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Impact of Total Cost of Production on Profitability: A Study on Selected Listed Pharmaceutical Companies in Gujarat

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Abstract

This study examines the impact of Total Cost of Production (TCP) on the profitability of a few pharmaceutical firms in India during the ten-year period from 2015-16 to 2024-25 will be considered. This research considers the following pharmaceutical firms located in Gujarat: Zydus Lifesciences, Torrent Pharmaceuticals, Alembic Pharmaceuticals, Dishman Carbogen Amcis, and Lincoln Pharmaceuticals. To analyze the effect of TCP on profitability, the researcher applies ratio analysis and correlation approaches.

The findings an increasing tendency in production costs in all the firms, but profitability varies from one firm to another. A negative correlation coefficient between TCP and Net Profit Ratio was found, indicating that an increase in the level of production costs leads to a decrease in profitability. Besides, the research emphasizes that various exogenous factors have impacted production costs and profitability, including the COVID-19 pandemic.

Keywords: Total Cost of Production, Profitability, Pharmaceutical Industry, Ratio Analysis, COVID-19 Impact

INTRODUCTION

Pharmaceuticals are an essential part of the growth of economies and the welfare of people. For instance, the Indian pharmaceutical industry is considered to be one of the leading ones. However, the industry itself is cost-conscious, since its total cost of production includes considerable expenditures.

Total Cost of Production includes expenditures associated with purchasing raw materials, employing labor force, manufacturing overheads, and other costs related to operation of pharmaceutical organizations. It should be noted that there has been increasing cost pressure due to increasing cost of raw materials, regulation and competition.

The purpose of this research will be to examine how cost of production affects profitability in the pharmaceutical industry and what impact some external factor (COVID-19 pandemic) may have on this relationship.

REVIEW OF LITERATURE

Kumar J and Vimala M (2016) examined how cost structure affects the financial performance of certain pharmaceutical firms in India. The research employed ratio analysis to assess the connection between cost elements and profitability metrics. The results indicated that operating and production expenses significantly impact financial performance. Nevertheless, the study was carried out at a national scale and did not concentrate on companies specific to certain regions or the long-term behaviour of costs.

Mahalakshmi S and Ganesan M (2025) analysed of the financial performance of pharmaceutical companies listed on the NSE, utilizing profitability and liquidity ratios. Their study revealed discrepancies in financial performance across different companies. Nevertheless, it did not empirically examine the connection between total production costs and profitability.

Mahor N and Banerji A (2023) studied the profitability of the Indian pharmaceutical sector using a co-integration methodology. Their research uncovered a long-term association between profitability and certain financial variables but the specific role of total production costs as a crucial factor influencing profitability was not addressed.

Patra D (2025) conducted an empirical investigation into the factors impacting the profitability of pharmaceutical firms in India, employing regression analysis. This study identified various financial determinants that affect profitability; however, it did not concentrate solely on total production costs or on pharmaceutical companies specific to certain regions.

Iyengar et al. (2020) analyzed the impact of the COVID-19 pandemic on the pharmaceutical and healthcare sector. The study highlighted changes in cost structures and profitability during the pandemic period, but did not empirically examine total production cost as a determinant of profitability.

Tyagi, S., and Nauriyal, D. (2017) examined firm-level determinants of profitability in the Indian pharmaceutical industry using panel data analysis. The study found that operating expenses, R&D intensity, and cost-related factors significantly affect profitability, but total production cost was not separately analyzed.

Saini M and Dani S (2025) assessed the financial performance metrics before and after the COVID-19 pandemic in Indian pharmaceutical firms. Although pandemic-related changes were highlighted, total production cost was not explicitly examined.

Rathod N, Chavda D, and Nakum D (2023) carried out a comparative analysis of profitability among selected pharmaceutical companies using accounting ratios. Their research emphasized inter-company comparisons but did not empirically explore the causal relationship between production costs and profitability.

Ali A (2020) investigated the relationship between working capital, profit and profitability among selected Indian pharmaceutical firms. While the study offered valuable insights into financial management, total cost of production was not considered as a major explanatory variable.

