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Water And Firm Performance Linkage - An Investigation Of Three Large Food Firms

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ABSTRACT
There is no hesitation in stating that water is directly linked to sustainability of firms. Food firms in particular interact with water environment in multiple ways -as input and output, through nutrient and thermal exchange, extreme water situations, peripheral processes, ecosystem and community equilibrium etc. Firms need to pay attention to optimal use, discharge, efficiency and technology for creating that acceptability and balance. Strategically for firms' financial logic plays a crucial role in taking water actions and becoming water conscious. The objective of this study was to examine whether the financial data of large companies can be analyzed through the water costs lens. It uses water charges information and financial data of 3 large Food and Beverages firms from India for a period of 8 years using CMIE database. Further, quantitative approach is applied to figure out statistical importance of Water variable using stepwise regression and relationship using POLS. The research shows a significant link between financial performance and water in food and beverages firms. Essentially, the econometric analysis confirmed the positive impact of water on firm performance. This research adds clarity to the existing academic discussion on the relationship between financial performance of firms and water.

Keywords: *water efficiency, water intensity, corporate water cost, firm performance, food and beverages*

INTRODUCTION

Growing water scarcity is alerting firms, government as well as Investors. Water concerns are resulting in shutdown for significant workdays of firms to even moving and shifting locations of production facilities. They even affect day-to-day functioning, like supply issues, regularity and quality of water.

Although water has been a permanent conquest, it is an emerging research issue in the context of firms and their performance.

Interaction with water environment is increasingly shaping firm performance, particularly in terms of water use efficiency, pollution control and ecological footprint. This is especially true in the food industry where both input quality and output waste directly impact environmental and economic outcomes. Firms are being in the eye for their wastewater outputs, judicial discharge and pollution loads on water. The formal and informal monitoring is taking place through Government, investors and communities. Regulatory compliances and reporting of water information have become important tools. Water quality impacts performance in several ways. For instance, production efficiency increases with water quality else there is costs involved in treatment of poor water. Firm's brand and reputation depends a lot on firm's posture towards natural resources. There is always a regulatory risk associated if issues arise around water quality. They come in the form of fines, shutdowns and water use restrictions. In the regions of extreme cases of water availability (droughts, and floods etc.) supply chain network, partnerships and transaction with the community become crucial.

Processes of food firms have continuous interaction with the aquatic ecosystem. It may cause degradation by nutrient runoff, thermal pollution or wastewater discharges resulting in long-term ecological issues. It further adds to reputational and operational perils or hit the bottom-line for firms. Firms as well as investors are interested in understanding water scarcity and its impacts on financial performance.

Financial statements carry most of the pertinent information for the firm. They constitute the principal source of essential information regarding a firm's financial condition, performance, activities and future projections. They are also being augmented towards present and future needs such as social and environmental issues. In

response to changing stakeholder expectations and the growing complexity of global challenges, financial reporting is progressively being broadened to encompass social, environmental, and governance (ESG) components. This transition indicates an increasing acknowledgment that a company's enduring sustainability and value generation rely on elements beyond mere financial performance. By incorporating these non-financial considerations into the accounting framework—via integrated reporting, sustainability disclosures, or expanded narrative sections—companies are allowing stakeholders to perceive these matters not in isolation, but within the wider context of financial well-being and strategic orientation. The main goal has been to have various issues within the accounting framework and be reflected through those statements. This facilitates the analysis of the relationship between a company's financial performance and its social and environmental effects, resulting in more informed decision-making by investors, regulators, and the public. It also becomes easier to comprehend and manage.

McKinsey study 2010 highlighted the need to improve water efficiency by firms. Their estimate suggests a gap of 40% between global water demand and supply by 2030 even with water management and water efficiency measures by corporates.

A seminal work of [2] on firm behavior suggested that firms should channelize attention on rules, resources and relationships, since it has huge implication on firm's performance vis-à-vis society. Quantifying water information is being actively pursued by researchers. It can be seen earlier in the works of Weber, who has captured water information from CDP survey and created a Water score to be able to analyze for Corporate environmental performance and Corporate financial performance. [3] studied Australian firms from water accounting point of view and advocated for measuring water use and its performance. [4] in a recent study explored 10 largest mining firms of the world and found that firm's disclosure practices and compliances were as per the norms. However, the study suggested priority management towards mine-site level management, and relationships with the stakeholders, government and society in particular. In **Table 1** we have looked at the prior studies pertaining to food and beverages sector.

