Feature

Measurement of Material Productivity: A Case Study of Pharmaceutical Sector Companies included in Nifty 50

MEENU MAHESHWARI AND PRIYA TAPARIA

In this modern environment, productivity has become an indicator of the progress of a country. It may be treated as a key to prosperity. Productivity can be denoted as a ratio of the monetary value of the output to the monetary value of the input which shows the actual performance of a unit. Higher the productivity means a more efficient use of the resources in an organisation. Productivity may include material productivity, labour productivity and overhead productivity and also the overall productivity. The Material Productivity of pharmaceutical sector companies included in Nifty 50 has been analysed in the present study. The sector consists of Cipla Ltd., Dr. Reddy's Laboratories Ltd., Lupin Ltd. and Sun Pharmaceutical Industries Ltd. Material productivity of eight years has been studied in the present study from 2008-09 to 2015-16. Both intra-sector and inter-sector hypotheses have been tested and results have been drawn from it. For intra-sector hypothesis, an analysis has been drawn with the help of Chi-Square Test and it has been observed that in all companies except in Sun Pharmaceutical Industries Ltd. null hypothesis has been accepted, which shows that the material productivity ratios of the sampled company for the study period are approximately equal. In the case of Butin Sun Pharmaceutical Industries Ltd an alternate hypothesis is accepted. In inter-sector hypothesis, analysis is drawn with the help of Kruskal Wallis Rank Sum Test popularly known as H Test and it has been observed that the null hypothesis is rejected, which means that the material productivity ratios between the pharmaceutical sector companies included in Nifty 50 differ significantly. The reason for the increase or decrease in the material productivity may be due to increase or decrease in the output or input or the components associated with productivity. For improving the material productivity it is recommended to improve the output, input or components of output or input.

Meenu Maheshwari, Assistant Professor, Department of Commerce and Management, University of Kota

Priya Taparia, Research Scholar, Department of Commerce and Management, University of Kota

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Introduction

In recent years, much has been said and written about the topic 'Productivity'. Earlier corporates were less concerned with the productivity concept. They didn't consider it as the priority. It is now given national importance and the efforts of government, business concerns, trade unions, workers, etc. are being coordinated to accelerate the process of economic growth and raise the standard of living of people in the country. It is only through the productive utilisation of the scarce resources we are able to produce quantity and quality of goods and services within a specified period of time which can meet the rising expectation of the people of a country. Business units want to improve their performance to ensure their survival in this competitive world and if possible try to capture the maximum market share. This improvement can only be attained by focusing on the production of quality goods, in a cost-effective manner and by generating enough profits to plough back into the business to further improve productivity and this should occur on a continuous basis to create an advantage in the market by capturing the market share. For fulfilling the above need of an organisation the concept of productivity gained importance.

The term productivity refers to the optimum use of productive resources in an organisation or the optimization of resources. It is the one's ability to produce more as compared to the input incurred. Productivity means the results produced in terms of output which is expressed in monetary terms by an input which is also expressed in the monetary terms under given condition say it be a material, labour, overhead, etc. and within a given period of time means the study period.

The term productivity and efficiency are synonyms. Yet there is a slight difference between the two. The productivity of an organisation may be indicated without

any improvement in its efficiency. On the other hand, the efficiency of an input may increase without any simultaneous improvement in its productivity.

As per business dictionary, "Productivity is a measure of the efficiency of a person, machine, factory, system, etc. in converting inputs into useful outputs. Productivity is computed by dividing average output per period by the total costs incurred or resources (capital, energy, material, personnel) consumed in that period. Productivity is a critical determinant of cost efficiency."

Review of Literature

Many studies on productivity trends in India and abroad have been carried out over the last few decades. Few studies are being summarised below:

1. **Schoer (2006)** in his paper, "Calculation of direct and indirect material inputs by type of raw material and economics activities" presented a technique for calculating the direct material input used in Raw Material Equivalents (RME). It is calculated according to the type of raw material and economic activities. Indirect raw material input had also been included in calculating Raw Material Equivalents. The study also states that RME as an indicator was more suitable for estimating the environmental pressure and discharging the global responsibility. This is only possible due to the comprehensive and detailed recording of material inputs. A technique known as Hybrid Input Output Table (IOT) had been developed for calculating the indirect raw material inputs.

2. **Yildirim (2015)** examines in his paper, "Relationship among Labour productivity, real wages and inflation in Turkey" the inter-relationship of the manufacturing industry of turkey for the period 1988 to 2012. The author applied Co-integration analysis and a Granger Causality test and concluded that the inflation has a greater impact on the labour productivity as compared to the real wages. According to the author, a feedback effect is there between labour productivity and inflation. Also, the author concluded that there is unidirectional causality from real wages to productivity, thus indicating a broken connection between productivity and wages. The author also suggested that broken connection may be due to less bargaining power and structural problems comprising high unemployment, a giant tax burden on wages and the big share of the informal sector.

3. **Gorantiwar and Shrivastava (2015)** in their paper, "Validating quality productivity improvement framework for sponge iron industry in India" tried to validate the quality productivity improvement framework with the help of model implementation called case study for sponge iron industry. Model is implemented in two different sponge iron manufacturing units. The selection of units was done in such a way that both the units differ in many aspects viz. manufacturing capacity, manufacturing process, year of establishment, number of employees, location, ownership, etc. It was observed that there is significant relationship between the implementation factors and the performance measures of the sponge iron industry companies. It was also noted that there has been the remarkable improvement over the years in the various performance indicators. The companies had accomplished both tangible and intangible benefits by practising quality management. The author also concluded that the framework developed is valid and reliable and can also be implemented in other countries in this world with modification according to the environment of that country.

4. **Fresenbichler and Peneder (2016)** investigated in their paper, "Innovation, competition and productivity: Firm-level evidence for Eastern Europe and Central Asia" the relationship of productivity to innovation and competition. Business environment and enterprise survey (BEEPS) data were used for analyzing the results. The survey was conducted in Eastern Europe as well as in Central Asia. The study covers the survey year 2012 for Russia and 2013 for the other countries. Monetary values are mostly for 2010 or 2011 as the last complete fiscal year and were converted from local currency units into USD. They concluded that productivity in terms of either sales or value added per employee is positively affected by competition and innovation. Further, the study also analysed that there is a positive impact on productivity from firm size, exports or population density.

5. **Maheshwari, M. (2016)** in her paper "Measurement of Productivity: Various Models" explained the different categories of Productivity models and their approaches as given by Sardana and Vrat. Seven models for measuring productivity had been discussed. One of the models is the Production Function Model. This model considers only labour and capital as input for calculating productivity.

Another model described was Economic Utility Model. In this model multi ratios had been used for calculating productivity. A particular economic activity is reflected by a particular ratio. Another model described is the Measurement through Financial Ratio where productivity is measured by calculating the ratios such as acid test ratio, debtor's turnover ratio, creditors turnover ratio, stock turnover ratio, asset turnover ratio, return on capital employed, etc. Another model discussed is the Surrogate Model. It is a partial productivity model which only considers the measures which are valid and easily available. Another model which had been talked about in the paper is the Systems Approach Based Model. It is based on the traditional method of computing output and input for calculating productivity. The second last model described is the Production Based Model. It has been described in two ways. The first model is based on output as the value of production and the second model based on the output as value addition. The last and the very important model discussed is the Productivity Accounting Model (PAM). This model considers all the elements of output and input, ignoring the effect of inflation.

Main Objective of the Research Work

In the present study, an attempt has been made to measure, analyse, compare and suggest the concepts regarding material productivity in the pharmaceutical sector companies included in Nifty 50.

The main objectives are being summarized as follows:-

1) To measure, analyse and compare the material productivity ratios of the pharmaceutical sector companies included in Nifty 50.

2) To measure, analyse and compare the intra company material productivity ratios of the study period.

3) To suggest ways for the improvement in material productivity ratios.

Research Methodology

Collection of Data

This research is based on the secondary data. The data and information regarding output, sales, materials consumed, total inputs and all other financial variables have been obtained from the annual reports of the respective companies. The annual reports are available on the website of the companies. To remove the inflation effect of prices on outputs and inputs, the revaluation of the values of outputs and inputs has been made. For the revaluation of values, index numbers have been used. The index numbers used in the study have been collected from the various bulletins published by Reserve Bank of India on its website.

Selection of Base Year

Pharmaceutical sector companies of Nifty 50 have been selected. The sector comprises four companies viz., Cipla Ltd., Dr. Reddy's Laboratories Ltd., Lupin Ltd. and Sun Pharmaceutical Industries Ltd. The study covers a period of eight years i.e. from 2008-09 to 2015-16. The year 2008-09 has been taken as a base year. The base year has been selected because the revaluation of output and input is done on the basis of base year prices.