Kumar Bhambu M and Professor A (2022) evaluated the financial performance of selected publicly listed pharmaceutical companies using financial ratios. Although the study included cost-related ratios, total cost of production was not examined as an independent factor affecting profitability.

Megavath M (2022) examined the profitability of selected pharmaceutical companies in India through the use of accounting ratios. The study concentrated on profit trends and inter-company comparisons, neglecting the analysis of production cost dynamics.

Yadav V and Raina A (2024) analyzed the financial performance and profitability of Indian pharmaceutical companies over time. However, their study did not offer a focused examination of the dynamics of production costs.

Mangayarkarasi R and Mugunthan C (2024) performed an evaluation of profitability trends through ratio and trend analysis. Their research underscored the fluctuations in profit margins over time; however, it did not delve into the effects of total production cost.

OBJECTIVES OF THE STUDY

- To analyze the trend of Total Cost of Production and profitability of selected pharmaceutical companies.
- To examine the relationship between Total Cost of Production and Net Profit Ratio.
- To evaluate the impact of external factors COVID-19 on cost and profitability

HYPOTHESES OF THE STUDY

Hypothesis 1: Impact of Total Cost of Production on Profitability

- **Null Hypothesis (H_{01}):**

Total cost of production has no significant impact on profitability.

- **Alternative Hypothesis (H_{11}):**

Total cost of production has a significant impact on profitability.

Hypothesis 2: Impact of COVID-19 on Profitability

- **Null Hypothesis (H_{02}):**

COVID-19 has no significant impact on profitability.

- **Alternative Hypothesis (H_{12}):**

COVID-19 has a significant impact on profitability.

RESEARCH METHODOLOGY
RESEARCH DESIGN AND DATA SOURCE

The present study adopts a **descriptive and analytical research design** to examine the impact of Total Cost of Production (TCP) on the profitability of selected pharmaceutical companies. The study is based on **secondary data** collected from the published annual reports of the selected companies.

The variables considered in the study are:

a) Independent Variables:

- **Total Cost of Production (TCP):** Calculated using Cost of Materials Consumed, Purchases of Stock-in-trade, and Changes in Inventory to ensure consistency and reliability.
- **COVID-19 Dummy Variable (COVID):** Used to indicate the presence of external economic disruption (0 = pre-COVID period, 1 = COVID and post-COVID period).

b) Dependent Variable: Net Profit Ratio (NPR)

Sample Selection and Study Period

The study covers a period of ten years from 2015–16 to 2024–25, enabling the analysis of long- term trends in cost behaviour and profitability, including the impact of external economic disruptions such as the COVID-19 pandemic.

Initially, seven pharmaceutical companies associated with Gujarat were identified. However, for detailed analysis, five companies—Zydus Lifesciences, Torrent Pharmaceuticals, Alembic Pharmaceuticals, Dishman Carbogen Amcis, and Lincoln Pharmaceuticals—were selected based on the availability of consistent financial data, comparability in cost structures, and their focus on manufacturing-oriented operations.

Companies such as Sun Pharmaceutical Industries and Eris Lifesciences were excluded due to differences in scale, global diversification, and business models, which may affect comparability.

Tools and Techniques of Analysis

For the purpose of this study, the following tools and techniques have been employed to achieve the objectives of the study:

- Trend Analysis - To analyze the data
- Ratio Analysis - To analyze the data
- Correlation Analysis - Pearson's Coefficient - To analyze the data
- Regression Analysis – To assess impact and causality Advanced techniques include:
- Dummy Variable Technique (COVID impact) – To capture the structural impact of the COVID-19 period.

DATA ANALYSIS AND INTERPRETATION

Hypothesis 1: Relationship between TCP and Profitability

Interpretation

The table shows that Total Cost of Production (TCP) for most pharmaceutical companies increased from 2015–16 to 2024–25, indicating expansion in operations. Zydus and Torrent show noticeable fluctuations with sharp rises in later years, while Alembic reflects steady growth. Dishman shows moderate variation, and Lincoln maintains lower costs with gradual increases. Overall, rising production costs are common, highlighting the need for effective cost management to maintain profitability.