Some of the earlier studies have highlighted the need to study the relationship between the financial performance and water in firms, such as Stockholm Research Institute's study which also points to that path. Whereas, most of the studies are done at macro level of different countries or Industry level like, metal and mining, manufacturing, construction, textile, pulp and paper, fertilizer and chemicals, etc. Some scholars within and outside India have attempted to link water to financial performance of listed firms. Most of these researches have taken country specific or group of firms using Stock exchange specific sample.

Water reporting even by large firms in India have been rare. The study used GRI (2016) and CDP water. India based Sustainability report - BRSR has not been used in water context due to lack of water information. There is a lack of consensus or standardized methodologies for measuring the impact as well as on how to effectively integrate these with financial reporting frameworks. Consequently, comparisons across studies are often difficult, and the development of universally accepted metrics remains an ongoing challenge in the field. As the existing body of literature remains relatively underdeveloped it would be better to explore and experiment with new ways to study the relationship.

Prior research work in the area have utilized sustainability-oriented disclosure metrics of water in the firm. Sustainability disclosure is still a complex and evolving practice, particularly in the context of water. Partly due to the absence of standardized frameworks and the technical difficulties associated with the consistent and reliable measurement and reporting of water data for water utilization, risks, water-related events, including droughts, pollution incidents, or regulatory changes. Table 1 in the Appendix carries the summary of papers referred.

In addition, sustainability disclosure is still a sophisticated measure, which are slowly being adopted by listed firms. The spread of water disclosure across all firms still has a long way to go. Consequently, firm level water information has recent origin, inaccessible, been scarce and inconsistent. Stakeholders, including investors, regulators, and researchers, frequently encounter difficulties in conducting comparative assessments or formulating meaningful conclusions due to the limited, inconsistent, or dispersed availability of data.

There is no study available which involves water charges incurred by the firm to their financial performance. Cost being a quantitative financial measure, through cost, performance can be most coherently analyzed and impact be measured. By including water charges, researchers may better evaluate the financial impact of resource usage and analyze sustainability measures. Quantifying the economic costs of water use may encourage corporations to adopt more efficient and eco-friendly techniques, linking corporate responsibility to financial results. Lack of

studies in this area shows a research gap where empirical analysis could improve academic literature and corporate decision-making.

However, some of the studies in the case of natural resources, like energy use have raised concerns about endogeneity while examining relationship between natural resource usage and corporate financial performance. It can happen due to omitted variable bias, measurement errors, or reverse causality which may cause the error term to be correlated with an explanatory variable. This can complicate interpretation and weaken the reliability of empirical findings. Therefore, in exploring similar relationships—such as the impact of water-related costs on financial performance—carefully considering the variables used and address potential endogeneity is important. Based on the prior literature, the aim of this research was to determine whether it is pertinent to evaluate the performance of a firm in relation to water. Therefore, following propositions are being put forward:

Hypothesis 1. The (water) variable is significant for examining the relationship with respect to firm performance.

Hypothesis 2. Water variable has significant impact on firm performance.

Hypothesis 3. Water variable and firm performance relationship suffers from endogeneity.

Therefore, the objectives of this research are (i) systematically attempt to examining the importance of water variable in firm performance analysis, (ii) to understanding the relationship (iii) to measuring the extent of the relationship and to also ascertain the endogeneity effect of water and corporate firm performance. The results can be useful to researchers and stakeholders by aiding in the understanding and assessment of a company's performance vis-a-vis water. It can help in choosing and allocating resources and activities logically. Henceforth, the paper is organized as follows: data and the Materials and Methods, as Section 2, Results and Discussion as Section 3, and conclusions as Section 4, of this research.

