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## CURRENT GEO-ECONOMIC ASPECTS OF CHEMICAL INDUSTRIES: A CASE STUDY OF DIFFERENT COMPANIES IN INDIA

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#### Abstract

Financial appraises create a prominent media for giving advice in the expansion, development of any society as well as its role in forbearance and stamina in depletion and recession. Obviously, manufacturing units have a main role in the development and progress of modern India. Indian economic relied on agricultural activities but industries also provide a prominent booster for the economic cycle. The current empirical study investigated the 7 Indian chemical companies in terms of financial aspect and geographical location using ratio analysis, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), ComplexProportionalAssessments (COPRAS) and Data Envelopment Analysis (DEA) along with weighing systems of equal weighing, Entropy Shannon and Friedman test as the objective of research during 2010 to 2018. By the way, present research resulted in weighing and ranking of above-named industries in three classes. The weighing systems of Friedman test and Entropy Shannon were revealed a relatively linear scatter plot with no significant differences between values. DEA model had distinguished and classified the efficient companies based on rank values.

Key words: Financial performance, Geographical location Companies, DEA, Ratio analysis.

#### **INTRODUCTION:**

The Indian chemical industry is one of the most important components of our economy and contributes around 7% to the nation's Gross Domestic Product (GDP). Amidst the global pandemic, the chemical industry has been one of the only few sectors to have not only survived it but also grown by leaps and bounds. Taking into consideration that India is the 6 th largest producer of chemicals in the world and 3rd in Asia has aided the Indian chemical industry which is now set to capitalize on forthcoming opportunities.

In 2019, the Indian chemicals industry stood at US\$ 178 billion and is anticipated to reach US\$ 304 billion by 2025, registering a CAGR of 9.3%. This estimation is predicated on the Indian chemical industry's ability to consistently create significant impacts on a global scale. However, this has indeed raised prospects for sustained, continual growth of the Indian chemical industry's top and bottom lines.

Furthermore, it has also been observed by experts that the global chemical industry has been doing well, with its Indian counterparts performing even better, yielding high total returns to shareholders (TRS) despite recent headwinds. A major investment of Rs 8 lakh crore is also anticipated in the sector by 2025, aiming to bolster its growth further.

In July 2021, production volumes of key chemicals stood at 909,310 MT. Today, despite numerous challenges, namely, inflation, geopolitical concerns, and supply chain disruptions, the sector continues to deliver great value to its stakeholders. Also, India's proximity to the Middle East, the world's largest source of petrochemicals stockpile, enables it to benefit from economies of scale.

### GLOBAL TRENDS: UNCERTAINTY FOR THE WORLD, POSSIBILITIES FOR INDIA:

The overall world dynamics have encouraged major multinational companies to turn their sights towards downstream chemical opportunities, thus leading to an increase in the focus on petrochemicals and specialty chemicals in India to boost self-sufficiency.

Exhibiting great awareness, several companies have embedded sustainability as the centerpiece of their ethos, with major global investors and analysts following suit. In such circumstances, it becomes imperative for chemical companies to prioritize environmental sustainability to protect long-term shareholder values while continuing to adhere to local regulations.

In recent years, safety and environmental issues have plagued chemical companies extensively, forcing regulatory authorities in countries such as China to crack down on erring companies that are compromising on quality and safety. This has triggered supply chain issues for multinational buyers of their products. To de-risk reliance on one country, now MNCs are looking at sourcing essential materials from countries like India.

Post-COVID-19, trade conflicts have affected the world, especially the trade relationship between China, the United States, and Western Europe, causing major shifts in global supply chains and affecting bilateral trade between China and the United States; putting other countries' risk economies at of massive repercussions. Large chemical markets that remain accessible in this scenario could present opportunities for Indian chemical companies. Moreover in India, there seems to be a move toward prioritization of core businesses and consolidation for greater scale industrywide, often through bigticket mergers and acquisitions.

## INDIA'S ROLE:

India consistently ranks third in chemical imports and fourth in exports over the last five years, proving itself as a substantial part of India's inclusive trade flow. In terms of world export, the data indicates the percentage share of exports has increased gradually over time with key factors such as economic growth and social emancipation acting as catalysts that shall boost domestic consumerism and consequently, higher per capita utilization of chemicals (directly or indirectly).

Two major initiatives by the Government, 'Make in India' and 'Atmanirbhar Bharat', are aptly designed for the chemicals & the petrochemicals sector to flourish in the country. The industry needs to build scale via ecosystem – this entails the creation of Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) across all four corners of the country, infrastructure linkages for a huband-spoke model and finally, integrating value chains.

