Prashant Sharma, 2023, 11:6
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology

An Open Access Journal

Productivity have Proven their Importance in Economic Development Worldwide

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Abstract- This chapter presents an overview of the conceptual framework, design, action plan, and methodology employed in the research. It also describes the phases of research, description of data collection instruments used and the methods for analysis of data to test the hypotheses. The basic theory in this study is to provide the rational and theoretical justification for the methods that were employed. It encompasses the discussion of the research paradigm in terms of the qualitative/quantitative approaches and various research methods. This chapter addresses the development of an appropriate procedure for the research including a description of the process used to develop the survey questionnaire and the final sample selection.

Keywords: productivity, SMES, Malmquest P Index

I. INTRODUCTION

Small and Medium Enterprises have proven their importance in economic development worldwide economic development. In India they represent about 80% of the total establishments and contribute approximately 40% of the total export and provide employment to over 18.6 million people. Productivity growth is the basis of efficient economic growth. Mongia Pooran and Sathaye Jayant defined economic growth (1998) as the process of a sustained increase in the production of goods and services with the aim of making available a progressively diversified basket of consumption goods to population. Scarcity of resources, which includes physical, financial and human resources, has been recognized as a limiting factor on the process of economic growth. While output expansion based on increased use of resources is feasible, it is not sustainable. Therefore, efficiency or productivity of resources becomes a critical issue in economic growth. These terms, which will be defined more precisely in the following sections, indicate ability to obtain a given amount of good or service by using a lesser amount of input. Productivity growth, therefore, is critical for ensuring sustained increase in the production of goods and services.

Economic growth has traditionally been associated with promotion of manufacturing activities. At least that is what makes the diversity in the basket of consumption goods and services possible, when trading possibilities are limited. If a country's economic growth is driven largely by massive investment in fixed capital and accompanied by negligible improvement in the way of its utilization, then the growth would not be sustainable and eventually wind down. The reason is that investing in more machinery and infrastructure inevitably faces diminishing returns unless additional machinery and infrastructure are of increasingly better quality, or used with increasing efficiency. Therefore, we should look beyond simple year to year comparisons of GDP or labour productivity to evaluate the long term sustainability of economic growth, and try to sort out how much of the GDP growth is in fact due to improvements in the manner a given Level of labour as well as capital stock is utilized and examines which GDP growth should simply be assigned to increases in labour and fixed capital.

II. RESEARCH DESIGN AND METHODOLOGY

Our main objectives are;

- Productivity analysis of MSEs in Madhya Pradesh.
- Analysis of Malmquist Productivity Index and comparison of growth in different industries.
- Establishing the sources of productivity change
- To carry out analysis of total factor productivity change, technical change and technical efficiency change in Madhya Pradesh.

1. Productivity, Technical Efficiency and Technical Change- Concept

Efficiency and productivity are used interchangeably, while they are not precisely the same. However, they broadly indicate ability to obtain a given amount of good or service by using a lesser amount of input. To distinguish the two, coelli, T., Rao, D. S. P., Battase, G. E. (2005) [3], illustrated through example of a simple production process where a single input 'X' is used to produce a single output. The line OF', in shown in fig (3.1), represents a production frontier, which defines the relationship between the input and output. Production frontier represents the maximum output attainable from each input level. Therefore it reflects the current state io technology in in the industry. Firm in this industry operate either on the frontier (B & C), if they are technically efficient or beneath the frontier (A) if they are not technically efficient.

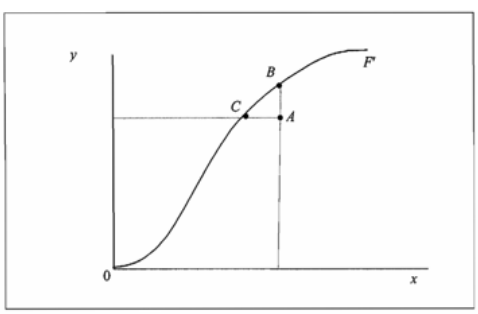

Figure.1: Production Frontier and Technical Efficiency

Further having understood the concept of technical efficiency let's take the help of figure 3.2 to distinguish between technical efficiency and productivity. Lines through origin and passing through A, B and C are drawn to present the measure of productivity by the slope of the line for a particular data point. If the firm operating at A were to move to the technically efficient point B, the slope of the ray would be greater, implying higher productivity at point B. however, by moving to the point C, the ray from the origin is at a tangent to the production frontier and hence defines the point of maximum possible productivity. This latter movement is an example of exploiting scale economies. The point C is the point of (technically) optimal scale. Operation at any other point on the production frontier results in lower productivity. From this discussion, it is concluded that a firm may be technically efficient but may still be able to improve its productivity by exploiting scale economics. Given that changing the scale of operations of a firm can often be difficult to achieve quickly, technical efficiency and productivity can in some cases be given short-run and long-run interpretations.