MATERIALS AND METHODS

Current study uses the secondary data from Food and Beverages Industry data available from ProwessIQ database of Center of Monitoring Indian Industries (CMIE). Water data could be obtained for 8 years i.e. 2015-2022 of three representative firms from F&B sector. The short description of those 3 firms is given in **Table 2.**

Methodology

In the stepwise Ordinary Least Squares Regression (OLS), all variables are assessed as they are either included or excluded from the model one at a time and eventually least significant variable gets eliminated. The model is re-adjusted and the process reiterates itself for further elimination till all non-significant variables have been eliminated. The stepwise OLS works in either backward stepwise regression where full model is used and least significant ones are eliminated; while in forward stepwise regression, model begins with no variable and most substantial ones are added [16]. We used forward Stepwise OLS in this study. OLS is applied for precisely defining the relationship between water variables and performance variables through the linear equation. For the analysis of three companies, individually and in group (consolidated values), simple OLS gave 2-d view for the data. Then, the Panel regression analysis or pooled OLS (POLS) is applied. For endogeneity issue, employing robust econometric techniques, such as fixed-effects models, or two-stage least squares (2SLS/TSLS), instrumental variable (IV) regression can help to mitigate and provide more valid inferences. Therefore, through fixed effect regression and using IVs and error term endogeneity issue was examined, replicating TSLS. This is shared in **Fig 2** Modelling study framework; Source: Author's compilation.

VARIABLES USED IN THIS STUDY

Variables:

A. Determinants of the Water variable (WC)

Water intensity defined by Business Responsibility and sustainability reporting framework (BRSR) as the "total water consumed divided by the total turnover in rupees (INR)". Following the working definition for water efficiency of S. Sudha 2020, which is taken from WBCSD and UNIDO Industrial Development Report, 2011 states that high water intensity refers to low efficiency and vice versa. Similarly, 'Water variable' is taken here as the 'ratio of Water charges over total Assets' (WC_TA) and ratio of 'Water charges over total Sales' (WC_TS).

Financial Performance

Financial performance is crucial for investors, managers, and stakeholders in assessing a firm's business decisions

and growth [17]. Different stakeholders have different interests in measuring a firm's revenue generation, such as creditors, bond holders, shareholders, and management [11].
For the examination, the variables chosen for firm performance were Return on Assets (ROA) that evaluates a firm's profit generation efficiency based on its average total assets balance [18], [19] and Return on Sales (ROS). Other financial variables such as NWCR- indicates firm's cash availability for temporary debt obligations and investments [21]. A lower ratio suggests potential financial difficulties.
NFAT which tells about the ability to convert fixed assets into sales [20]. Leverage tells about firm's utilization of borrowed money [22], assessing solvency and capital structure. It evaluates a company's debt level against other accounts. Handling high leverage is a risky art, but can be beneficial during profit periods but increase default risk. In this study, we have taken leverage ratio with total assets and leverage ratio (as LEVTA) with total sales (LEVTS)., are considered for the purpose of this study. **Table 3** contains information on the variables used in this study**.**

Data Sources
Center for Monitoring Indian Economy (CMIE) collects data from various sources including Govt. and company website to compile a detailed and authentic time series data for the Indian companies. Those firms are selected for which all the data of parameters and the determinants are available throughout the sample. The firm's data which had the mention of water charges are taken and aggregated on the annual basis for the industry for the period. Overall, 3 companies' data could be obtained for 8 years period covering 24 datapoints for each variable.

ANALYSIS RESULTS AND DISCUSSION

The descriptive statistics reveal that the variables in the dataset show varying trends over time. However, for all variables, the mean values exceed their standard deviations, indicating relative stability in the data. Additionally, the Jarque-Bera test results demonstrate that all variables have p-values well above 0.05, suggesting that their distributions exhibit little to no skewness or excess kurtosis, and thus conform closely to normality. Description of statistics are shared in **Table 4.**
Correlation analysis shows that the water charges to total assets ratio (WC_TA) is positively associated with both LEVTA and ROA, though these relationships are moderate, with correlation coefficients below the 0.7 threshold. WC_TA also shows a mild negative correlation with NFAT. Meanwhile, ROA is positively correlated with NWCR and negatively correlated with NFAT, indicating mixed associations across financial performance and efficiency indicators. Correlation Analysis is shown in **Table 5**.
Eigen analysis of the correlation matrix (n=8) done using STATA is captured in **Table 6.**
Principal Components Analysis, conducted using STATA, confirmed the absence of multicollinearity through the Belsley-Kuh-Welsch collinearity diagnostics, where no condition index exceeded 10.
The Compound Annual Growth Rate (CAGR) analysis over an 8-year period for key financial and operational variables revealed that MTR Foods and Parle Agro Ltd experienced consistent growth across most metrics, including sales, profit, and water charges—likely influenced by increasing industrial water tariffs across India. In contrast, Vadilal showed declining growth in sales, profit, and net fixed assets, but a reduction in water charges and a slight increase in total assets, suggesting strategic investments in operational and water use efficiency. 8 Years CAGR of main variables for individual companies is shown in **Table 7.**
OLS regression models were developed using forward stepwise selection in both EViews and STATA, with pooled and individual-level analyses. Model diagnostics supported the robustness of the results: the test for group intercepts found no significant heterogeneity among groups, justifying the use of pooled OLS. Other diagnostic tests—including checks for heteroskedasticity (Wald test), autocorrelation (Wooldridge test), and residual normality—produced non-significant results, indicating the absence of specification issues such as heteroskedasticity, serial correlation, or non-normal error terms. The Pesaran CD test further confirmed no cross-sectional dependence.
Stepwise Ordinary Least Square (Forward) regression-variable selection Consolidated, Individual & panel using E-views is shared in **Table 8.**
Stepwise Ordinary Least Square (Forward) regression-variable selection using STATA is shown in **Table 9. Robustness Check**:
Tests for LSDV (Year) yielded insignificant result is shared in **Table 10**. While Test (Cross-section) i.e. Pooled OLS:

Standard errors clustered by unit is found to be significant.
Belsley-Kuh-Welsch collinearity diagnostics results are shown through Variance proportions using STATA in **Table 11.** There is no evidence found of excessive collinearity.

Model appropriateness:
Table 12 Tests to choose between panel data models, i.e. POLS, Fixed effects, random effects and TSLS also done using Hausman Test, Breush-Pagan Test and TSLS using STATA. POLS confirmed as most suitable.
To test for endogeneity, a Two-Stage Least Squares (TSLS) model was applied using lagged variables as instruments. Using STATA, Wu-Hausman test was performed The analysis results are tabulated in **Table 13**. The test results did not show evidence of endogeneity in the WC_TA variable, supporting its validity as an exogenous predictor.
Finally, a quadratic regression analysis using SPSS suggested the presence of a non-monotonic (curved) relationship between the key variables, implying that their association may change direction at different levels, and highlighting the complexity of the dynamics being modeled. Quadratic equation coefficient is shared in **Table 14 and Fig 2** which displays non-monotonic relationship.
As per the analysis, it was revealed that Water variable (WC_TA) has been a significant variable, both consolidated and separately for each of the three firms. The disclosure reports also confirmed the fact that regulatory requirement does help in building water consciousness in firms. The 3 chosen firms reported water usage consistently in past 10 years among food firms. Two were listed and also did sustainability reporting, Vadilal also employed third-party assurance. Further, Vadilal, despite having higher water intensive activities in cleaning, cooling and pasteurization, had not only reported marked decline in water usage indicating efficiency, it also had negative CAGR on sales, PAT, NFA as well as Water cost. It can therefore be inferenced that, restructuring, investment in technology and conscious shift towards reporting may have caused marginal decline in financials during the study period. However, as per current market, Vadilal and Parle display strong national presence and growth while MTR is regionally strong [12].

CONCLUSION

The findings suggest that, water variable (WC_TA) does explain the financial performance of the firm. The relationship is positive and significant. As per regression result a 1% change in WC_TA positively impacts ROA by 22%. This in a way indicates that more water to be used in Food industry for more profits. This result however, is in conflicts with sustainability reporting based studies which are interpreted as efficiency in water use enhances the performance of the firm. In real terms, water use as an essential input and part of multiple process led to more activities and higher results. However, practically water efficiency all the more will support in the firm both in cost terms and in perception by stakeholders. Water cost at present rate is not a factor for firms to exercise restraints. Current study extends the literature both in the assessment of water in firms with a different approach, and in analyzing its impact on performance. Stakeholders can make use of the study in enhancing the understanding and assessment of a company's performance vis-a-vis water.
To address endogeneity, robust econometric techniques like instrumental variable regression can be employed. Acknowledging and tackling endogeneity not only strengthens the methodological rigor of the study but also enhances the credibility and relevance of its findings in informing corporate and policy decisions. Future studies may take longer period, employ more firms and may even attempt comparison with top firms.