Figure 7.1 shows a clear upward trend in Total Cost of Production for most companies, with noticeable spikes in later years indicating expansion. Some fluctuations are visible, especially around 2020–21, reflecting COVID-19 disruptions. Overall, rising costs highlight the need for efficient cost management to sustain profitability.

Net Profit Analysis

Interpretation

Net profit is considered a key indicator of a company's financial performance, as it reflects all Net profit is a key indicator of financial performance. Zydus and Torrent show relatively high but fluctuating profits, while Alembic has moderate and inconsistent profitability. Dishman displays significant instability, including losses in some years, indicating periods of weak financial performance. Lincoln shows gradual improvement over time. Overall, profitability does not always align with cost or revenue trends, highlighting the importance of efficient cost management.

The graph shows clear fluctuations in net profit across all firms, with no consistent upward trend. Dishman's negative profit periods highlight instability, while larger firms perform better but still face volatility. Overall, profitability is influenced by multiple factors and not solely by cost or revenue trends.

Profitability Ratios

Interpretation

Ratio analysis helps compare financial performance across companies by converting absolute figures into relative measures. In this study, the Net Profit Ratio (NPR) is used to assess overall profitability.

The table shows that while some firms maintain stable profitability, fluctuations are evident across years. Zydus demonstrates relatively strong and stable profitability, while Torrent remains relatively stable with some variation. Alembic shows moderate profitability with a slight declining trend, and Dishman exhibits high volatility, including negative ratios. Lincoln maintains moderate but fluctuating profitability.

Overall, variations in NPR indicate that profitability depends not just on revenue but significantly on effective cost control and expense management.

For a clearer comparison of overall profitability across companies, the Net Profit Ratio has been graphically represented below:

The graph shows clear variations in Net Profit Ratios across firms over time. Zydus and Torrent maintain relatively higher and stable profitability, while Dishman records negative values in some years. Lincoln and Alembic show moderate but fluctuating performance. Overall, the graph indicates that profitability varies due to differences in cost management and operational efficiency.

Correlation Analysis

Interpretation

Firms show a negative correlation between TCP and NPR, meaning higher production costs lead to lower profitability. Zydus, however, shows a weak and inconsistent relationship, indicating that profitability is less sensitive to cost changes. Dishman and Alembic have a strong negative relationship, while Torrent and Lincoln show a moderate one, indicating differences in cost efficiency.

This supports the principle that rising costs reduce profitability if not controlled. **Decision:** Reject H_0 and accept H_1, confirming a negative relationship between TCP and profitability.

Regression Analysis

Interpretation

The regression results show a negative coefficient of TCP for most firms, indicating an inverse relationship between cost and profitability, except Zydus, which shows a positive but insignificant effect.

The relationship is significant at 5% level for Alembic (p = 0.03183) and Dishman (p = 0.00313), leading to rejection of H_0 for these firms. For Zydus, Torrent, and Lincoln, the impact is not significant as p-values exceed 0.05.

R^2 values are higher for Dishman and Alembic, showing better explanatory power, while lower values for others suggest the influence of additional factors.

Decision: Reject H_0 and accept H_1, indicating that influences profitability. However, the extent of impact varies across companies.

Hypothesis 2: Impact of COVID-19 on Profitability

Regression Analysis

Interpretation

The regression analysis with a COVID-19 dummy variable shows that TCP has a negative impact on profitability for all firms, but it is statistically significant only for Lincoln Pharmaceuticals. For other companies, the relationship is not significant, indicating relative resilience to cost changes.

The COVID-19 effect is mixed—positive for Torrent, Alembic, and Lincoln, but negative for Zydus and Dishman. However, it is statistically significant only for Lincoln, suggesting a strong pandemic impact only in this case.

R^2 values vary, with higher explanatory power for Dishman and Lincoln, and lower for Zydus and Torrent, indicating the influence of other factors.