India's attractiveness as a manufacturing destination has been rising because of competitive labour costs, its ability to build manufacturing units at less cost than in the developed world, and recent changes to corporate tax rates that have shaped a more supportive ecosystem. Many Indian specialty chemical players have developed distinctive capabilities and established supply relationships with global networks.

Despite industry-specific challenges, chemical companies in India could benefit in the long term from factors such as rising domestic demand in chemical end-use sectors like agriculture, consumer and retail, infrastructure, auto and electronics, and healthcare that could spur around 50 percent of incremental growth in chemicals as the economy grows. All of these factors are expected to drive chemical demand, creating lucrative value pools across most chemical sub segments.

## **OPPORTUNITIES:**

At a broader level, structural shifts are going to be critical for 'Make in India' to take shape. While 'China+1' is still taking form, India's neighbours and peers have already taken off on a steeper plane. China has in many ways been the world's manufacturing hub over the past two decades while also being a megaconsumer. For instance, industries such as cosmetics, fashion, and FMCG are poised for robust growth, as the pandemic recedes, and spending levels rise. This augurs well for segments such as perfumery cosmetics, essential oils, and products that are linked to the senses, where India has an edge. Also, it would equally aid faster growth of chemicals linked to the packaging of products.

What this brings to the fore, is that it is essential to explore, diversify and build scale by integrating the value chain, and not simply by focusing on a single segment of the industry. 'Atmanirbhar' can succeed, only when the industry builds capabilities across the value chain. This shall reduce dependence on imports, deleverage risks emanating from supply chain disruptions, and more importantly boost the economy. As the government shifts focus on industries such as electronics & semiconductors, renewable energy, and pharma, the role of chemicals & amp; petrochemicals the industry shall evolve into а more specialized one. Eventually, it shall emerge as a stepping stone towards 'making in India, for the world.'

## CHALLENGES:

India has a strong vision to be a US\$ 5 trillion digital economy. In order to turn this goal into a reality, the Indian chemical Industry has a major role to play. Often the sector faces key challenges such as inadequate infrastructure facilities, high costs of basic raw materials like natural gas and crude oil, high cost of capital, and the need for technological modernization of its facilities. The charter for stabilization has already been prescribed by the government with PLI (Production Linked Incentives) initiatives such as Aatmanirbhar Bharat, Make in India, etc. However, one of the biggest challenges faced as an industry is contracting gross margins due to soaring raw material costs and increasing operating costs due to higher freight, especially owing to the backdrop of the COVID pandemic.

## LITERATURE REVIEW:

The financial performance of many companies such as Tata Steel Ltd., Jindal Steel & Power Ltd., J S W Steel Ltd., Bhushan Steel Ltd. and Steel Authority of India Ltd evaluated based on Liquidity, Solvency, Activity and Profitability ratios in India (Arab et al 2015). Kettiramalingam et al (2017) estimated the financial performance using productivity and efficiency relationships as a case study industry in India. The obtained results revealed a rise in the performance of the industry in a period of 20 years. To investigate the interplay between executive compensation and companies' performance has been used the ratios analysis as main and important variables by Raithatha and Komera (2016) in Indian companies. 50 listed non-financial companies on Pakistani Stock Market investigated for financial performance via working capital management, inventory turnover, cash conversion cycle, average collection period, and average payment period, return on asset, return on equity and earning per share in a period ranging from 2005 to 2014 (Bagh et al 2016). A study targeted to evaluate the performance of manufacturing 744 small and medium enterprises based on input and output variables in Turkey. By the way, it has been reported to exist around 94 efficient units (Bulak and Turkyilmaz 2014). A study estimated the efficiency score (relies on value-added amounts) of manufacturing companies of both China and Turkey via the DEA model. The canonical correlation analysis used to figure out the weight values. The ttest analysis has been selected to compare the significant differences between the efficiency values of two groups of companies. The statistical analysis has been manifested the highest efficiency level to Chinese companies (Bayyurt and Duzu 2008). Amini and Alinezhad (2016) carried out his research using the DEA method for ranking 15 Iranian industries. In the following steps, it was found around 8 efficient industries with a score of 1. The research conducted by Lu et al (2014) used a similar procedure close to DEA to figure out the efficiency of industries. The results appeared with the efficiency scores about 0.905 to 0.973 for 34 Chinese life insurance companies from 2006 to 2010. An article devoted to assessing the efficiency and performance of around 40 retail workshops via DEA method in the Portuguese in the period of 2010 to 2013. It has been reported that the technical efficiency complied from a failure. Therefore, the authors tried to offer some improvement steps of marketing and selling trends (Xavier et al 2015). Ahmadi and Ahmadi (2012) revealed that DEA models can provide efficiency scores scaled to a maximum value of 1 to