AUTHOR CONTRIBUTIONS STATEMENT

All authors have made significant contributions to this work. Shweta Dasgupta and Amit Banerji did the conceptualization of this paper. Then, Shweta Dasgupta performed data collection, Data curation, investigation and Formal Analysis. Amit Banerji and Varsha Rokade provided methodological guidance, and support in interpretations. Shweta Dasgutpa took care of the visualization, writing original draft, review and editing work of this manuscript. The work was suitably supervised by Amit Banerji and Varsha Rokade. Finally, Amit Banerji, Varsha Rokade and Shweta Dasgupta were involved in the validation of the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICTS OF INTERESTS

"All three authors declare that they have no conflicts of interest related to this study."

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SUPPLEMENTARY MATERIALS

Data and other related information as Supplementary Materials to this study can be made available on specific requests and on declaration of intended purpose to prohibit any possible misuse.

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Appendix:

Table 1 Summary of referred paper

Study context & Author references	Findings and variables
Large scale survey in 2006 comprising 3892 facilities of north west American Food and beverages industry firms [5]	Sustainability activities have both direct and mediating impact on the performance.
Studied small firms or restaurants through primary survey consisting 374 interviews [6]	Deduced that there is a significant direct impact of Quality Management practices on market success factors. Even small service companies can have the competitive advantages based on their natural resources and quality consciousness.
Top 100 Japanese firms of Nikkei Index for the 2013/14 [7]	Found water sensitivity, size and ownership to be better predictor of water disclosure also signify larger firm's sustainability stances and relationship with stakeholders
Top 50 Indian companies listed on BSE for the year 2014-15 [8]	Studied through disclosure report and found that there is significant difference between disclosing and non-disclosing firms for environmental factors. Energy is highly reported followed by Effluent and waste, emission and water and then material use.
Indonesian food and beverages industry [9]	F&B sector of Indonesia receives higher investment, even in the form of FDI. They found R&D expenses, eco-innovation, cooperation and development and high no of innovative employees to have positive influence on eco-efficiency. However, short-run performance had several other factors industry concentration had negative affect, primarily for lack of pressure among peers. There policy

	intervention can be applied to increase competitive spirit.
Canadian F&B sector and analysed for the year 2011-12 [10]	Created water score using Reports of voluntary disclosure, annual reports and CDP survey questionnaire and studied Water performance as a subgroup of CSP proved to be improving financial performance of water intensive firms.
Studied on profitability determinants of 12 listed Indonesian F and B firms from 2013- 2016 period [11]	Found that profitability was positively influenced by size, age, lagged profitability, growth, and productivity of the companies, but not by industry affiliation.
Spanish agrifood industry [12]	Sales, profitability, and cost reduction. R&D intensity, size (no of employee) Personnel innovation, technological innovation and cooperative development, and cooperative use were other variables used. Found that firm performance was influenced by firm's eco-innovation strategy which in turn get influenced by Market demand pull, Regulation, Collaboration & partnership Firms resources & capabilities.
71 IT sector-micro-electronics firms from S&P 500 Index for the period 2009-2020 [13]	Studied Water, Energy consumption and Wastewater, Liquidity, profitability; indebtedness, taxation Rate, financing activity Investing activity Also for Board Governance. were used as explanatory variables ROA displayed positive and significant relationship with water. However, for wastewater entire variables displayed negative influence.
S&P 500 listed 224 firms for the 2002-2011 period [1]	Taken ROA, ROE and ROS as dependent variable(s) while EPS, Leverage, Energy and Water intensity, Material intensity, size and RDI, along with year dummy, industry dummy and pollution dummy as IV. Found that Water and energy efficiency is positively related to ROA and ROS, while ROE is found to be related to material intensity and cause at least one panel VAR.
26 listed firms of food, beverage, and tobacco at Colombo stock exchange for the period, 2012-19 [14]	Study deduced that liquidity did not have substantial impact but firm size had significant positive impact on firm's performance.
172 Kenyan food and beverages firms through primary survey 2021-22 [15]	Studied green procurement and the performance and found that performance of food and beverage manufacturing and green procurement are positively correlated with a correlation of 0.7.