Decision: Fail to reject H_0, as COVID-19 does not have a consistent or significant impact on profitability across most firms.

FINDINGS

The major findings of the study based on the analysis of Total Cost of Production and profitability of selected pharmaceutical companies are as follows:

- The Total Cost of Production (TCP) of the selected pharmaceutical companies exhibits an overall increasing trend during the study

period, indicating expansion in scale of operations along with rising input and operational costs.

- The analysis of Net Profit reveals significant fluctuations across companies and years, suggesting that profitability is not consistent and is influenced by multiple internal and external factors.
- The Net Profit Ratio (NPR) also shows variability across firms, indicating differences in cost efficiency and financial performance. While some firms maintain relatively stable profitability, others experience volatility and even negative returns.
- The correlation analysis indicates a negative relationship between TCP and NPR for most companies, confirming that an increase in production cost leads to a decrease in profitability. However, Zydus Lifesciences shows a weak positive relationship.
- The regression results reveal that TCP has a statistically significant impact on profitability in the case of Alembic Pharmaceuticals and Dishman Carbogen Amcis, whereas the relationship is not significant for the remaining firms.
- The variation in R^2 values across companies suggests that, apart from production costs, other factors also play a role in determining profitability.
- The inclusion of the COVID-19 dummy variable indicates mixed results, with a statistically significant impact observed only in the case of Lincoln Pharmaceuticals, while for other firms the impact remains insignificant.
- The effect of COVID-19 is not uniform across all companies, indicating that firm- specific characteristics such as adaptability, scale, and business model influence performance during external disruptions.

CONCLUSION

The study concludes that Total Cost of Production is an important determinant of profitability in the pharmaceutical industry. The analysis establishes that, for most firms, there exists an inverse relationship between production cost and profitability, implying that rising costs adversely affect profit margins if not effectively controlled.

However, the impact of production cost on profitability is not uniform across all companies, as it depends on firm-specific factors such as operational efficiency, cost structure, and management practices.

Furthermore, the study finds that external factors such as the COVID-19 pandemic do not have a consistent or statistically significant impact on profitability across the selected firms, indicating varying levels of resilience among companies.

In conclusion, the study emphasizes that efficient cost control, optimal resource utilization, and strong operational management are essential for achieving sustainable profitability in the pharmaceutical industry.

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Analysis of Total Cost of Production (TCP) Table 7.1: Total Cost of Production (₹ Crores)

Year	Zydus	Torrent	Alembic	Dishman	Lincoln
2015–16	3095.9	1182.76	769.41	193.84	277.44
2016–17	3445.1	1791.66	958.1	142.07	217.1
2017–18	1695.7	1673.47	885.49	155.31	192.51
2018–19	298.37	2219.64	993.59	162.58	81.38
2019–20	1951.7	2166.92	1039.39	200.11	182.9
2020–21	2351.4	2146.42	1255.33	468.15	197.73
2021–22	2870.2	2442.01	1446.43	447.42	218.6
2022–23	3171.3	2735.19	1708.82	511.41	1708.82
2023–24	6228.2	2686.21	2215.08	597.19	1715.08
2024–25	1278.1	3325.74	1793.36	501.65	1793.36