evaluate efficiency and inefficiency of industries (case study conducted among 23 main industries). So, obtained results revealed amounts of around 0.591, 0.418 and 0.484 for Iranian recycling industries at efficiency scale, while values were about 1, 1, and 1 at pure technical efficiency during 2005, 2006 and 2007 respectively. Also, results asserted that there are 3 major manufacturing industries and two provinces which are identified as the best performers, namely tobacco, transport equipment and coal coke. Among 30 provinces, Bushehr and North Khorasan provinces have the utmost performance. Keramidou et al (2011) evaluated the purely technical and scale efficiency of the Greek meat products industry from 1994 to 2007 via DEA.

## **METHODOLOGY:**

This study has relied on secondary data obtained from valuable resources (website) and then secondary data came through the following procedures. Seven Indian large chemical companies were chosen as case studies in a period from 2010 to 2018. Companies have been chosen from around the top 10 chemical companies in India. appropriate performance analysis An demands a reliable procedure to measure the availability in the best possible situation. It requires a procedure to conduct the empirical methods and practices such as DEA, ratios analysis (turn over ratios, liquidity, profitability and solvency). In order to analyze the collected data, the IBM SPSS statistics 20 and EXCEL package were used. Companies were ranked by the TOPSIS, COPRAS and DEA models.

## **RESULTS AND DISCUSSION:**

Financial data analysis: Financial Statements (FS) are summaries of the operating, financing, and investment activities of a business. FS should present useful data to both investors and creditors in making credit, investment, and other business decisions. This usefulness means that investors and creditors can use these statements to predict, compare, and evaluate the amount, timing, and uncertainty of potential cash flows. In other words, FS provides the information needed to assess a company's future earnings and therefore the cash flows expected to result from those earnings. By this study, the financial data of 7 Indian industries were collected according to –

	TataChemicals(A)									
ſ	(1)	3,447.99	3,591.36	8,170.30	9,984.39	8,590.23	8,440.93	7,912.63	6,225.27	5,411.70
	(2)	3,466.01	3,606.80	8,220.86	10,082.00	6 8,689.64	8,529.87	7,996.25	6,332.86	5,411.70
ľ	(3)	194.49	176.92	164.37	194.75	202.92	365.6	308.57	108.03	88.35
ľ	(4)	531.39	479.95	2,041.14	3,778.55	3,194.24	2,988.79	2,864.91	2,198.87	2,724.92
	(5)	-19.7	39.95	591.34	-850.84	130.19	273.78	-409.36	-10.07	171.17
	(6)	258.03	266.66	286.27	330.17	267.05	273.56	239.75	207.38	204.66
ľ	(7)	86.51	100.98	215.16	186.78	185.32	203.25	210.19	201.49	189.71
	(8)	126.55	129.6	153.5	192.71	158.82	214.29	224.68	204.46	187.19
ľ	(9)	1,537.82	1,513.61	2,031.18	3,072.81	2,556.19	2,542.98	2,109.54	1,744.50	717.95
ľ					Gujarat	tFluorochen	nicals(B)			
	(1)	2,044.48	1,417.22	1,319.08	1,309.21	1,134.87	1,504.16	2,065.56	978.97	985.57
	(2)	2,050.46	1,421.52	1,338.31	1,320.97	1,140.94	1,596.08	2,069.00	982.85	985.57
	(3)	103.02	71.12	52.36	56.19	65.0	6 56.9	57.64	99.53	49.23
	(4)	539.38	374.41	335.54	410.09	320.84	303.47	252.35	212.16	377.57
	(5)	38.42	1.19	50.63	-47.05	41.05	-75.08	-94.3	39.66	-9.2
	(6)	138.35	120.06	103.04	96.16	80.69	74.53	66.53	55.63	56.97
	(7)	47.62	35.18	47.73	51.98	55.28	68.95	57.13	29.87	48.03
	(8)	152.14	148.84	144.15	123.85	101.7	96.38	77.82	44.86	57.03
	<u>(9)</u>	755.3	615.38	559.59	581.94	507.66	588.8	760.65	350.71	83.35
SolarIndustriesIndia©										
	(1)	1,230.54	1,094.29	1,084.25	1,009.18	896.76	884.56	722.62	531.21	480.21
	(2)	1,273.27	1,137.31	1,089.50	1,014.75	904.03	886.99	723.75	534.01	480.21
	(3)	18.23	13.38	10.19	19.83	17.1	17.64	24.97	24.81	20.09
	(4)	750.02	678.57	640.97	599.86	489.22	509.02	393	261.62	218.92
	(5)	-19.46	-1.79	-2.98	2.37	-3.81	-1.61	-1.87	-0.43	0.19
	(6)	69	54.35	43.41	40.42	38.69	32.24	24.15	18.88	16.83
	(7)	14.23	13.79	7.92	7.24	14.48	21.91	20.09	11.45	8.27
	(8)	26.09	19.28	17.72	17.66	12.57	10.31	8.05	6.64	6.32
	(9)	154.81	113.27	164.54	161.13	206.44	162.45	109.63	102.62	95.62
GujaratAlkalies&Chemicals (D)										
	(1)	2,420.13	2,023.04	1,955.67	1,931.81	1,882.85	1,794.31	1,698.22	1,423.17	1,280.47
	(2)	2,454.50	2,070.21	1,995.45	1,948.12	1,896.06	1,814.60	1,710.97	1,434.68	1,280.47
	(3)	105.74	55.92	46.23	48.95	30.27	18.7	11.77	12.01	49.26
	(4)	1,177.41	1,132.21	1,219.66	675.57	717.22	714.75	720.8	615.79	807.34
	(5)	1.47	5.68	-1.95	25.04	-4.47	3.71	-30.57	-4.66	6.2

