-1978

M.G. KORGAONKER

ENTERPRISE LEVEL FACTORS INFLUENCING PRODUCTIVITY
IN PSEs

The extensive discriminant analysis performed earlier established effectiveness of productivity ratio, as a major determinant of financial performance. This finding is of major significance, since the implication is that efforts to improve productivity of an enterprise through improved physical performance necessarily leads to improvement of financial performance. Indeed, even if other variables identified by MDA as major discriminants are considered, performance improvement vis-a-vis these ratios may involve upward swing in sales and a concomittant control of costs. Clearly, both have favourable impact on productivity. Another noteworthy conclusion stemming from MDA is that from the point of total financial performance, control over total cost and not fixed cost alone, should result in enhanced financial performance.

The third part of our study refers to factors affecting productivity in PSEs. Since improved productivity is a consequence of better physical performance of various activities of the enterprise such as production, sales, exports, etc., factors affecting productivity must be looked for, in these activities. Two types of factors may nevertheless, be recognized:

1. Specific activity level factors
2. Enterprise level factors.

The activity level factors may be viewed as appropriate microfactors which markedly affect activity performance. For instance, factors such as improved work methods, improved planning and control of materials and production, improved scheduling, maintenance, balancing of equipment capacities, improved layouts, material handling, division of labour, value analysis are known to contribute to higher productivity of manufacturing activity. Similarly efficient management of working capital particularly with respect to receivables and inventories, improved financial forecasting and planning, better control over fund flow, is understood to imply better financial management.

Cumulatively effect of the micro-factors manifests itself in the form of favourable impact on aggregate performance indicators of the activity as a whole. Examples of these are higher capacity utilisation of manufacturing facilities, higher sales turn over through customer diversification, etc. We shall designate such indicators of aggregate physical performance as enterprise level factors of productivity or macro-factors.

In the present study we focus on the enterprise level factors of productivity. The objective was to establish the factors through a cross section of PSEs, manufacturing and selling goods. A multivariate statistical set up was again thought appropriate. Specifically, multiple regression analysis (MRA) was selected for the purpose.

To start with we selected following enterprise level factors as independent variables for multiple regression analysis:

1. Capacity utilisation (CU)
2. Number of houses/staff strength (NHSS)
3. Value of exports/sales (ES)
4. Loans/Investment (LI)
5. Depreciation/Gross Block (DGB)
6. Inventories/Working Capital (IWC)
7. Materials Consumption/Value of Production (MCVP)

Capacity utilisation was chosen to reflect manufacturing performance. Number of houses/staff strength, was expected to show effect of township burden which PSEs carry. Ratio of exports/sales presumably determined ability of the enterprise to improve its sales through exports. The ratio of loans/investment was allowed to see if the specific capital structure of an enterprise had significant effect on productivity. Similarly, ratio of depreciation to gross block was included to determine the effect, if any, of the enterprise policy regarding depreciation. The ratio of inventories to working capital reflected nature of control on working capital. Finally the ratio of materials consumption to value of production understandably highlighted effect of material costs.

Actual values of factors were computed for 43 enterprises manufacturing and selling goods for which data was available. The regression coefficients and their statistical significance, obtained using MRA are given in Exhibit 1. Only 46% of the variation in sample productivity ratio was however explained

by the regression. For the universe plane of regression, the percentage explained was 34%. The F-ratio of 4.28 was significant at 0.01 level of significance.

Exhibit 1

Regression Coefficients and Their Statistical Significance

- MRA- Ist Run

Sr.No.	Factor	Regression coefficient	Significance
1.	Constant	1.1316	✓
2.	CU	0.2947	✓
3.	NHSS	-0.0824	x
4.	ES	0.3076	x
5.	LI	-0.3177	✓
6.	DGB	1.7323	x
7.	IWC	-0.0071	x
8.	MCVP	-0.4379	✓

To improve the correlation, two new factors were added as independent variables to the MRA set up, namely

1. Short term credit/paid up capital (SCPC)
2. Sales other than to government/total sales (OSTS)

The first factor highlighted utilisation of short-term credit in relation to the overall resources. The other factor indicated extent of diversification achieved by the enterprise in its customer composition. Exhibit 2 gives the regression coefficients and their statistical significance, using the MRA with revised data. About 59% of variation in sample PR and 46% of variation of universe plane of regression was explained. The F-ratio of 5.19 was statistically significant at 0.01 level of significance. Although introduction of two new factors improved correlation, the overall regression was rather unsatisfactory.

Exhibit 2Regression Coefficients and Their Statistical Significance- MRA - IInd Run

Sr.No.	Factor	Regression coefficient	Statistical significance
1.	Constant	1.0396	✓
2.	CU	0.3518	✓
3.	NHSS	-0.1611	x
4.	ES	0.4064	✓
5.	LI	-0.1604	x
6.	DGB	0.4106	x
7.	IWC	-0.0061	x
8.	MCVP	0.3006	x
9.	SCPC	-0.0122	X
10.	OSTS	0.00006	✓

For further revision of multivariate set up, two of the factors that were not statistically significant were removed, namely Depreciation to Gross Block and Short term credit to paid up capital, in order to restrict the number of independent variables. These were replaced by cost of production/value of production (CPVP) and Capital Works in Progress to Gross Block (CWPGB). The factor CPVP represented extent of control over factory cost while CWPGB, indicated effect on productivity of the on-going capital works of the enterprise. Admittedly, the latter could affect productivity through requirement of additional input without quantifiable material addition to output.