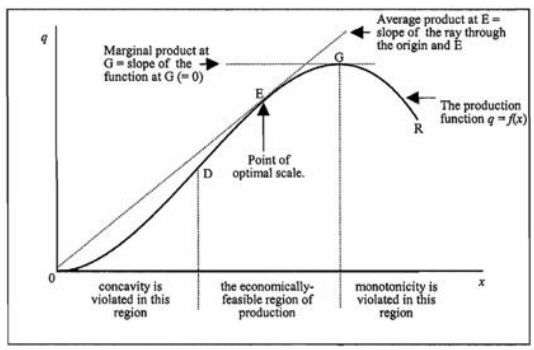

Figure. 2. Productivity, Technical Efficiency & Scale Economy

The discussion above does not include a time component. When one considers productivity comparisons through time, an additional source of productivity change, called technical change, is possible. This involves advances in technology that may be represented by an upward shift in the production frontier. This is shown in figure 4.3, by the movement of the production frontier from OF_o' in period 0 to of' in period 1. In period 1, all firms can technically produce more output for each level of inputs, relative to what was possible in period 0. When is observed is that a firm has increased its productivity from one year to next, the improvement need not have been from efficiency improvements alone, but may have been due to technical change or the exploitation of scale economies or from some combination of these three factors.

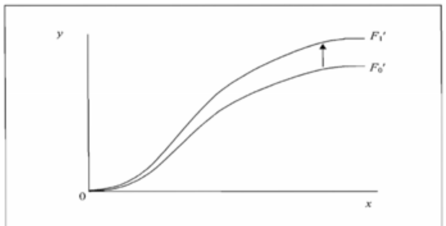

Figure.3 Technical Change between Two Periods

Up to this point, all discussion has involved physical quantities and technical relationships. We have not discussed issues such as costs or profits. If information on prices is available, and a behavioral assumption, such as cost minimization or profit maximization, is appropriate, then performance measures can be devised which incorporate this information. In such cases it is possible to consider a locative efficiency, in addition to technical efficiency. Allocative efficiency in input selection involves selecting that mix of inputs (e.g., labour and capital) that produces a given quantity of output at minimum cost (given the input prices which prevail). Allocative and technical efficiency combine to provide an overall economic efficiency measure.

2. Measurement of Productivity Change and Tfp Index

This chapter presents various approaches to productivity measurement. In the case of firms producing multiple outputs using multiple inputs, we represents change or growth (or decrease) of productivity by a total factor productivity (TFP).As per Singh S P et al. (2006) [28], most commonly used measures of productivity are partial or single factor productivity (SFP) and total factor productivity. SFP is the ratio of total output to the quality or number of the factors for which productivity is to be estimated. SFP provides a distorted view about the contribution of a factor to the total production. For instance, partial productivity of labor can be increased by reducing quantity of labor and increasing quantity of capital in the production unit. Therefore, concept of TFP is more relevant in context of resource use efficiency. TFP is defined as the ratio of weighted sum of output to the weighted sum of inputs.

Over the last three decades, researchers have developed several theories and methods of TFP measurement. Before the mid-1990s, most studies estimated TFP growth by growth accounting approach (Hsiao and park, 2002) [12]. This approach is based on unrealistic assumptions of perfect competitions and constant return to scale. It assumes that a firm operates on its production frontier, implying that it has 100% technical efficiency. Thus, TFP growth measured through this approach is due to technical change, not due to technical efficiency change (maw son et al., 2003) [21]. In recent years, stochastic frontier analysis and DAE-based MPI have become popular approaches that use panel data for estimation of TFP of individual decision making units (DMUs). These approaches do not assume that all production units operates at 100 per cent technical efficiency. According to the MPI approach, TFP can increase not only due to technical progress (shifting of frontier) but also due to improvement in technical efficiency (catch-up).