Model to be used

In the present research work Productivity Accounting Model has been used for measuring productivity because it considers all the elements of output and input, ignoring the effect of inflation. According to Sardana and Vrat, this model is known as productivity accounting model because it is based on the accounting data and the study is also being conducted in the field of accounting.

Hypotheses

Keeping in mind the objectives of the research work, following hypotheses have been developed and tested.

Intra-Company Comparison

To measure, analyse and compare the material productivity ratios of the sampled company for the study period following hypothesis has been developed and tested.

Null Hypothesis (H_0): There is no significant difference in the material productivity ratios of the sampled company for the study period.

Alternate Hypothesis (H_1): There is a significant difference in the material productivity ratios of the sampled company for the study period.

Above hypothesis has been tested and analysed with the help of the Chi-Square Test. For calculating expected values for the purpose of calculating chi-square, the least square method has been used.

Inter-Company Comparison

To measure, analyse and compare the material productivity ratios of sampled companies following hypothesis has been developed and tested.

Null Hypothesis (H_0): There is no significant difference in the material productivity ratios of sampled companies.

Alternate Hypothesis (H_1): There is a significant difference in the material productivity ratios of sampled companies.

For testing the above hypothesis, Kruskal Wallis Rank Sum Test popularly known as H Test has been used.

Variables used:

The variables used in the present study are output and input. For calculating output and input monetary values have been considered. Output and input both have been revalued on the basis of price index with reference to the base year.

Calculation of Index Numbers and Conversion Factors

For the revaluation of data on the base year's prices for eight years from 2008-09 to 2015-16, index numbers and conversion factors have been used. Wholesale price index has been used for revaluating the output and the material input. Here the year 2008-09 has been taken as base year (Table 1). Following formula has been used to calculate conversion factors:

Index number of the base year

Index number for the current year

Table 1 : Index Numbers and Conversion Factors for Revaluation of Data

Year	Wholesale Price Index Base year 2004-05-100	Conversion Factor
2008-09	123.50	1.000
2009-10	136.30	0.906
2010-11	149.50	0.826
2011-12	161.00	0.767
2013-14	170.10	0.726
2014-15	176.10	0.701
2015-16	175.30	0.705

Revaluation of Output:

The output of the companies has been revalued by multiplying the output values with the conversion factors. Here for the purpose of the study sales, other income and change in the inventories of finished goods, work in progress and traded goods are considered as output. Revaluation of Output of the companies from 2008-09 to 2015-16 has been calculated and shown in Appendix 1 to 4 respectively.

Revaluation of Material Input:

The material input of the companies has been revalued by multiplying the input values with the conversion factors. Here for the purpose of this study, the material input includes raw material and its components, stores and spares and purchases of traded goods or stock in trade. Revaluation of Input of the companies from 2008-09 to 2015-16 has been calculated and shown in Appendix 5 to 8 respectively.

Material Productivity

Materials are termed as the first and foremost factor in the cost of production because of the dependence of manufacturing operation on material input. Performance evaluation of resources in a business concern largely depends on material input use. Material Productivity indicates that how much has been produced as output by a unit of material input. It measures the efficient and effective utilisation of material input.

$$\text{Material Productivity} = \frac{\textbf{Total output}}{\text{Material input}}$$

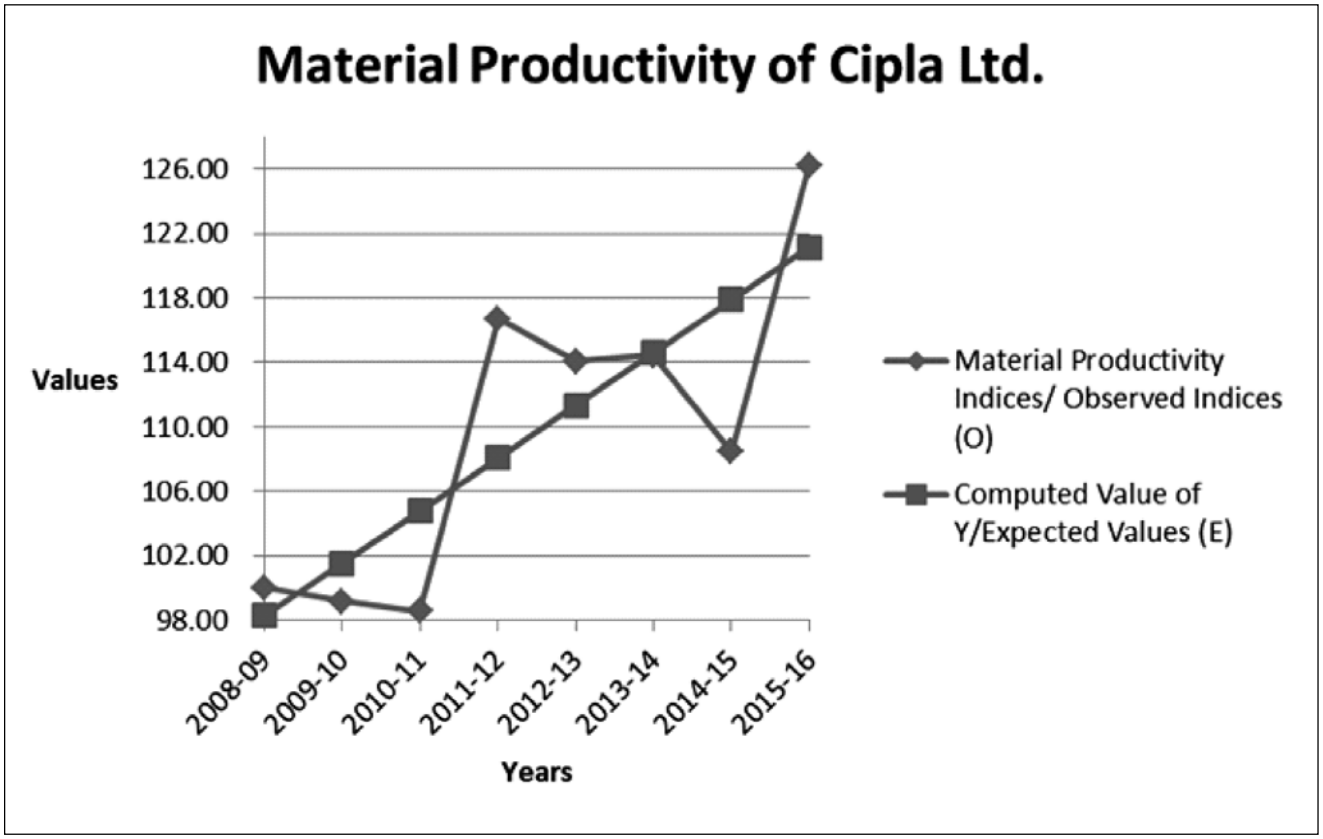
Analysis and Interpretation:

Output: The revalued output of Cipla Ltd. has an increasing trend except in the year 2009-10.

It is the highest Rs 8827.72 crore in 2015-16 and it is the lowest Rs 5009.41 crore in 2009-10.

Table 2: Material Productivity of Cipla Ltd. From 2008-09 to 2015-16

Material Productivity of Cipla Ltd. From 2008-09 to 2015-16									
Base Year 2008-09									Amount Rs in Crore
S. No.	**Items**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
1	Output (Rs in Crore)	5,213.22	5,009.41	5,210.52	5,474.11	5,910.22	6,509.18	6,961.39	8,827.72
2	Raw Material and Components (Rs in Crore)	1,872.91	1,825.96	1,912.22	1,764.75	1,921.60	2,154.56	2,402.14	2,561.50
3	Raw Material and Components (Input Output Ratio)	0.35926	0.36451	0.36699	0.32238	0.32513	0.33100	0.34507	0.29017
4	Stores and Spares (Rs in Crore)	52.16	45.73	82.38	70.23	62.75	57.57	59.04	79.16
5	Stores and Spares (Input Output Ratio)	0.01001	0.00913	0.01581	0.01283	0.01062	0.00884	0.00848	0.00897
6	Purchases of Traded Goods/Stock in Trade (Rs in Crore)	588.04	563.22	554.35	426.11	513.20	529.78	633.29	731.48
7	Purchases of Traded Goods/ Stock in Trade (Input Output Ratio)	0.11280	0.11243	0.10639	0.07784	0.08683	0.08139	0.09097	0.08286
8	Total Material Input (Rs in Crore)	2,513.11	2,434.91	2,548.95	2,261.09	2,497.55	2,741.91	3,094.47	3,372.14
9	Material (Input Output Ratio)	0.48206	0.48607	0.48919	0.41305	0.42258	0.42124	0.44452	0.38199
10	Material Productivity Ratio	2.0744	2.0573	2.0442	2.4210	2.3664	2.3740	2.2496	2.6178
11	Material Productivity Indices/ Observed Indices (O)	100.00	99.18	98.54	116.71	114.08	114.44	108.45	126.20
12	Computed Value of Y/Expected Values (E)	98.25	101.52	104.79	108.06	111.33	114.61	117.88	121.15
13	Chi-Square $(O-E)^2/E$	0.03121	0.05410	0.37260	0.69166	0.06754	0.00024	0.75442	0.21042



Total material inputs consist of raw material and components, stores and spares, purchases of traded goods/ stock in trade.