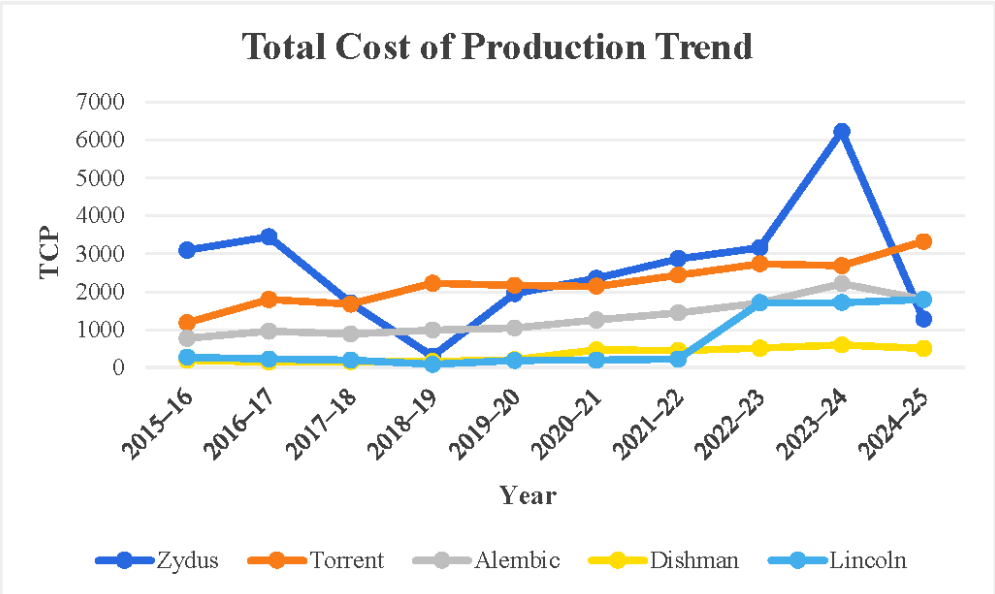

Figure 7.1: Trend Analysis of Total Cost of Production (2015–2025)

Net Profit Analysis

Table 7.2 Net Profit (₹ Crores)

Year	Zydus	Torrent	Alembic	Dishman	Lincoln
2015–16	1552.6	1763.44	719.58	87.15	23.68
2016–17	661.9	1059.73	398.41	24.24	27.06
2017–18	406.4	536.86	409.63	37.07	34.74
2018–19	171.24	436.31	589.12	56.01	48.77
2019–20	1412.9	1024.72	798.88	38.52	50.99
2020–21	1476.2	1251.88	1142.81	- 165.13	62.26
2021–22	857.9	777.18	522.34	18.01	69.48
2022–23	1529.2	1245.23	341.99	- 29.80	355.36
2023–24	3972.8	1656.38	615.82	-153.45	604.98
2024–25	346.9	1911.25	582.01	3.24	587.54

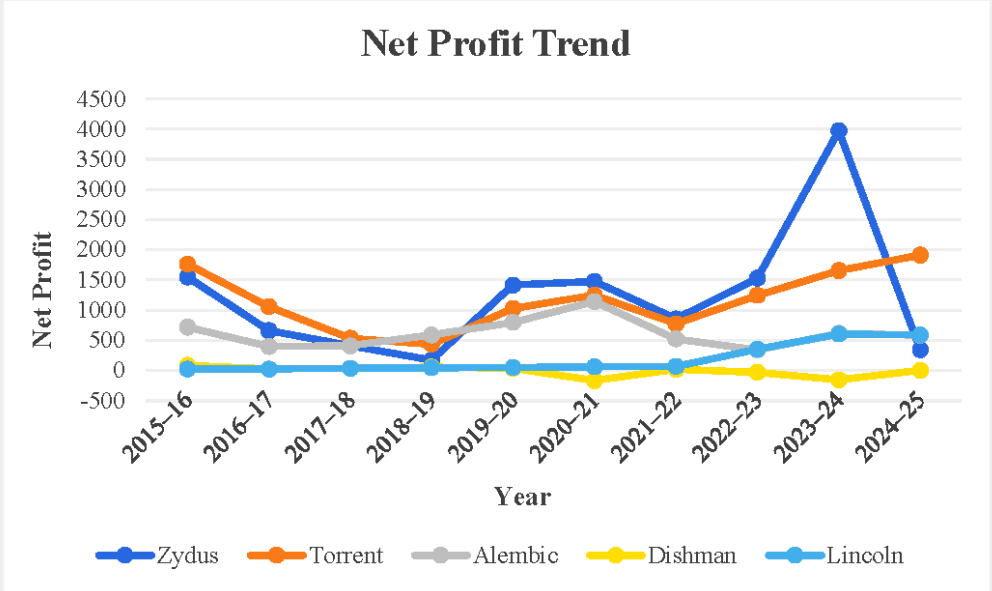

Figure 7.2: Net Profit Trend Analysis (2015–2025)