According to coelli, T., et al. (2005) [3] if following information related to a firm, who's productivity change is to be measure from period 's' to period 't'; The firm produces outputs qs and qt using input xs and xt in periods 's' and 't'.

- The level of technology and state of knowledge used are $ss$and st.

He proposed four alternatives to measure the productivity changes:

- The first approach is to simply use a measure of output growth, net of growth in inputs. Diewert (1992) [6] has attributed this simple approach to hicks and moorsteen and is known as the hicks-moors teen approach.

- The second approach is to extend the profitability approach and measure productivity change using growth in profitability after making appropriate adjustments for movements in input and output prices over the period s to t.

- The third approach, advocated in caves, Christensen and diewert (1982a),thus labeled as the CCD approach, is to measure productivity by comparing the observed outputs in period s and t with the maximum level of outputs (keeping the output mix constant) that can be produced using xs and xt, operating under the reference technology. With respect to the reference technology, suppose the firm produced 70 per cent of the maximum feasible output for the given input vector, xt then a measure of productivity change from period's' to 't' given by a ratio 1.30/0.70=1.857.

- Finally, one may use an entirely different approach in measuring productivity change. Suppose we think and identify various sources of productivity growth: technical change; efficiency change; change in the scale of operations; etc. if we can measure these effects separately, then productivity change can then be measured as the product (or sum total) of all these individual effects. Balk (2001) describes this approach and discusses the resulting measure of productivity change with those recommended in the literature. Coelli et al. (1998) named this approach as the component-based approach to productivity change measurement.

3. Malmquist TFP Index

The Mamquist TFP index was first introduced in two very influential papers by caves, Christensen and Diewert (hereafter, CCD in 1982a and 1982b). In these papers. CCD defined the TFP index using Malmqist input and output distance functions, and thus the resulting index has come to be known as the Malmqist TFP index. The method of using these distance functions in defining the TFP index is due to the approach proposed by caves et al. (1982a, 1982b). Malmquist TFP Index numbers make use of the third approach that is outlined at the in the section. The index is constructed by measuring the radial distance of the observed output and input vectors in periods 's' and 't', relative to a reference technology. As the distance can be either output oriented or input oriented, the Malmquist TFP indices differ according to the orientation used. However, these two alternative approaches result in the same numerical measure if the technology in periods 's' and 't' exhibit the property of global constant returns to scale (CRS).

The Malmquist productivity index is decomposed into two components – technical efficiency change and technical change. The value of this decomposition is that it provides insight in to the sources of productivity change.

Output oriented Malmquist productivity index between period's t and t+1 as,

$$M_o=\left(\frac{D_o^{t+1}(x^{t+1},y^{t+1})}{D_o^t(x^t,y^t)}\right)\left[\frac{D_o^t(x^{t+1},y^{t+1})}{D_o^{t+1}(x^{t+1},y^{t+1})}\times\frac{D_o^t(x^t,y^t)}{D_o^{t+1}(x^t,y^t)}\right]^{\frac{1}{2}} \quad \text{.......(3.1)}$$

A value of Mo >1 indicates positive growth of TFP from period t to t+1, and a value Mo<1 represents deterioration in TFP in eq. (1), the ratio outside the brackets is equal to the change of technical efficiency between time t and t+1. In other words, it Represent the change in the relative distance of the observed production from the maximum potential production. The component insight the brackets of eq. (1) is the geometric mean of two productivity indexes and represents the shift in production technologies between time t and t+1. That is, technical efficiency Change (TEC).

$$TEC=\left(\frac{D_o^{t+1}(x^{t+1},y^{t+1})}{D_o^t(x^t,y^t)}\right) \quad \text{..........(3.2)}$$

Technical change TCH,

$$TCH=\left[\frac{D_o^t(x^{t+1},y^{t+1})}{D_o^{t+1}(x^{t+1},y^{t+1})}\times\frac{D_o^t(x^t,y^t)}{D_o^{t+1}(x^t,y^t)}\right]^{\frac{1}{2}} \quad \text{..........(3.3)}$$

Orientation to TFP indices: Output-oriented productivity measures focus on the maximum Level of outputs that could be produced using a given input vector and a given production technology relative to the observed level of outputs. This is achieved using the output distance functions. The input oriented productivity focuses on the level of inputs necessary to produce observed output vectors qs and qr under a reference technology.