Raw material and Components: The most important part of the raw material input is raw material and components. It is Rs 1872.91 crore in 2008-09, Rs 1825.96 crore in 2009-10, Rs 1912.22 crore in 2010-11, Rs 1764.75 crore in 2011-12, Rs 1921.60 crore in 2012-13, Rs 2154.56 crore in 2013-14, Rs 2402.14 crore in 2014-15 and Rs 2561.50 crore in 2015-16. Raw material and components input output ratio is the highest 0.36699 in 2010-11 while it is the lowest 0.29017 in 2015-16. The lowest raw material and components input output ratio indicates optimum raw material and components utilisation has been achieved in this year.

Stores and Spares: Another part of the total material input is stores and spares. The input output ratio of stores and spares is the lowest 0.00848 in 2014-15 as compared to the highest 0.01581 in 2010-11. This indicates stores and spares is optimally utilized in 2014-15.

Purchases of Traded Goods / Stock in Trade: Input output ratio is the lowest 0.07784 in 2011-12 indicates optimum utilisation.

Total Material: Total material input output ratio 0.48206 in 2008-09, 0.48607 in 2009-10, 0.48919 in 2010-11, 0.41305 in 2011-12, 0.42258 in 2012-13, 0.42124 in 2013-14, 0.44452 in 2014-15, 0.38199 in 2015-16 respectively. The lowest material input output ratio in the year 2015-16 with 0.38199. This means material is the best utilized in the year 2015-16.

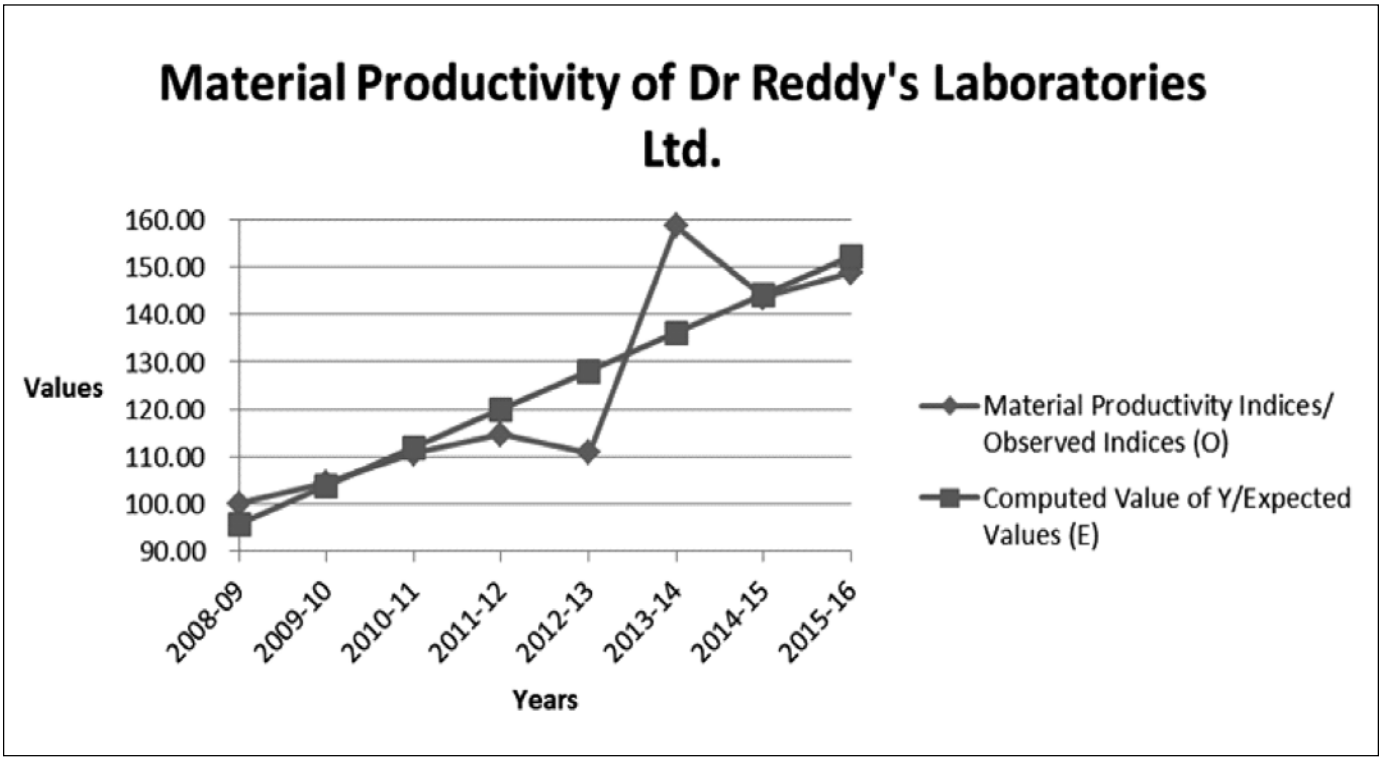
Material Productivity Ratio: There is an erratic trend in the material productivity ratio. Material productivity ratio is 2.0744 in 2008-09, 2.0573 in 2009-10, 2.0442 in 2010-11, 2.4210 in 2011-12, 2.3664 in 2012-13, 2.3740 in 2013-14, 2.2496 in 2014-15, 2.6178 in 2015-16.

Material productivity ratio is the lowest 2.0442 in 2010-11 while it is the highest 2.6178 in 2015-16. The highest ratio indicates efficiency and effectiveness while the lowest ratio indicates that the material input has not been utilized efficiently and mismanagement may be responsible for the low productivity.

Hypothesis Testing: The table value of chi square at 5% level of significance with (8-1) = 7 degree of freedom is 14.07 while the calculated value of chi square of Cipla Ltd. is 2.18.

Table 3: Material Productivity of Dr. Reddy's Laboratories Ltd. From 2008-09 to 2015-16

Material Productivity of Cipla Ltd. From 2008-09 to 2015-16									
Base Year 2008-09									Amount Rs in Crore
S. No.	Items	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1	Output (Rs in Crore)	4,233.80	4,174.21	4,415.05	5,151.71	6,152.92	8,268.84	8,750.02	8770.91
2	Raw Material and Components (Rs in Crore)	921.20	997.05	880.02	1333.51	1653.32	1501.38	1576.13	1401.89
3	Raw Material and Components (Input Output Ratio)	0.21758	0.23886	0.19932	0.25885	0.26870	0.18157	0.18013	0.15983
4	Stores and Spares (Rs in Crore)	356.40	229.58	291.66	58.83	73.69	64.80	263.23	302.52
5	Stores and Spares (Input Output Ratio)	0.08418	0.05500	0.06606	0.01142	0.01198	0.00784	0.03008	0.03449
6	Purchases of Traded Goods/Stock in Trade (Rs in Crore)	256.40	222.42	273.41	235.93	285.39	321.27	368.80	430.33
7	Purchases of Traded Goods/ Stock in Trade (Input Output Ratio)	0.06056	0.05328	0.06193	0.04580	0.04638	0.03885	0.04215	0.04906
8	Total Material Input (Rs in Crore)	1,534.00	1,449.05	1,445.09	1,628.27	2,012.40	1,887.45	2,208.16	2,134.74
9	Material (Input Output Ratio)	0.36232	0.34714	0.32731	0.31606	0.32706	0.22826	0.25236	0.24339
10	Material Productivity Ratio	2.7600	2.8807	3.0552	3.1639	3.0575	4.3810	3.9626	4.1087
11	Material Productivity Indices/ Observed Indices (O)	100.00	104.37	110.70	114.64	110.78	158.73	143.57	148.87
12	Computed Value of Y/Expected Values (E)	95.69	103.77	111.84	119.92	127.99	136.07	144.14	152.22
13	Chi-Square $(O-E)^2/E$	0.19376	0.00351	0.01177	0.23281	2.31522	3.77433	0.00227	0.07392



As the calculated value of chi square is less 1 increasing. It is the highest 0.26870 in 2012-13 while it is the lowest 0.15983 in 2015-16 indicates that raw material and components are optimally utilized in year 2015-16.