Table 2 Short description of the three Firms

Firms	**Vadilal Industries**: Founded in 1907; Website: https://vadilalgroup.com	**MTR Foods Pvt Ltd.**: Mavalli Tiffin Room (MTR) is the Food products firm started as a restaurant in Bangalore in 1924 by Yagnanarayana Maiya; Website: https://www.mtrfoods.com	**Parle Agro Pvt. Ltd**.: Founded in 1985, Website: https://www.parleagro.com
Stock Exchange Listing status	Listed in both BSE and NSE in India	Not listed	NSE Listed Agro firm
Main Business	Oxygen and specialty gases businesses, cold storage, forex management, money changing and chemicals real estate, cold chain network, frozen foods, candies, and various dairy products	Spices, ready to cook mix, restaurants	Branded drinks such as SMOODH, Frooti, Appy, Appy Fizz, BFizz, Bombay 99 and Bailley,
Current presence	Their revenue was INR 1,057 Cr in the year 2023. They extended itself outside India in the Middle East Asia, the Asia pacific, North America, Europe, and Africa AND Online sales	MTR Foods became a wholly owned subsidiary of Orkla a Norwegian food firm in 2007. Separately, MTR's restaurant business spreading its stronghold across southern India. MTR Foods further acquired Eastern foods for spices. Its revenue was INR 400 Cr in 2022.	Revenue of INR 8,000 Crs (US$1.14 billion) and over 5500+ employees. Also went international in over 50 countries.
Unique Position	Listed Dairy firm with wide presence in India. A well-recognised brand.	Spices, Ready to cook, restaurants; It Complies with highest quality standards, for sourcing ingredients to processing and MTR Foods packing. ISO 22000 and HACCP certified.	A Popular and established brand. The firm is passionate about innovation and building brands.
Water related disclosure	Mention of Wastewater treatment, STPs, ZLD in several plants	Mention of CSR Projects on water conservation	Pledges on Rainwater Harvesting and reduced plant level consumption
Water Withdrawal	Data for 2021-22 onwards Withdrawal declining in 22-23 and 23-24	Data or numerical information not available	Data or numerical information not available

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Table 3 Variables along with their explanation

Terms	**Explanation**	**Abbreviation**
Return over Assets	Ratio of Profit over Tax over Total assets	ROA
Return over Sales	Ratio of Profit over Tax over Total Sales	ROS
Net Fixed Assets Turnover	Net Fixed Assets over Profit over Tax (PAT)	NFAT
Leverage	Debt by Total assets	Lev_TA
Leverage	Debt by sales	Lev_TS
Net Working Capital Ratio	Net Working Capital over Total assets	NWCR
Water charges (in monetary terms, reported annually)	Expenses on Water resource in INR	WC

Table 4 Descriptive Statistics of Variables

Statistical measure	Variables				
	ROA	NWCR	NFAT	LEVTA	WC_TA
Mean	0.26	0.11	16.36	0.07	0.01
Median	0.27	0.11	16.96	0.07	0.01
Std. Dev.	0.13	0.05	3.09	0.01	0.003
Jarque-Bera	0.53	0.25	0.66	0.75	0.81
Probability	0.77	0.88	0.72	0.69	0.67

Source: Author's compilation using Eviews

Table 5 Correlation Analysis

Correlation Analysis: Ordinary					
Correlation of the main variables: ROA, WC_TA, NWCR_NFAT, LEVTA					
Correlation	**ROA**	**NWCR**	**NFAT**	**LEVTA**	**WC_TA**
ROA	1.00				
NWCR	0.79*	1.00			
NFAT	-0.55	-0.18	1.00		
LEVTA	0.59	0.74*	-0.18	1.00	
WC_TA	0.65	0.39	-0.21	0.72*	1.00

Table 6 Eigen analysis of the correlation matrix (n=8)

	Component	Eigenvalue	Proportion	Cumulative
1	16.3242	0.6046	0.6046	ROA
2	4.6906	0.1737	0.7783	ROS
3	2.7476	0.1018	0.8801	WC
4	1.4959	0.0554	0.9355	WC_TA
5	0.7671	0.0284	0.9639	NWCR
6	0.5764	0.0213	0.9853	NFAT
7	0.3982	0.0147	1.0000	LEVTA

Table 7 CAGR of 8 Years of main variables for individual companies

8 years CAGR of following Financials	Vadilal industries	MTR Foods P Ltd	Parle Agro Pvt. Ltd
Sales	-8%	8%	13%
Profit After Tax (PAT)	-11.025%	19%	9%
Total Assets (TA)	2%	32%	22%
Net Fixed Assets (NFA)	-17%	6%	19%
Water Charges or cost (WC)	-47%	24%	24%

Table 8 Stepwise OLS (Forward variable selection) Consolidated, Individual & panel using E-views