Table 1

(6)	201.39	169.76	162.1	167	151.44	118.9	118.13	114.93	119.91	
(7)	14.9	12.83	9.93	9.34	6.36	8.34	20.53	21.17	17.48	
(8)	127.32	110.92	107.44	98.06	150.65	151.52	138.95	133.12	121.55	
(9)	285.78	308.67	268.82	800.46	658.4	481.93	506.43	423.31	64.89	
		•		PhillipsC	CarbonBlack	:(E)	•			
(1)	2,542.63	1,924.04	1,892.03	2,467.24	2,276.10	2,280.72	2,180.65	1,690.14	1,232.57	
(2)	2,546.98	1,926.95	1,894.10	2,470.19	2,277.46	2,284.91	2,186.78	1,695.72	1,232.57	
(3)	19.73	18.94	16.76	14.42	20.51	9.27	10.44	20.91	25.62	
(4)	1,650.89	1,221.26	1,291.46	1,864.41	1,856.05	1,889.63	1,701.80	1,228.17	937.15	
(5)	8.42	15.28	35.61	43.09	-25.54	-26.03	-43.57	11.24	-15.06	
(6)	97.18	81.8	72.61	70.16	62.91	58.43	52.35	47.7	36.66	
(7)	41.44	51.45	72.1	94.8	80.23	72.13	67.63	43.75	31.21	
(8)	60.52	60.62	62.15	57.53	53.74	50.79	48.59	38.58	31.15	
(9)	404.44	349.96	311.06	307.34	358.48	289.27	267.01	182.83	100.8	
	GujaratHeavyChemicals(F)									
(1)	2,905.65	2,780.70	2,532.19	2,361.58	2,210.82	2,106.28	1,868.88	1,469.11	1,215.87	
(2)	2,905.65	2,780.70	2,532.19	2,373.61	2,224.21	2,124.95	1,896.73	1,498.17	1,215.87	
(3)	35.75	10.78	7.47	11.26	5	2.98	9.63	13.3	14.28	
(4)	1,100.08	1,069.91	900.42	903.92	888.6	790.91	770.75	593.61	655.15	
(5)	23.62	-43.53	-5.33	-12.77	-10.13	5.58	-24.35	-25.15	11.41	
(6)	176.37	158.13	133.24	125.87	121.99	111.03	99.93	95.67	82.98	
(7)	124.16	133.77	162.82	163.84	170.53	157.96	184.96	110.43	103.39	
(8)	109.53	85.69	81.74	84.45	81.57	81.97	80.85	84.4	76.11	
(9)	866.62	790.79	806.23	772.06	762.08	739.55	583.56	479.04	131.13	
				τ	UPL(G)					
(1)	7,091.00	6,794.00	5,821.76	5,226.20	4,814.85	3,826.27	3,216.99	2,822.46	2,699.10	
(2)	7,263.00	6,939.00	5,982.53	5,334.99	4,968.27	3,939.44	3,308.00	2,911.09	2,699.10	
(3)	435	325	458.78	240.47	317.84	134.32	151.49	153.59	103.88	
(4)	3,517.00	3,029.00	2,833.75	2,438.76	2,014.58	1,838.39	1,557.89	1,270.96	1,415.03	
(5)	2	-108	-66.28	-207.37	-153.99	-38.2	-116.85	-51.05	108.57	
(6)	486	445	390.41	317.8	257.87	237.46	184.65	153.12	127.36	
(7)	135	149	192.61	35.27	243.29	105.99	164.37	293.64	108.34	
(8)	666	655	243.94	186.75	169.09	157.76	143.49	114.68	107.91	
(9)	1,905.00	1,929.00	1,720.56	1,630.12	1,380.77	1,127.93	876.67	788.52	508.63	