As the calculated value of chi square is less as compared to the table value hence null hypothesis is accepted and the alternate hypothesis is rejected. This reveals that the material productivity ratios of the Cipla Ltd. for the eight year period are approximately equal.

Analysis and Interpretation:

Output: The revalued output of Dr. Reddy's Laboratories Ltd. for the year 2008-09 is Rs 4233.80 crore, in 2009-10 it reached to Rs 4174.21 crore, in 2010-11 it is Rs 4415.05 crore, in 2011-12 output becomes Rs 5151.71 crore, in 2012-13 it is Rs 6152.92 crore, in 2013-14 Rs 8268.84 crore, in 2014-15 Rs 8750.02 crore and in 2015-16 output is Rs 8770.91 crore.

Total material inputs consist of raw material and components, stores and spares, purchases of traded goods/ stock in trade.

Raw material and Components : The raw material and component elements in Dr. Reddy's Laboratories Ltd. is Rs 921.20 crore, Rs 997.05 crore, Rs 880.02 crore, Rs 1333.51 crore, Rs 1653.32 crore, Rs 1501.38 crore, Rs 1576.13 crore and Rs 1401.89 crore respectively from 2008-09 to 2015-16. Raw material and components input output ratio are also showing an erratic trend that is in some year it is decreasing and in some year it is increasing.

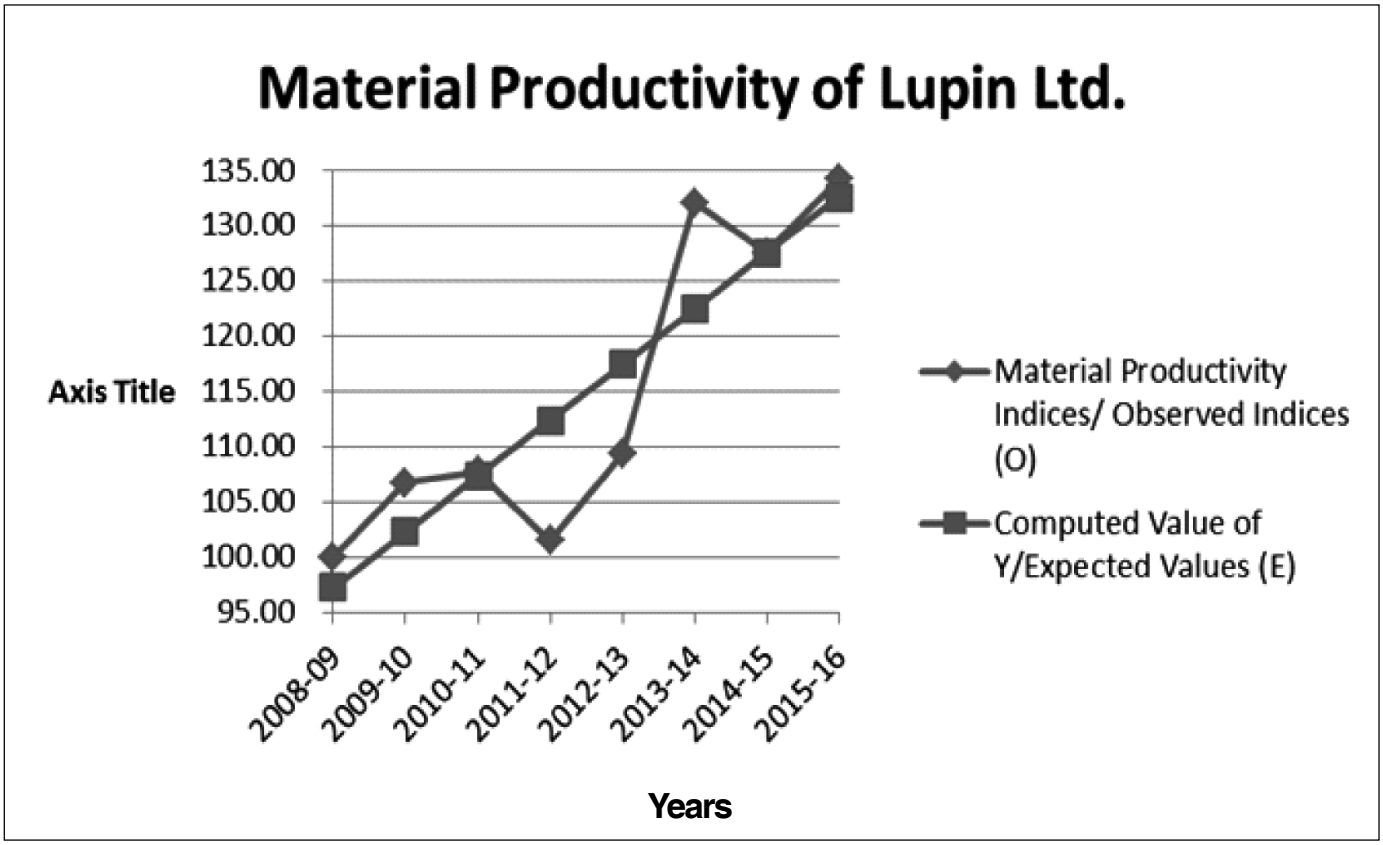
Stores and Spares: Another part to analyse in the total material input is stores and spares. It is Rs 356.40 crore in 2008-09, Rs 229.58 crorein 2009-10, Rs 291.66 crore in 2010-11, Rs 58.83 crore in 2011-12, Rs 73.69 crore in 2012-13, Rs 64.80 crore in 2013-14, Rs 263.23 crore in 2014-15 and Rs 302.52 crore in 2015-16. Also stores and spares input output ratio is calculated which is the highest in 2008-09 i.e. 0.08418 and the lowest in 2011-12 i.e. 0.01142. This means that stores and spares was the best utilized in 2011-12 as compared to other years.

Purchases of Traded Goods / Stock in Trade: Input output ratio of purchases of traded goods or stock in trade is 0.06056 in 2008-09, 0.05328 in 2009-10, 0.06193 in 2010-11, 0.04580 in 2011-12, 0.04638 in 2012-13, 0.03885 in 2013-14, 0.04215 in 2014-15 and 0.04906 in 2015-16.

Total Material: Total material input output ratio 0.36232 in 2008-09, 0.34714 in 2009-10, 0.32731 in

Table 4: Material Productivity of Lupin Ltd. From 2008-09 to 2015-16

Material Productivity of Lupin Ltd. From 2008-09 to 2015-16									
. Base Year 2008-09									Amount Rs in Crore
S. No.	**Items**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
1	Output (Rs in Crore)	2,945.50	3,365.42	3,726.04	4,031.19	5,055.41	6,355.81	6,843.37	7,961.56
2	Raw Material and Components (Rs in Crore)	919.85	982.59	1,141.88	1,221.19	1,399.15	1,460.42	1,569.76	1,654.45
3	Raw Material and Components (Input Output Ratio)	0.31229	0.29197	0.30646	0.30294	0.27676	0.22978	0.22938	0.20780
4	Stores and Spares (Rs in Crore)	84.31	96.02	127.67	142.66	160.61	179.65	231.37	287.41
5	Stores and Spares (Input Output Ratio)	0.02862	0.02853	0.03426	0.03539	0.03177	0.02827	0.03381	0.03610
6	Purchases of Traded Goods/Stock in Trade (Rs in Crore)	347.46	368.06	317.34	459.64	563.40	568.00	660.69	780.24
7	Purchases of Traded Goods/ Stock in Trade (Input Output Ratio)	0.11796	0.10937	0.08517	0.11402	0.11144	0.08937	0.09654	0.09800
8	Total Material Input (Rs in Crore)	1,351.62	1,446.67	1,586.89	1,823.49	2,123.16	2,208.07	2,461.82	2,722.10
9	Material (Input Output Ratio)	0.45888	0.42986	0.42589	0.45235	0.41998	0.34741	0.35974	0.34191
10	Material Productivity Ratio	2.1792	2.3263	2.3480	2.2107	2.3811	2.8784	2.7798	2.9248
11	Material Productivity Indices/ Observed Indices (O)	100.00	106.75	107.74	101.44	109.26	132.09	127.56	134.21
12	Computed Value of Y/Expected Values (E)	97.20	102.25	107.30	112.36	117.41	122.46	127.51	132.56
13	Chi-Square $(O-E)^2/E$	0.08066	0.19781	0.00181	1.05979	0.56516	0.75653	0.00002	0.02048



2010-11, 0.31606 in 2011-12, 0.32706 in 2012-13, 0.22826 in 2013-14, 0.25236 in 2014-15, 0.24339 in 2015-16 respectively. It is the highest in 2008-09 which indicates that maximum material remained unutilised in 2008-09 as compared to other years in the study.