4. Design of Survey (Research Process)

In a survey approach, there are several important steps that must be taken to make certain adequate response rate so as to reduce probability of partial responses. The following sections provide a short summery of the relevant steps taken in survey design.

Firstly prepared the questionnaire (appendix 1) of entrepreneurs; a letter was mailed to the entrepreneurs with mention about the purpose of the research, its objectives, and scope for MSEs units in this respect. Their cooperation was requested in completing the survey. Secondly, the small industries service institute located at Mandideep and Govindpura industrial area Bhopal was contacted with a request to circulate the letter and questionnaire among entrepreneurs coming in their contact. Thirdly we personally meet some of the entrepreneurs and collected the response from them.

III. RESULTS AND DISCUSSION

1. Introduction

This chapter presents the results of data analysis conducted using the data collected with an aim to attain the objectives of the research. The research hypotheses developed in the last chapter are tested to address to the research questions. First, the measurement of scale key constructs are examined and assessed. Finally the result of the statistical tests that were used to test the hypotheses is provided.

2. Hypotheses Related to Productivity Analysis of MSEs

In order to analyze productivity growth of MSEs, data of all 112 firms (All input/output data's are showing APPENDIX-I, whose are attached last section in this thesis. These datas collect from direct MSEs visit whose industries are show in APPENDIX-II.

The value that are considered for the study production (in laks): Capital and labour (in laks). It has been defined by Summanth (1990), TFP is mathematically expressed as ratio of output to input (capital and labour). The use of these data firm wise lable for the analysis and comparison of TFP change, technical change and technical efficiency change.The Data Envelopment Analysis Programme (DEAP) version2.1.Is used to study the productivity growth trend in 112 MSEs, in operation at Mandideep, DisttRaisen and Govindpura industrial area Bhopal. Input and output data for five years i.e. 2004-05 to 2008-09 were collected and data was prepared as required by the Data Envelopment Analysis Programme (DEAP) version 2.1.

The data Envelopment analysis Programme is run for output orientation, at constant return to scale (CRS) and for Malmquist-DEA model. The assumption of CRS is justified by the statistical examination of data before the analysis. The result outputs are presented in table 5.1 and 5.2. It presents the firm-wise and annual mean wise average of TEC (technical efficiency change); TCH (technical change) and TFPCH (TFP change).

Table.1 Malmquist Index Summary of Firm Mean

FIRM	TEC	TCH	TFPCH

Table.2: Malmquist Index Summary of Annual Means

YEAR	TEC	TCH	TFPCH
2	0.764	1.368	1.045
3	0.928	1.06	0.984
4	4.15	0.244	1.013
5	1.274	0.726	0.925
MEAN	1.391	0.712	0.991

3. Observations from Mpi-Dea Results

Following observations are recorded from the result shown in table 5.1 and 5.2. :

- Result reveal that the TFP change has been negative as a mean during the period of study. The average decline in TFP during the period of study is measured as 1%. This supports the hypothesis H-1.

- The TFP change has decomposed into technical change and technical efficiency change, the mean technology and technical efficiency show mean increase by 39% and decline by 19% respectively. Also since the two are the factors to

TFP change, from the data of 112 MSEs correlation analysis between TFP change, Technical change and Technical efficiency change-TFP change needs be run.

- MSEs in Madhya Pradesh shows an increase of technical efficiency change by 39.1%

- To understand the effect of TEC and TCH in MSEs of Madhya Pradesh Bhopal correlation analysis has been run using SPSS12 and Table 5.3 represents the strength and pattern of association of TFP change with the two source of productivity.

Accordingly to Pearson correlation coefficients at 99% confidence interval (significance<<0.01) and correlation coefficients at 95% confidence interval (significance<<0.05), that TFP change has been more effectively contributed by technical change (frontier shift) as compared to technical efficiency change.