Variable	Consolidated Prob.*	Vadilal Prob.*	MTR Foods Prob.*	Parle Agro Prob.*	Panel Prob.*
C	0.294	0.847	0.93	0.96	0.01**
WC_TA	0.148	0.014**	0.03**	0.08*	0.02**
NFAT	0.115	0.002***	0.42	0.30	0.0002**
NWCR	0.041*	0.002***	0.06*	0.54	0.05*
Adjusted R-squared	0.79	0.87	0.98	0.99	0.58
F-statistic	9.742	18.38	148.34	182.31	11.76
Prob(F-statistic)	0.026*	0.004***	0.00***	0.00***	0.0001**
Akaike-info-criterion	-2.23	-3.534	-3.61	-3.96	−74.14
Schwarz criterion	NA	-3.446	-3.52	-3.87	−72.89
Hannan-Quinn-Criterion	-2.19	-3.723	-3.80	-4.15	NA
Durbin-Watson stat	1.974	2.476	1.87	1.64	2.38
Selection Summary Number of selected regressors:	**NA**	**1 Added WC_TA**	**1 Added WC_TA**	**1 Added WC_TA**	**NA**

Table 9 Stepwise Ordinary Least Square (Forward-variable selection) with ROA as DV using STATA

Independent Variable	WC_TA	WC_TA + NFAT	WC_TA + NFAT+ LevTA	Coef.
C	0.31	0.029	0.576	**0.027**
WC_TA	0.00***	0.008***	0.000***	**22.84**
NFAT		0.002***	0.006***	**0.024**
LevTA			0.003***	**-0.68**
R-squared	0.16	0.56	0.69	
F-statistic	24.3	11.43	22.06	
Prob(F-statistic)	0.0001*	0.0001*	0.0000*	
RMSE	0.069	0.051	0.044	

Tests for LSDV (Cross-section)

Table 10 Pooled OLS: Standard errors clustered by unit

Variable	Prob* (Du_1 and du_2)	Prob*(Du_2 and du_3)	Prob*(Du_1 and du_3)	Panel- POLS
C	0.0510*	0.0881*	0.0733*	0.01**
WC_TA	0.0186**	0.0186**	0.0186**	0.02**
NWCR	0.2853	0.2853	0.2853	0.0002***
NFAT	0.0075***	0.0075***	0.0075***	0.05*
du_1	0.0085***		0.0129**	
du_2	0.0129**	0.0040***		
du_3		0.0085***	0.0040***	
R-squared	0.658	0.658	0.658	0.69
Adjusted R-squared	0.56	0.56	0.56	0.58
Akaike info criterion	−71.535	−71.535	−71.535	−72.89
Schwarz criterion	−64.467	−64.467	−64.467	NA
Hannan Quinn C.	−69.660	−69.660	−69.660	−74.14
Durbin-Watson stat	2.54	2.54	2.54	2.38
rho	−0.52	−0.52	−0.52	

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Belsley-Kuh-Welsch collinearity diagnostics: **Table 11** Variance proportions using STATA

lambda	cond	const	WC_TA	NWCR	NFAT
3.242	1.000	0.006	0.015	0.031	0.007
0.585	2.355	0004	0.024	0.923	0.008
0.133	4.928	0.035	0.862	0.013	0.186
0.040	0.006	0.956	0.099	0.033	0.799

Count of condition indices >= 30: 0; Count of condition indices >= 10: 0

No evidence of excessive collinearity

Table 12 Tests to choose between panel data models Hausman Test, Breush-Pagan Test and TSLS

Variable	POLS- Prob*	Fixed Effect~ Prob*	Random Effect~ Prob*	TSLS
C	**0.58**	**0.33**	**0.56**	**0.07**
WC_TA	0.00***	0.003***	0.00***	0.002
LevTA	0.003***	0.379	0.004***	0.002
NFAT	0.006***	0.002***	0.007***	
R-Squared	0.69	0.65	0.69	0.66
Within		0.63	0.61	
Between		0.99	0.997	
F-statistic /Wald (Chi Sq.)	14.89	10.31	44.66	
Prob	0.00	0.0004	0.000	
RMSE	0.044			0.041

Tests for endogeneity

Table 13 Tests of endogeneity: Wu-Hausman test (Ho: variables are exogenous) using STATA