Material Productivity Ratio: Material productivity ratio is fluctuating in nature. It is 2.7600 in 2008-09, then increasing to 2.8807 in 2009-10, 3.0552 in 2010-11, 3.1639 in 2011-12, then it slightly decreased to 3.0575 in 2012-13, then again increased to 4.3810 in 2013-14, then it lowered down to 3.9626 in 2014-15, ultimately it increased to 4.1087 in 2015-16. Material productivity ratio is the lowest 2.7600 in 2008-09 while it is the highest 4.3810 in 2013-14. The highest ratio indicates efficiency and effectiveness while the lowest ratio indicates that the material input has not been utilized efficiently.

Hypothesis Testing: For testing the hypothesis Chi Square method has been used. The table value of chi square at 5% level of significance with (8-1) = 7 degree of freedom is 14.07 while the calculated value of chi square of Dr. Reddy's Laboratories Ltd. is 6.61. As the calculated value of chi square is less as compared to the table value hence null hypothesis is accepted and the alternate hypothesis is rejected. This reveals that the material productivity ratios of the Dr. Reddy's Laboratories Ltd for the eight year period are approximately the same.

Analysis and Interpretation

Output: The output of Lupin Ltd. showing an increasing trend. It is Rs 2945.50 crore for the year 2008-09 and it reached to Rs 7961.56 crore in 2015-16.

Total material inputs consist of raw material and components, stores and spares, purchases of traded goods/ stock in trade.

Raw material and Components: The raw material and components are forming the major part of the material productivity of Lupin Ltd. It is showing an increasing trend from the year 2008-09 to 2015-16. It is Rs 919.85 crore in 2008-09 and it reached to Rs 1654.45 crore in 2015-16. Raw material and components input output ratio is showing an erratic trend. It is 0.31229 in 2008-09, 0.29197 in 2009-10, 0.30646 in 2010-11, 0.30294 in 2011-12, 0.27676 in 2012-13, 0.22978 in 2013-14, 0.22938 in 2014-15 and 0.20780 in 2015-16. This means that for any one Rs of output, 0.31229 as input is required in 2008-09 and so on.

Stores and Spares: Another aspect in total material input is stores and spares. It is Rs 84.31 crore in 2008-09, Rs 96.02 crore in 2009-10, Rs 127.67 crore in 2010-11, Rs 142.66 crore in 2011-12, Rs 160.61 crore in 2012-13, Rs 179.65 crore in 2013-14, Rs 231.37 crore in 2014-15 and Rs 287.41 crore in 2015-16. Also stores and spares input output ratio is 0.02862, 0.02853, 0.03426, 0.03539, 0.03177, 0.02827, 0.03381 and 0.03610 respectively. It is the highest 0.03610 in 2015-16 while it is the lowest in 0.02827 in 2013-14. The lowest stores and spares input output ratio indicates that stores and spares are the best utilized in the year 2013-14.

Purchases of Traded Goods / Stock in Trade: Purchases of traded goods or stock in trade is Rs 347.46 crore in 2008-09, Rs 368.06 crore in 2009-10, Rs 317.34 crore in 2010-11, Rs. 459.64 crore in 2011-12, Rs 563.40 crore in 2012-13, Rs 568.00 crore in 2013-14, Rs 660.69 crore in 2014-15 and Rs 780.24 crore in 2015-16. Input output ratio is 0.11796 in 2008-09, 0.10937 in 2009-10, 0.08517 in 2010-11, 0.11402 in 2011-12, 0.11144 in 2012-13, 0.08937 in 2013-14, 0.09654 in 2014-15, 0.09800 in 2015-16.

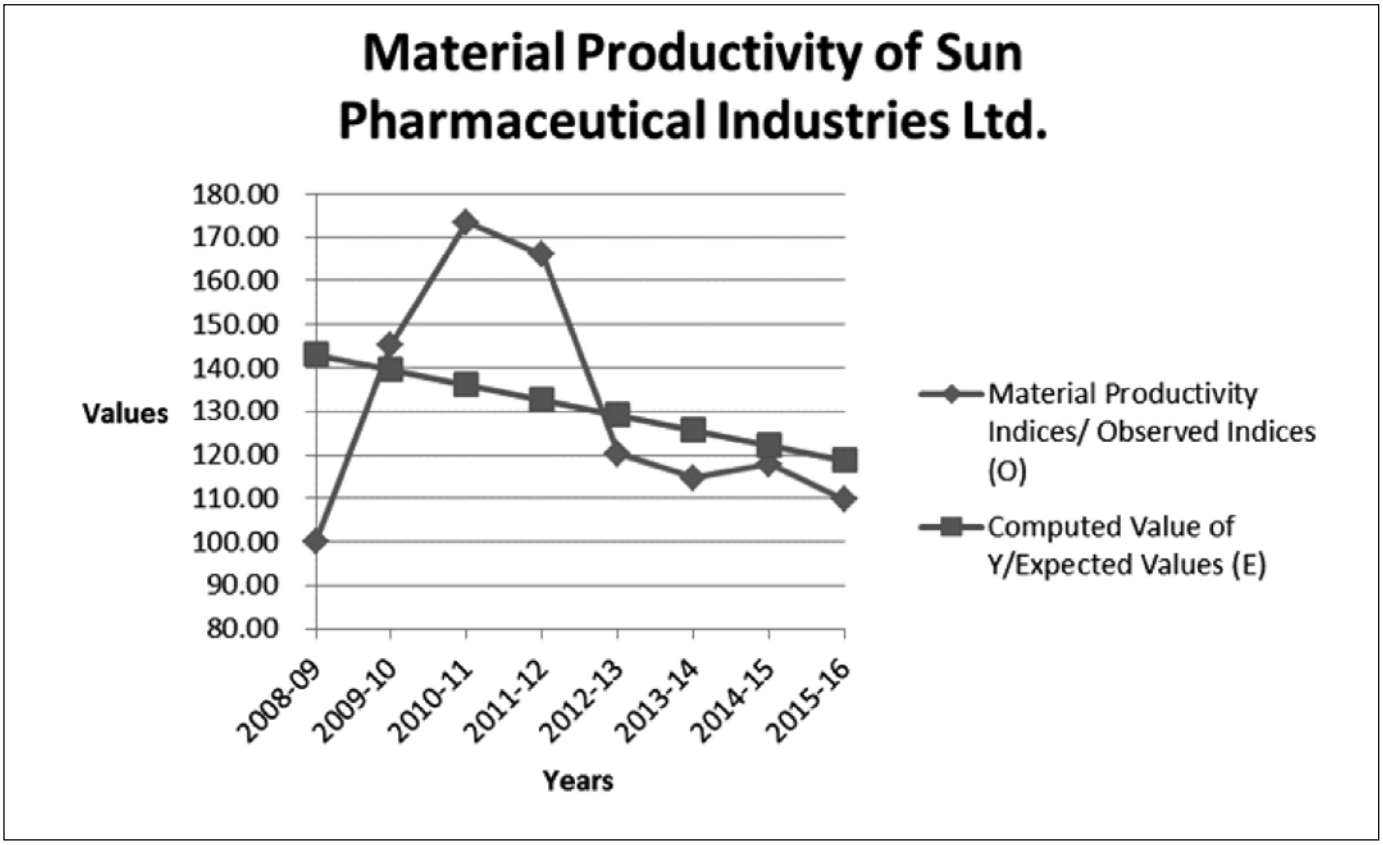
Total Material: Total material of Lupin Ltd. showing an upward trend. Total material input output ratio 0.45888 in 2008-09, 0.42986 in 2009-10, 0.42589 in 2010-11, 0.45235 in 2011-12, 0.41998 in 2012-13, 0.34741 in 2013-14, 0.35974 in 2014-15, 0.34191 in 2015-16 respectively. Total material input output ratio is the lowest in the year 2015-16 with 0.34191 indicating that total material is not optimally utilized in this year.

Material Productivity Ratio: Material productivity ratio is showing an erratic trend. It is 2.1792 in 2008-09, then increasing to 2.3263 in 2009-10, again increased to 2.3480 in 2010- 11, then decreased to 2.2107 in 2011-12, then it slightly increased to 2.3811 in 2012-13, then again increased to 2.8784 in 2013-14, then it lowered down to 2.7798 in 2014-15, ultimately it increased to 2.9248 in 2015-16. The highest material productivity ratio in 2015-16 with 2.9248 indicates that material is the best utilized in 2015-16. It represents that for every unit of input 2.9248 units of output is obtained in 2015-16.