The MRA output with new set of variables showed that nearly 88% of variation in productivity ratio was explained by the factors considered. For the universe plane of regression, the variation explained was nearly 84%. This meant a sample correlation coefficient of 0.94 and a universe multiple correlation coefficient of nearly 0.91. The F-ratio of 26.04 was clearly significant. Regression coefficients

of various factors are shown in Exhibit 3. Seven out of ten coefficients are seen to be statistically significant at 0.05 level of significance.

Exhibit 3

Multiple Regression Coefficients of Various Factors - MRA

- 3rd Run

Sr.No.	Factor	Coefficient	Statistical significance
1.	Constant	1.9694	✓
2.	CU	0.1622	✓
3.	NHSH	-0.1248	✓
4.	ES	0.1175	x
5.	LI	-0.0338	x
6.	IWC	0.0282	✓
7.	CMVP	-1.1672	✓
8.	OSTS	-0.0275	x
9.	CPVP	-1.2655	✓
10.	CWPGP	0.0564	✓

Addition of two more factors namely DGB and SCPC as independent variables did not result in any marked further improvement of correlation. The resulting MRA output, again showed that the regression coefficients were statistically significant for six out of eleven factors, namely CU, IWC, CMVP, CPVP, CWPGP, NHSS.

Confining to the above six factors, we performed stagewise multiple regression analysis, to ascertain the amount of variation in productivity ratio (PR) explained by the regression, with successive addition of a new factor as independent variable. The results of the stagewise multiple regression analysis (SMRA) are shown in Exhibits 4 to 9. A remarkable result of the SMRA is that only two factors namely CPVP and CMVP together explain a nearly 79% of variation in sample productivity ratio and around 77%.

variation in the universe productivity ratio. We therefore conclude that the two predominant factors influencing productivity in PSEs are the magnitude of material consumption relative to the total value of production and the magnitude of factory cost of production relative to the value of production. The implication is clear that the productivity in PSEs is critically dependent upon effective cost control - specially in relation to material consumption and control of factory cost. While there are inter-organizational differences in capital structure, utilisation of short-term credit, extent of diversification achieved in customers and exports, depreciation of assets, capacity utilisation, township burden and on-going capital works, the cumulative effect of these differences appears to have had only marginal impact on productivity. The priority factors of productivity improvement are those which relate to the control of costs namely material consumption and factory cost relative to the aggregate value of output. Savings effected in these, should contribute significantly to productivity improvement.

Exhibit 4

Stagewise Regression Analysis - Independent

Variable CPVP

Sr.No.	Independent variable	Regression coefficient	R^2	\bar{R}^2	F-ratio	statistical significance of coefficients
1.	Constant	1.1888	0.1229	0.0801	5.7454	✓
2.	CPVP	-0.4774				✓

Exhibit 5Stagewise Regression Analysis - Independent
Variables: CPVP, CMVP

Sr.No.	Independent Variable	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	2.1246				✓
2.	CPVP	-1.2934	0.7857	0.7697	73.3385	✓
3.	CMVP	-1.2383				✓

Exhibit 6Stagewise Regression Analysis - Independent Variables:
CPVP, CMVP, CU

Sr. No.	Independent variables	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	1.9774				✓
2.	CPVP	-1.2356	0.8065	0.7866	54.1797	✓
3.	CMVP	-1.1984				✓
4.	CU	0.1417				✓

Exhibit 7Stagewise Regression Analysis - Independent Variables:CPVP, CMVP, CU, NHSS

Sr. No.	Independent variables	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	1.9931				✓
2.	CPVP	-1.2224	0.8137	0.7892	41.4977	✓
3.	CMVP	-1.1765				✓
4.	CU	0.1344				✓
5.	NHSS	-0.0603				x

Exhibit 8Stagewise Regression Analysis - Independent Variables:- CPVP, CMVP, CU, NHSS, CWPGB

Sr. No.	Independent variables	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	1.9229				✓
2.	CPVP	-1.1485				✓
3.	CMVP	-1.1015	0.8318	0.8046	36.6043	✓
4.	CU	0.1436				✓
5.	NHSS	-0.0985				✓
6.	CWPGB	0.0496				✓

Exhibit 9Stagewise Regression Analysis - Independent Variables:CPVP, CMVP, CU, NHSS, CWPGB, IWC

Sr. No.	Independent variables	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	2.0004				✓
2.	CPVP	-1.2734				✓
3.	CMVP	-1.2127	0.8573	0.8296	36.0529	✓
4.	CU	0.1362				✓
5.	NHSS	-0.1282				✓
6.	CWPGB	0.0560				✓
7.	IWC	0.0257				✓

Exhibit 10Stagewise Regression Analysis - Independent Variables:CPVP, CMVP, CU, NHSS, CWPGB, IWC, OSTS

Sr. No.	Independent variables	Regression coefficients	R^2	\bar{R}^2	F-ratio	Statistical significance of coefficients
1.	Constant	1.9960				✓
2.	CPVP	-1.2648				✓
3.	CMVP	-1.2225	0.8579	0.8254	30.1799	✓
4.	CU	0.1391				✓
5.	NHSS	-0.1297				✓
6.	CWPGB	0.0542				✓
7.	IWC	0.0251				✓
8.	OSTS	0.0163				x