Table.3: Correlations (TEC, TCH, AND TFPCH)

	EFFICIENCY CHANGE	TECHNICAL CHANGE	TOTAL FACTOR PRODUCTIVITY CHANGE
EFFICIENCY pearson correlation CHANGE sig.(2-tailled) N	1.000 112.000	−625** .000 112	.610** .000 112
TECHNICAL pearson correlation \CHANGE Sig.(2-tailed) N	−626** .000 112	1.000 112.000	.222 .019 112
TOTAL peorson correlation FACTOR sig.(2-taied) PRODUCTIVITY N CHANGE	.610** .000 112	.222 .019 112	1.000 112.000

- The inter-correlation TEC and TCH can also be explained by the relation between technology Adaption and Capability to exploit the benefits of (Kelmer and wanghman1995) technology. HYPOTHESIS H 1:

“The total factor productivity has varied with time”
The technical efficiency change (catch-up) and technical change (frontier shift) has positive and significant according to Pearson’s correlation coefficient being 0.610 and 0.222

4. Impact of Technical Efficiency Change and Technical Change on Productivity Growth

To investigate the impact of two TCH and TECH on productivity growth of MSEs, Entre method of regression has been employed.

Table.4 describes the entering variables and the method used for the multiple Regressions.

Table.4: Variable Entered / Removed

Model	Variable Entered	Variable removed	Method
1	Tech, effch[a]	.	Enter

The model summary is described in table 5.5; it reveals that 97.1% (adjusted R Square =0.971) variance is going to be predicted from the two independent variables in the regression.

Values of R (0.986) present the multiple correlations, using all the predictors simultaneously. Also the adjust R square value (0.971) is equal that the R square value (0.971).

Table.5: Model Summary

Model	R	R square	Adjuste R Square	Std. Error of The estimate
1	0.986[a]	0.971	0.971	0.0173790

The Anova table (table 5.6) indicates that the F =1854.290, and is statistically significant, which indicates that the combination of predictors significantly combine together to predict the productivity growth.

Table .6: Anova

Model	Sum of squares	Df	Mean squares	F	Sig.
Regression Residual Total	1.120 .033	2	.560	1854.290	.000[a]

Table .7 Coeficients of Regression

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(constant)	−0.890	.032		−27.845	.000
	Effch	.711	.012	1.231	59.335	.000
	Tech ch	1.241	.026	.992	47.814	.000

One of the most important tables is the coefficient table (table.7). It presents the standardized beta coefficients, which are interpreted much like correlation coefficients. The t- value and significance opposite each independent variable indicates whether that variable is significantly contributing to the equation for predicting of productivity growth. Thus, in the present result it is quite clear that both predictors and constant are significantly contributing to the equation for prediction of productivity growth

5. Prediction Equation

TFPCH = − (0.890) + 0.711(Technical Efficiency Change) + 1.241 (Technical Change)..(5.5)

The above predictor equation supports the hypothesis H-2.

Comparison of actual and computed total factor productivity change (TFPCH) is shown in figure. 4.

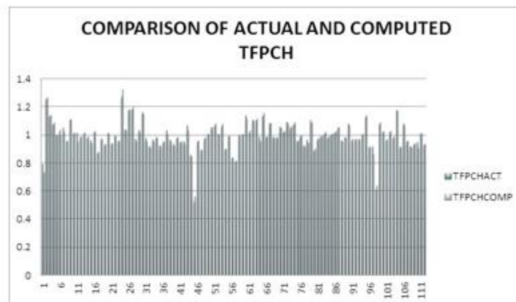

Figure. 4: Comparison of Actual And Computed Tfpch

IV. CONCLUSION

This chapter describes the conclusions drawn by the scholar and the recommendations made to the stakeholders of the system.

1. Research concludes, from the result outputs of Malmquist productivity index based data envelopment analysis of MSEs and the regression analysis, that the technological progress (shift in production frontier/technical change) has stronger positive effect on TFP change than the technical efficiency change (catch up).

2. The source of TFP change are seen as variables that will affect the technical change over time and the ability to exploit the resources so as to convert inputs in to outputs in most efficient manner. The researcher finds the second source

very close to management aspects of technology.

3. The predictor equation (5.5) revels the impact of the TECH and TCH to determine the productivity growth of MSEs. The equation is helpful in determining the optimum level of productivity growth that can be achievable by positive intervention of relevant support system to enhance the capacity on TECH and TCH.

V. FUTURE PLAN

Not much has been really done related to TFP of MSEs and therefore generally a wide scope has been realized.

However in view of the limitations of this study following are seen as future scope of research.

- Variable return to scale may be explored as assumption while using Malmquist production's base DEA.
- Broader geographical area may be covered to better generalize the results.

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