Hypothesis Testing: Chi square has been used for testing the hypothesis. The table value of chi square at 5% level of significance with (8-1) = 7 degree of freedom is 14.07 while the calculated value of chi square of Lupin Ltd. is 2.68. As the calculated value of chi square is less as compared to the table value hence null hypothesis is

Table 5: Material Productivity of Sun Pharmaceutical Industries Ltd. From 2008-09 to 2015-16

Material Productivity of Sun Pharmaceutical Industries Ltd. From 2008-09 to 2015-16									
Base Year 2008-09									Amount Rs in Crore
S. No.	**Items**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
1	Output (Rs in Crore)	4,019.89	2,369.92	2,726.51	3,280.21	1,929.55	2,036.94	5,991.36	5,624.35
2	Raw Material and Components (Rs in Crore)	662.93	642.50	593.28	729.96	512.40	612.81	1,585.04	1,423.99
3	Raw Material and Components (Input Output Ratio)	0.16491	0.27111	0.21760	0.22253	0.26555	0.30085	0.26455	0.25318
4	Stores and Spares (Rs in Crore)	28.23	29.23	28.01	90.97	124.23	126.68	242.19	254.07
5	Stores and Spares (Input Output Ratio)	0.00702	0.01233	0.01027	0.02773	0.06438	0.06219	0.04042	0.04517
6	Purchases of Traded Goods/Stock in Trade (Rs in Crore)	1,270.67	124.16	145.94	143.80	145.90	126.75	654.89	824.85
7	Purchases of Traded Goods/ Stock in Trade (Input Output Ratio)	0.31610	0.05239	0.05353	0.04384	0.07561	0.06223	0.10931	0.14666
8	Total Material Input (Rs in Crore)	1,961.83	795.89	767.23	964.73	782.53	866.24	2,482.12	2,502.91
9	Material (Input Output Ratio)	0.48803	0.33583	0.28140	0.29411	0.40555	0.42527	0.41428	0.44501
10	Material Productivity Ratio	2.0491	2.9777	3.5537	3.4001	2.4658	2.3515	2.4138	2.2471
11	Material Productivity Indices/ Observed Indices (O)	100.00	145.32	173.43	165.94	120.34	114.76	117.80	109.67
12	Computed Value of Y/Expected Values (E)	143.05	139.58	136.11	132.64	129.17	125.70	122.23	118.76
13	Chi-Square $(O-E)^2/E$	12.95801	0.23579	10.23187	8.35736	0.60409	0.95238	0.16045	0.69612



accepted and the alternate hypothesis is rejected. This reveals that the material productivity ratios of the Lupin Ltd. for the eight year period are approximately the same.

Analysis and Interpretation:

Output: The output of Sun Pharmaceutical Industries Ltd. showing a fluctuating trend. Output in 2008-09 is Rs 4,019.89 crore, in 2009-10 Rs 2,369.92 crore, in 2010-11 Rs 2, 726.51 crore, in 2011-12 Rs 3,280.21 crore, in 2012-13 Rs 1,929.55 crore, in 2013-14 Rs 2,036.94 crore, in 2014-15 Rs 5,991.36 crore and in 2015-16 Rs 5,624.35 crore.

Total material inputs consist of raw material and components, stores and spares, purchases of traded goods/ stock in trade.

Raw material and Components*:* The raw material and components of Sun Pharmaceutical Industries Ltd. is Rs 662.93 crore in 2008-09, Rs 642.50 crore in 2009-10, Rs 593.28 crore in 2010-11, Rs 729.96 crore in 2011-12, Rs 512.40 crore in 2012-13, Rs 612.81 crore in 2013- 14, Rs 1,585.04 crore in 2014-15 and Rs 1,423.99 crore in 2015-16. Raw material and components are highly consumed in the year 2014-15 and 2015-16. The input output ratio is the lowest 0.16491 in 2008-09 while it is the highest 0.30085 in the year 2013-14. The lowest ratio indicates that the raw material and components is best utilized in the year 2008-09.

Stores and Spares*:* Another point to discuss in the total material input is stores and spares. It is the lowest Rs 28.01 crore in 2010-11 while it is the highest Rs 254.07 crore in 2015- 16. Also stores and spares input output ratio is 0.00702 in 2008-09,0.01233 in 2009- 10,0.01027 in 2010-11, 0.02773 in 2011-12, 0.06438 in 2012-13, 0.06219 in 2013-14, 0.04042 in 2014-15 and 0.04517 in 2015-16. It is the lowest 0.00702 in 2008-09 which indicates that for every unit of output produced 0.00702 unit of input is required. Hence reflecting a positive signal that for small amount of input more output is generated.

Purchases of Traded Goods / Stock in Trade*:* Purchases of traded goods or stock in trade is Rs 1270.67 crore in 2008-09, Rs 124.16 crore in 2009-10, Rs 145.94 crore in 2010-11, Rs 143.80 crore in 2011-12, Rs 145.90 crore in 2012-13, Rs 126.75 crore in 2013-14, Rs crore in 2014-15 and Rs 824.85 crore in 2015-16. Input output ratio is 0.31610 in 2008-09, 0.05239 in 2009-10, 0.05353 in 2010-11, 0.04384 in 2011-12, 0.07561 in 2012-13, 0.06223 in 2013-14,0.10931 in 2014-15, 0.14666 in 2015-16.

Total Material*:* Total material of Sun Pharmaceutical Industries Ltd. is showing a fluctuating trend. It is Rs 1,961.83 crore in 2008-09, Rs 795.89 crore in 2009-10. Rs 767.23 crore in 2010-11, Rs 964.73 crore in 2011-12, Rs 782.53 crore in 2012-13, Rs 866.24 crore in 2013-14, Rs 2,482.12 crore in 2014-15, Rs 2,502.91 crore in 2015-16. Total material input output ratio is 0.48803 in 2008-09, 0.33583 in 2009-10, 0.28140 in 2010-11, 0.29411 in 2011-12, 0.40555in 2012-13,0.42527 in 2013-14, 0.41428 in 2014-15,0.44501in 2015-16 respectively. Total material input output ratio is the highest 0.48803 in 2008-09 while it is the lowest 0.28140 in 2010-11. The lowest ratio indicates that material has been optimally utilized in the year 2010-11.

Material Productivity Ratio*:* Material productivity ratio is 2.0491 in 2008-09, 2.9777 in 2009-10, 3.5537 in 2010-11, 3.4001 in 2011-12, 2.4658 in 2012-13, 2.3515 in 2013-14, 2.4138in 2014-15 and 2.2471 in 2015-16. It is the highest 3.5537 in 2010-11, which means that for every unit of input, 3.5537 units of output is obtained. It is the lowest 2.0491 in 2008- 09 which means that for every unit of input, 2.0491 units of output is obtained. So the highest material productivity ratio is better as it gives more output with small amount of input.

Hypothesis Testing: Chi square has been used for testing the hypothesis. The table value of chi square at 5% level of significance with (8-1) = 7 degree of freedom is 14.07 while the calculated value of chi square of Sun Pharmaceutical Industries Ltd. is 34.20. As the calculated value of chi square is more as compared to the table value hence null hypothesis is rejected and alternate hypothesis is accepted. This reveals that the material productivity ratios of the Sun Pharmaceutical Industries Ltd. for the eight years period are different.

Material Productivity Ratios in Pharmaceutical sector and Kruskal Wallis Rank Sum Test

Table 6 shows the material productivity ratios of the companies of the pharmaceutical sector. The material productivity of all the samples is combined and arranged in order of increasing size and given a rank number. Where the tie occur the mean of the available rank numbers is used. The rank sum of each of the sample has been calculated. The detailed calculation has been done in the table 6.

Table 6: Kruskal Wallis Rank Sum Test

Comparative Material Productivity Ratios From 2008-09 to 2015-16 and Kruskal Wallis Rank Sum Test								
Base Year 2008-09								
Year	**Cipla Ltd.**		**Dr Reddy's Laboratories Ltd**		**Lupin Ltd**		**Sun Pharmaceutical Industries Ltd**	
	Ratio	**Rank 1**	**Ratio**	**Rank 2**	**Ratio**	**Rank 3**	**Ratio**	**Rank 4**
2008-09	2.0744	4	2.7600	19	2.1792	5	2.0491	2
2009-10	2.0573	3	2.8807	22	2.3263	9	2.9777	24
2010-11	2.0442	1	3.0552	25	2.3480	10	3.5537	29
2011-12	2.4210	16	3.1639	27	2.2107	6	3.4001	28
2012-13	2.3664	12	3.0575	26	2.3811	14	2.4658	17
2013-14	2.3740	13	4.3810	32	2.8784	21	2.3515	11
2014-15	2.2496	8	3.9626	30	2.7798	20	2.4138	15
2015-16	2.6178	18	4.1087	31	2.9248	23	2.2471	7
Total		75		212		108		133

Source: Author's Calculation

Table 7: Comparative Average Material Productivity of Pharmaceutical Sector From 2008-09 to 2015-16