Test type	Value	Prob.*
Durbin (score) chi2(1)	0.000277	(p = 0.9867)
Wu-Hausman F(1,20)	0.00024	(p = 0.9878)

Consolidated Quadratic Curve fitting (using SPSS)

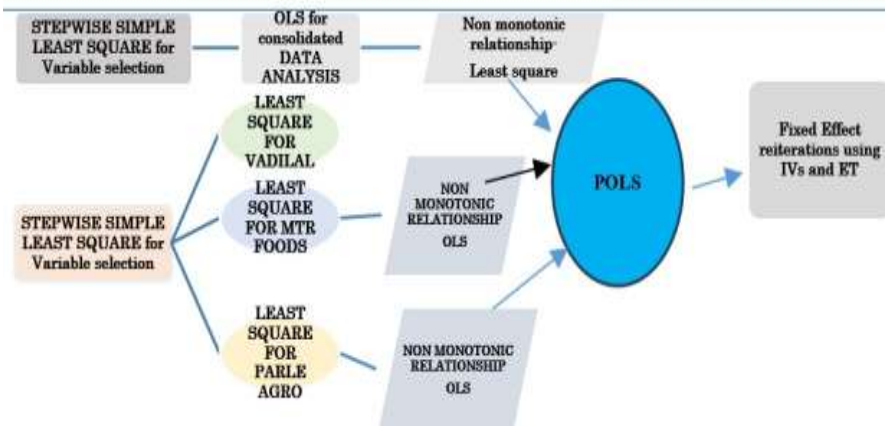

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Table 14 Consolidated Quadratic Curve fitting Coefficient and Inflection points (using SPSS)

Firm Name	Coefficient (-b)	Coefficient (2a)	Inflection point (x)
MTR FOODS	12.48	662.8	0.019
Parle Agro	19.11	2200.6	0.009
Stacked Panel	19.49	513.52	0.038
Consolidated	57.94	3000.88	0.019

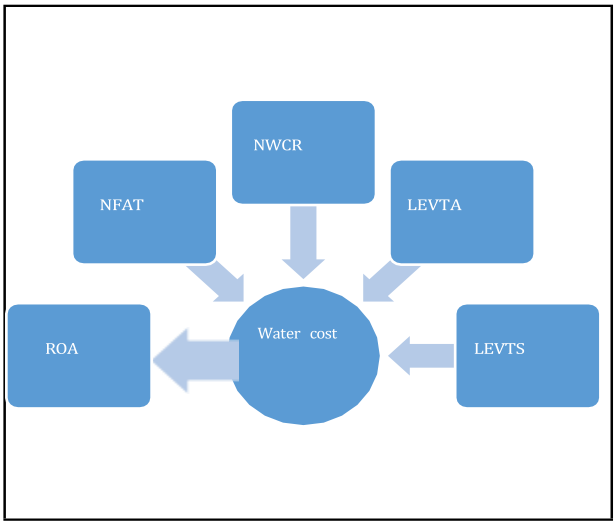

Fig 1 Variables relationship and Modelling study framework; Source: Author's compilation

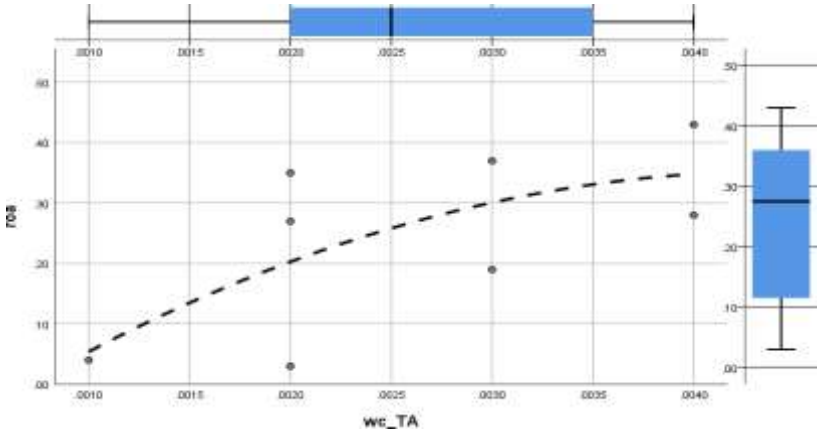

Fig 2 Consolidated Quadratic Curve fitting (using SPSS)