Table 7.3: Profitability Ratios (NPR %)

Year	Zydus	Torrent	Alembic	Dishman	Lincoln
2015–16	15.78	32.48	22.59	16.89	5.83
2016–17	20.21	18.09	12.71	5.37	7.40
2017–18	6.98	8.94	13.08	7.81	9.61
2018–19	20.32	5.69	14.97	10.19	13.32
2019–20	22.26	12.91	17.35	6.63	13.19
2020–21	18.95	15.64	20.85	-8.64	14.68
2021–22	10.75	9.13	9.75	0.84	14.72
2022–23	17.51	12.88	6.05	-1.24	6.29
2023–24	20.32	15.36	9.89	-5.87	9.71
2024–25	12.81	16.60	8.72	0.12	8.81

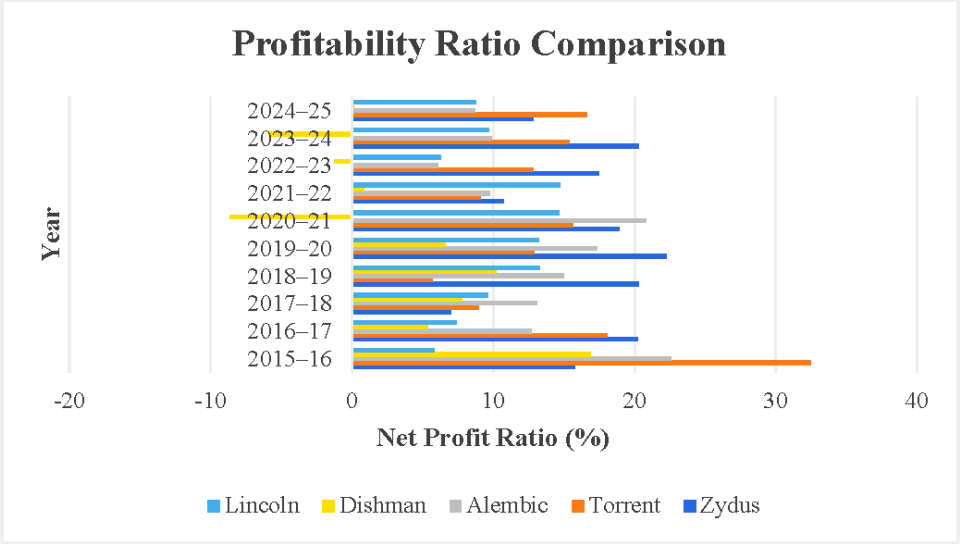

Figure 7.3: Comparative Analysis of Net Profit Ratios (%)

Table 7.4: Correlation between TCP and NPR

Company	r (TCP vs NPR)	Interpretation
Zydus	0.22488	Weak positive relationship
Torrent	-0.41144	Moderate negative relationship
Alembic	-0.67615	Strong negative relationship
Dishman	-0.82752	Very strong negative relationship
Lincoln	-0.4511	Moderate negative relationship

Table 7.5: Regression Results- Impact of TCP on Profitability

Company	a	Coefficient (b)	R^2	p-value
Zydus	14.7442	0.000699	0.050573	0.532197
Torrent	25.8926	-0.00497	0.16928	0.23748
Alembic	23.6566157	-0.0077004	0.45717828	0.03183
Dishman	15.0727736	-0.0350998	0.6847953	0.00313
Lincoln	11.7046	-0.00205	0.20349	0.19069

Table 7.6: Regression Results – Impact of TCP and COVID-19 on Profitability

Company	TCP Coefficient	Prob.	COVID Coefficient	Prob.	R^2
Zydus	-0.000944	0.4571	-2.063	0.5870	0.092
Torrent	-0.008745	0.1856	+5.822	0.4244	0.246
Alembic	-0.010054	0.1267	+2.498	0.6451	0.47
Dishman	-0.003287	0.9316	-1.123	0.4058	0.71
Lincoln	-0.004433	0.0221	+5.122	0.0486	0.56