Base Year 2008-09

Companies	**Raw Material Components (Input Output Ratio)**		**Stores and (Input Output Ratio)**		**Purchase of Traded Goods Stock in Trade (Input Output Ratio)**		**Material (Input Output Ratio)**		**Material Productivity Ratio**		**Chi Square Test**	
	Average	**Rank**	**Average**	**Rank**	**Average**	**Rank**	**Average**	**Rank**	**Average**	**Rank**	**Value**	**Rank**
Cipla Ltd.	0.3381	4	0.0106	1	0.0939	2	0.4426	4	2.2756	4	2.1822	1
Dr. Reddy's Laboratories Ltd	0.2131	1	0.0376	4	0.0498	1	0.3005	1	3.4212	1	6.6076	3
Lupin Ltd.	0.2697	3	0.0321	2	0.1027	3	0.4045	3	2.5035	3	2.6823	2
Sun Pharmaceutical Industries Ltd.	0.2450	2	0.0337	3	0.1075	4	0.3862	2	2.6823	2	34.1961	4

Source *:* Author's Calculation

Calculation of Kruskal Wallis Rank Sum Test (H Test)

$$H = \frac{12}{32(32+1)}\left[\frac{(75)^2}{8} + \frac{(212)^2}{8} + \frac{(108)^2}{8} + \frac{(133)^2}{8}\right] - 3(32+1)$$

$$H = 14.5256$$

H Test follows the Chi-Square distribution with (k-1) degree of freedom. k is the number of samples. Here in this case degree of freedom is 4-1 = 3. At 5 % level of significance with 3 degrees of freedom, the critical value/ table value is 7.8147.

The calculated value of H is 14.5256 and the table value is 7.8147. As the calculated value is greater than the table value hence null hypothesis rejected and alternate hypothesis is accepted. This means that the material productivity ratios of the pharmaceutical sector companies of Nifty 50 are different.

Raw Material and Components Average Input Output Ratio : The raw material and components average input output ratio is the best of Dr. Reddy's Laboratories Ltd. by 0.2131, followed by the Sun Pharmaceutical Industries Ltd. by 0.2450, Lupin Ltd. by 0.2697 and lastly Cipla Ltd. by 0.03381.

Stores and Spares Average Input Output Ratio : Stores and spares average input output ratio is the best of Cipla Ltd. as compared to Lupin Ltd., Sun Pharmaceutical Industries Ltd. and Dr. Reddy's Laboratories Ltd.

Purchase of Traded Goods/Stock in Trade Average Input Output Ratio : Purchase of traded goods/stock in trade average input output ratio is 0.0498 of Dr. Reddy's Laboratories Ltd., 0.0939 of Cipla Ltd., 0.1027 of Lupin Ltd. and 0.1075 of Sun Pharmaceutical Industries Ltd.

Material Average Input Output Ratio : The total material average input output ratio is the best of Dr. Reddy's Laboratories Ltd. with 0.3005, followed by Sun Pharmaceutical Industries Ltd. with 0.3862, Lupin Ltd. 0.4045, Cipla Ltd. 0.4426.

Average Material Productivity Ratio : Average material productivity ratio is the best of Dr. Reddy's Laboratories Ltd. with 3.4212 which means that for every one unit of material input, the output produced is 3.4212. This is followed by Sun Pharmaceutical Industries Ltd. with 2.6823 then Lupin Ltd. with 2.5035 and lastly Cipla Ltd. with 2.2756.

Chi Square Test : On analysing the Chi Square of the Pharmaceutical Sector Companies included in Nifty 50 it has been observed that Cipla Ltd. has the least chi square value with 2.1822 then the Lupin Ltd. with 2.6823, followed by Dr. Reddy's Laboratories Ltd. with 6.6076 and lastly it is Sun Pharmaceutical Industries Ltd. with the highest chi square value 34.1961. The table value of chi square at 5% level of significance with (8-1) = 7 degree of freedom is 14.07. This shows that the null hypothesis based on the chi square is accepted in case of Cipla Ltd., Lupin Ltd. and Dr. Reddy's Laboratories Ltd. while in case of Sun Pharmaceutical Industries Ltd. null hypothesis is rejected and alternate hypothesis is accepted. This reveals that the material productivity ratios of the Cipla Ltd., Lupin Ltd. and Dr. Reddy's Laboratories Ltd. for the eight years period are approximately the same while the material productivity ratios of the Sun Pharmaceutical Industries Ltd. for the eight years period are different.

Suggestions and Recommendations

The reason for the increase or decrease in the material productivity may be due to increase or decrease in the output or input or the components associated with productivity.

If output increases with no increase in input, it results in an increase in the material productivity and vice-a-versa and if output remains same but input decreases then also it results in increase in material productivity and vice-a-versa.

For improving the material productivity it is recommended to improve the components of output or input.

1. The company should optimally utilize the raw material without any wastage or spoilage.
2. The technology used in processing the raw material to make it a finished good should be of high quality so that there is low wastage of material.
3. Equipment used in material processing should be of good quality and proper maintenance of equipment should be there.
4. The standardized raw material should be used. The less standardized material should be avoided.

By keeping in mind the above points, from a small amount of input big amount of output can be obtained. Hence productivity increases.

Conclusion

It may be concluded from the above analysis that the pharmaceutical sector companies included in Nifty 50 are able to utilize its material resources efficiently as for each amount of input, twice or more than twice amount of output is obtained. This indicates that for small amount of input used, more amount of output is obtained. But this should not be the only criteria for analyzing the material productivity. Material productivity may increase due to other factors. One of such factors may be unfair practices adopted to increase the price of raw material. Price of raw material may increase by creating fake demand of raw material in the market and it is a universally known fact that as the demand increases in the market, prices also increases. Due to this increase, output in terms of quantity remains same but the output in terms of amount increases. As this study is based on the monetary values thus these factors are inseparable from the productivity calculation.

However, on analyzing pharmaceutical sector as a whole, it may be observed that the material productivity was the best of Dr. Reddy's Laboratories Ltd. as it has the highest output per rupee of material input. Its average

material productivity ratio is 3.4212, which is the highest among the others. Next highest average material productivity ratio is 2.6823 of Sun Pharmaceutical Industries Ltd., followed by 2.5035 of Lupin Ltd. and 2.2756 of Cipla Ltd.

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Wholesale Price Index from the website of Reserve Bank of India

"A nation's culture resides in the hearts and in the soul of its people."

– Mahatma Gandhi

Appendix 1

Revaluation of Output of Cipla Ltd. From 2008-09 to 2015-16

Revaluation of Output of Cipla Ltd. From 2008-09 to 2015-16															
Base Year 2008-09 **Rupees in Crore**															
S. No. Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
1 Sales	4960.60	5359.52	4855.73	6135.16	5067.64	6977.50	5351.74	8202.42	5954.96	9380.29	6425.50	10131.80	7102.39	12034.10	8484.04
2 Other Income	366.17	353.72	320.47	298.72	246.74	148.30	113.75	229.13	166.35	280.28	191.99	147.91	103.68	259.14	182.69
3 Changes in Inventories of Finished Goods,Work in progress and Traded Goods	-113.55	-184.09	-166.79	-125.74	-103.86	11.24	8.62	-290.75	-211.08	-158.12	-108.31	-349.05	-244.68	228.35	160.99
Total Output	5213.22	5529.15	5009.41	6308.14	5210.52	7137.04	5474.11	8140.80	5910.22	9502.45	6509.18	9930.66	6961.39	12521.59	8827.72

Source : Author's Calculation

Appendix 2

Revaluation of Output of Dr. Reddy's Laboratories Ltd. From 2008-09 to 2015-16

Revaluation of Output of Dr. Reddy's Laboratories Ltd. **From 2008-09 to 2015-16**															
Base Year 2008-09 **Rupees in Crore**															
S. No. Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
1 Sales	3999.70	4401.10	3987.40	5218.10	4310.15	6603.80	5065.11	8074.40	5862.01	9495.70	6504.55	9887.40	6931.07	9921.80	6994.87
2 Other Income	298.20	323.50	293.09	206.00	170.16	217.70	166.98	501.30	363.94	383.80	262.90	346.40	242.83	530.70	374.14
3 Changes in Inventories of Finished Goods,Work in progress and Traded Goods	64.10	-117.30	-106.27	-79.00	-65.25	-104.80	-80.38	-100.60	-73.04	2191.80	1501.38	2248.40	1576.13	1988.50	1401.89
Total Output	4233.80	4607.30	4174.21	5345.10	4415.05	6716.70	5151.71	8475.10	6152.92	12071.30	8268.84	12482.20	8750.02	12441.00	8770.91