RevenueFromOperations[Net](1),TotalOperatingRevenues(2),OtherIncome(3),CostOfMate rialsConsumed(4),ChangesInInventoriesOfFG,WIPAndStock-

InTrade(5),EmployeeBenefitExpenses(6),FinanceCosts(7),Depreciation And Amortization Expenses (8),Other Expenses (9)

Based on existing data in Table 1, one Based on existing data in Table 1, sample ttest had shown a significant difference around 0.001 among criteria such as Revenue From Operations [Net], Total Operating Revenues, Other Income, Cost Of Materials Consumed, Changes In Inventories Of FG, WIP And Stock-In Trade, Employee Benefits Expenses, Finance Costs, Depreciation and Amortization Expenses and Other Expenses. It was found the amount of around 0.806 for the Cronbach, s alpha reliability test. The distributions of revenue from operations (net), total operation revenues, distribution of other income, distribution of changes in inventories of FG, WIP, and stock-in-trade, depreciation amortization expenses and other expenses were obtained normally with mean and standard deviation of 2843.29 and 2273.20, 2877.84 and 2308.48, 2877.84 and2306.48, 88.06 and 110.02, 64.72 and 140.32, 118.69 and 115.19, 762.99 and 702.47based on one sample Kolmogorov-Simonov test.

Therefore, the null hypothesis was retained for them respectively. The distributions of the cost of materials consumed, employee benefit expenses and finance cost with the mean and standard deviation of 1229.84 and 912.45, 144.00 and 104.08, 88.18 and 74.21 were also achieved normally based on the same test but null hypothesis was rejected for them respectively. Chi- square test had revealed a value of 0.000 for all criteria such as revenue from operation (net), total operating revenues, other income, cost of materials consumed. changes in inventories of FG, WIP and stock-in-trade, employee benefit expenses, depreciation finance costs. and amortization expenses and other expenses. The Friedman test was revealed the mean weights around 8.08, 8.92, 2.68, 6.83, 1.71, 4.37, 2.89, 3.38 and 6.14 for the revenue from operation (net), total operating revenues, other income, cost of materials consumed. changes in inventories of FG, WIP and stock- intrade, employee benefit expenses, finance depreciation and amortization costs, expenses and other expenses respectively (with a chi-square value around 446.966).Performance analysis based on financial data using DEA method. In many studies the financial performance evaluation ratios have been defined as asset turnover ratio (input/output), inventory turnover ratio (input/output), receivable accounts turnover ratio (input),

quick ratio (input), current ratio (input), cash earned from set activities to company earning ratio (input), interest coverage ratio (input), total debt to equity ratio (input), debt ratio (input/output), earning per share ratio (output), return on assets ratio (output), net profit margin ratio (output), economic value added (output), growth rate of sales (output), growth rate of earnings per share (output), sustainable growth rate (output), price to earnings ratio (input/output), Tobin Q ratio (output). A study determined the universe of input/output parameters of introduced into DEA equations including return on equity, return on assets, net profit margin, earnings/share, receivables turnover, inventory turnover, current ratio, quick ratio, debt to equity ratio, leverage ratio, solvency ratios, price to earnings ratio, price to book ratio, revenue growth rate, net income growth rate and EPS growth rate (Edirisinghe and Zhang 2010). DEA is a non-statistical method methodology is used to measure performance in a relative manner and each producer unit or decision maker is compared to the best unit in that industry. Of course, the higher the number of units, the better the comparison and the more realistic results. Simple ratios do not lead to ranking and comparison of companies' performance, and multiple inputs and outputs in this field should be used. Also, through the method of DEA, there is no need for a definite form of production function as it is in the economy, and this technique can be used with minimal data. According to our knowledge, financial ratios and indicators make an ad hoc and a relative appraise of corporate performance, however, we know DEA can be employed to develop very complex investigations (Fenyves et al 2015). Table 2 shows the DEA score for the seven Indian chemical companies [This study].