Source : Author's Calculation

Appendix 3

Revaluation of Output of Lupin Ltd. From 2008-09 to 2015-16

Revaluation of Output of Lupin Ltd. From 2008-09 to 2015-16															
Base Year 2008-09 **Rupees in Crore**															
S. No. Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
1 Sales	2898.56	3640.09	3297.92	4426.25	3656.08	5384.83	4130.16	7122.51	5170.94	8939.38	6123.48	9752.47	6836.48	11280.07	7952.45
2 Other Income	72.40	72.52	65.70	85.21	70.38	3.49	2.68	23.31	16.92	415.38	284.54	180.63	126.62	185.64	130.88
3 Changes in Inventories of Finished Goods,Work in progress and Traded Goods	25.46	1.98	1.79	-0.51	-0.42	-132.53	-101.65	-182.44	-132.45	-76.21	-52.20	-170.80	-119.73	-172.72	-121.77
Total Output	2945.50	3714.59	3365.42	4510.95	3726.04	5255.79	4031.19	6963.38	5055.41	9278.55	6355.81	9762.30	6843.37	11292.99	7961.56

Source : Author's Calculation

Appendix 4

Revaluation of Output of Sun Pharmaceutical Industries Ltd. From 2008-09 to 2015-16

Revaluation of Output of Sun Pharmaceutical Industries Ltd. From 2008-09 to 2015-16															
Base Year 2008-09 **Rupees in Crore**															
S. No. Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
1 Sales	2769.75	1846.13	1672.59	1933.12	1596.76	4015.56	3079.93	2432.14	1765.73	2828.79	1937.72	8017.19	5620.05	7614.46	5368.19
2 Other Income	1273.92	800.59	725.33	1365.75	1128.11	342.85	262.97	236.17	171.46	159.38	109.18	211.58	148.32	431.82	304.43
3 Changes in Inventories of Finished Goods,Work in progress and Traded Goods	-23.78	-30.91	-28.00	1.99	1.64	-81.73	-62.69	-10.53	-7.64	-14.53	-9.95	318.10	222.99	-68.48	-48.28
Total Output	4019.89	2615.81	2369.92	3300.86	2726.51	4276.68	3280.21	2657.78	1929.55	2973.64	2036.94	8546.87	5991.36	7977.80	5624.35

Source : Author's Calculation

Appendix 5

Revaluation of Material Input of Cipla Ltd. From 2008-09 to 2015-16

Revaluation of Material Input of Cipla Ltd. From 2008-09 to 2015-16															
Base Year 2008-09 **Rupees in Crore**															
S. No.	Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
		Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
		Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
(A)	**Raw Material And Components**															
1	Purchased Bulk Drugs	776.56	909.59	824.09	1075.24	888.15	884.16	678.15	953.33	692.12	1367.62	936.82	1567.24	1098.64	1409.10	993.42
2	Raw Material (Solvents, Capsules, etc.)	101.25	105.62	95.69	131.67	108.76	139.29	106.84	168.37	122.24	201.84	138.26	942.06	660.38	1190.19	839.08
3	Packing Material	461.25	465.27	421.53	558.59	461.40	572.55	439.15	663.69	481.84	812.29	556.42	891.11	624.67	956.03	674.00
4	Intermediates and Others	643.82	634.09	574.49	643.37	531.42	796.30	610.76	977.36	709.56	900.90	617.12	127.84	89.62	78.02	55.00
5	Less Recoverable Duties	-109.97	-99.16	-89.84	-93.83	-77.50	-91.45	-70.14	-115.92	-84.16	-137.31	-94.06	-101.51	-71.16	0.00	0.00
	Total (A)	1872.91	2015.41	1825.96	2315.04	1912.22	2300.85	1764.75	2646.83	1921.60	3145.34	2154.56	3426.74	2402.14	3633.34	2561.50
(B)	**Stores and Spares**	52.16	50.47	45.73	99.73	82.38	91.57	70.23	86.43	62.75	84.05	57.57	84.22	59.04	112.28	79.16
(C)	**Purchases of Traded Goods/ Stock in Trade**	588.04	621.66	563.22	671.13	554.35	555.55	426.11	706.89	513.20	773.40	529.78	903.41	633.29	1037.56	731.48
	Total Material Input (A+B+C)	2513.11	2687.54	2434.91	3085.90	2548.95	2947.97	2261.09	3440.15	2497.55	4002.79	2741.91	4414.37	3094.47	4783.18	3372.14

Source : Author's Calculation

Appendix 6

Revaluation of Material Input of Dr. Reddy's Laboratories Ltd From 2008-09 to 2015-16

Revaluation of Material Input of Dr. Reddy's Laboratories Ltd. From 2008-09 to 2015-16															
Base Year 2008-09 **Rupees in Crore**															
S. No. Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
(A) Raw Material And Components	921.20	1100.50	997.05	1065.40	880.02	1738.60	1333.51	2277.30	1653.32	2191.80	1501.38	2248.40	1576.13	1988.50	1401.89
(B) Stores and Spares	356.40	253.40	229.58	353.10	291.66	76.70	58.83	101.50	73.69	94.60	64.80	375.50	263.23	429.10	302.52
(C) Purchases of Traded Goods/ Stock in Trade	256.40	245.50	222.42	331.00	273.41	307.60	235.93	393.10	285.39	469.00	321.27	526.10	368.80	610.40	430.33
Total Material Input (A+B+C)	1534.00	1599.40	1449.06	1749.50	1445.09	2122.90	1628.26	2771.90	2012.40	2755.40	1887.45	3150.00	2208.15	3028.00	2134.74

Source : Author's Calculation

Appendix 7

Revaluation of Material Input of Lupin Ltd. From 2008-09 to 2015-16

Revaluation of Material Input of Lupin Ltd. From 2008-09 to 2015-16																
Base Year 2008-09 **Rupees in Crore**																
S. No.	Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
		Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
		Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
(A)	Raw Material And Components															
1	DL2 (RECEMIC)	61.54	77.46	70.18	74.89	61.86	81.42	62.45	93.46	67.85	95.42	65.36	111.03	77.83	117.67	82.96
2	PEN G	176.34	169.26	153.35	216.52	178.85	184.01	141.14	176.94	128.46	237.75	162.86	257.69	180.64	277.95	195.95
3	Packing Material	118.25	131.22	118.89	155.58	128.51	196.87	151.00	239.18	173.64	259.28	177.61	277.64	194.63	316.85	223.38
4	Others	563.72	706.60	640.18	935.43	772.67	1129.87	866.61	1417.63	1029.20	1539.55	1054.59	1592.96	1116.66	1634.27	1152.16
	Total (A)	919.85	1084.54	982.59	1382.42	1141.88	1592.17	1221.19	1927.21	1399.15	2132.00	1460.42	2239.32	1569.76	2346.74	1654.4
(B)	Stores and Spares	84.31	105.98	96.02	154.57	127.67	186.00	142.66	221.22	160.61	262.27	179.65	330.06	231.37	407.68	287.41
(C)	Purchases of Traded Goods/ Stock	347.46	406.25	368.06	384.19	317.34	599.27	459.64	776.03	563.40	829.19	568.00	942.50	660.69	1106.73	780.24
	Total Material Input (A+B+C)	1351.62	1596.77	1446.67	1921.18	1586.89	2377.44	1823.50	2924.46	2123.16	3223.46	2208.07	3511.88	2461.83	3861.15	2722.11

Source : Author's Calculation

Appendix 8

Revaluation of Material Input of Sun Pharmaceutical Industries Ltd. From 2008-09 to 2015-16

Revaluation of Material Sun Pharmaceutical Industries Ltd. **From 2008-09 to 2015-16**																
Base Year 2008-09 **Rupees in Crore**																
S. No.	Items	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
		Actual	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued	Actual	Revalued
		Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
(A)	Raw Material And Components															
1	Raw Material	626.71	645.23	584.58	655.57	541.50	832.81	638.77	583.90	423.91	707.50	484.64	1881.40	1318.86	1701.42	1199.50
2	Packing Material	36.22	63.93	57.92	62.69	51.78	118.90	91.20	121.89	88.49	187.12	128.18	379.71	266.18	318.43	224.49
	Total (A)	662.93	709.16	642.50	718.26	593.28	951.71	729.96	705.79	512.40	894.62	612.81	2261.11	1585.04	2019.85	1423.99
(B)	**Stores and Spares**	28.23	32.26	29.23	33.91	28.01	118.60	90.97	171.12	124.23	184.93	126.68	345.49	242.19	360.38	254.07
(C)	**Purchases of Traded** Goods/ Stock	1270.67	137.04	124.16	176.68	145.94	187.48	143.80	200.96	145.90	185.04	126.75	934.22	654.89	1170.00	824.85
	Total Material Input (A+B)	1961.83	878.46	795.88	928.85	767.23	1257.79	964.72	1077.87	782.53	1264.59	866.24	3540.82	2482.11	3550.23	2502.91

Source : Author's Calculation