Input	Weights	Output	Weights	Productivity	Co.	DEA
CostOfMaterialsConsumed	6.83	Revenue From Operations[Net]	8.08	3.84167709	A	1
Changes In Inventories Of FG,WIPAndStock-InTrade	1.71	Totaloperating revenue	8.92	3.697579817	В	0.963
EmployeeBenefitExpenses	4.37	OtherIncome	2.68	3.314725349	С	0.863
				3.136225512	D	0.817
FinanceCosts	2.89					
Depreciationand AmortizationExpenses	3.38			2.737699477	Е	0.713
				3.308276204	F	0.862
OtherExpenses	6.14					

#### PERFORMANCE ANALYSIS BASED ON FINANCIAL DATA USING COPRAS METHOD

The criteria used for weighing by Entropy Shannon were encompassed; Revenue From Operations [Net] (1), Total Operating Revenues (2), Other Income (3), Cost Of Materials Consumed (4), Changes In Inventories Of FG,WIP And Stock-In Trade (5), Employee Benefit Expenses (6), Finance Costs (7), Depreciation and Amortization Expenses (8), Other Expenses (9). There are negative and positive relations among 9 aforementioned criteria. Therefore, the weighting and ranking systems were selected Entropy Shannon and COPRAS. Table 3 includes weighted values based on Entropy Shannon procedure.

Criteria	Е	dj=1-Ej	Wj	$\sum dj$	K
1	1.995278628	-0.99527863	0.133719351	-7.44304112	0.5139
2	1.994522361	-0.99452236	0.133617744		
3	1.817204902	-0.8172049	0.10979449		
4	2.001968116	-1.00196812	0.134618108		
5	0.776434672	0.223565328	-0.03003683		
6	2.008943625	-1.00894363	0.135555294		
7	1.946715084	-0.94671508	0.12719466		
8	1.959818549	-0.95981855	0.128955159		
9	1.942155183	-0.94215518	0.12658202		

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Со.	Total revenue	Total expenses	Rankbasedon revenuescore	Rankbasedon expensesscore
А	35.44	131.94	3	2
В	13.75	44.2	6	4
С	57.04	291.766	2	1
D	14.3	29.67	5	7
E	15.12	38.7	4	5
F	11.44	31.23	7	6
G	84.089	53.883	1	3

Table4.TherankingsystemdevelopedinCOPRASmethod

It was found a significant difference about 0.012 between total revenue and total expenses values (between seven industries) in Table 7 according to the t-test analysis.

## THE RELATIONSHIP BETWEEN THE WEIGHTS VALUES OBTAINED FROM THE FRIEDMAN TEST AND ENTROPY SHANNON

It was conducted a scatter plot for the data of weights values obtained from the Friedman test and Entropy Shannon base on the results of profit & loss accounts according to Figure 1.



# Figure 1. Scatter plot developed for the weight's values obtained from the Friedman test and Entropy Shannon

According to the t-teat analysis, there is no significant difference between the weights values obtained from the Friedman test and Entropy Shannon. Moreover, the scatter plot is representing that there is a relatively linear relationship between both weight values obtained from Friedman test and Entropy Shannon with receding the weight values associated to a criterion of changes in inventories of FG, WIP and stock- in-trade.

#### CONCLUSION

By the present study, we tried to figure out the efficiency of seven Indian industries. The obtained results for the efficiency of industries were approached to full efficiency of industries in most cases. The statistical analysis revealed significant differences among the data of industries. The Friedman test has provided valuable weights for raw values. The Entropy Shannon weighting system has provided the positive and negative weights for existing values and also sought the highest consistency with the COPRAS ranking system. By the way, the COPRAS ranking system had classified industries based on negative and positive criteria (expenses and revenues). The TOPSIS procedure ranked the industries based on the available ratio analysis and it has emerged a good agreement among the industries ratio values. The profit and loss analysis made clear the output incomes and input expenses. Also, it resulted in output and input criteria for introducing into the DEA findings based on the The model. COPRAS model predict the situation of industries for the further financial statement concept. With regard to a rise in the expenses, the ranking system for the income will be taken lots of fluctuations.

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