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Efficiency of Working Capital Management using Y-Score Model: An Evidence of BSE SENSEX

Waseem Bashir[1*], N. Periyasami[2]
[1]Department of Commerce, Annamalai University, Annamalai Nagar, Chidambaram Tamil Nadu; [2]Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu
[*]Email: waseemkhan974@gmail.com

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Abstract

Due to supply chain interruptions, the COVID-19 pandemic posed substantial issues in managing working capital. The current study looks at the effectiveness of working capital management among non-financial firms listed in the BSE SENSEX from the 2010-11 to 2019-20. The Y-Score model and its various constituents were used to analyse the efficiency of working capital management. In addition, various regression models have been developed for the desired level of efficiency. The overall Y-Score model depicts that the firms listed in the BSE SENSEX perform well in managing working capital during the study period. Furthermore, the Sun Pharmaceutical Inds Ltd was the only successful firm followed by Nestle India Ltd, Reliance Industries Ltd to achieve the target level of efficiency. The study suggests that companies listed in BSE SENSEX should improve their sales faster than tangible assets and also firms should improve their cash flows.

Keywords: Y-Score, BSE SENSEX, Working Capital Efficiency, Non-Financial Firms, Target Level of Efficiency.

Introduction

Financial management is crucial to the success of a company's operations. Financial management tasks assist in raising cash for businesses, implementing steps to improve operational efficiency and controlling the company's operations (Le et al., 2018). The study of long-term financial decisions, such as investment decisions (long-term asset mix), financing decisions (capital-mix), and dividend decisions (profit allocation), short-term financial decisions (working capital decisions) has traditionally been the emphasis of corporate finance literature (Agyemeng et al., 2019). Short-term assets and liabilities, on the other hand, are important components of total assets and must be carefully managed (Nazir and Afza, 2011). The WCM is seen as a critical factor in the firm's liquidity and short-term investment decisions. WCM is an essential component of corporate finance management since it has a direct impact on the firm's liquidity and profitability (Pakdel and Ashraf, 2019). Working capital is the metric that gauges a company's financial efficiency and represents the liquid assets that are available with a company (Kaur and Singh, 2013).

WCM is said to be the process of obtaining the appropriate amount of cash from the most cost-effective source (Alsulayhim, 2019). It reveals a company's short-term financial health and ability to cover day-to-day expenses (Drangay and Periyasami, 2018). WCM is necessary to keep the business running. The goal of WCM is to maximise earnings, which reduce the risk of not being able to pay off short-term debt that is due to mature (Goel and Sharma, 2015). Working capital management efficiency is determined by the balance of liquidity and profitability. Higher risks of liquid-

ity result in high profitability for a company (Paul and Mitra, 20018). Since effective WCM is critical for avoiding liquidity risks, it plays a critical role in a company's viability during a downturn (Vijayakumaran, 2019). For example, a KPMG report in China (2011) notes that effective WCM played a critical role in mitigating the effects of the 2011 financial crises. The problem is that while managing working capital, a firm must examine all of the items in both accounts and strive to strike the balance between risk and reward (Brigham and Houston, 2021).

Effective WCM is one of the prerequisites for an organization's success, as working capital is the lifeblood of an economic entity (Harsh, 2014). Efficient working capital management involves planning and controlling of current assets and current liabilities in such a manner that it eliminates the risk of inability to meet short term obligations that became due, on one hand, and avoid excessive investment in these assets on the other (Eljelly, 2004). The appropriate assessment of working capital actually needed is a tough task for management because the quantity of working capital needed varies over time depending on the nature of business, cycle of production, raw material availability, and other factors (Mandal and Goswami, 2010). This requires a considerable quantity of money to be invested in the form of different current assets on a long-term basis. For example, because of time lag between the sale of items and their actual cash realisation, sufficient working capital must constantly be available to maintain the targeted level of sales. The empirical finding shows that the industrial sickness is the major cause of inefficient management of working capital. So modern financial management aims at minimising the number of current assets without neglecting the threat of stock outs (Bhattacharya, 1977). Efficient working capital management is thus a vital measure of an organization's sound health, as it necessitates the elimination of superfluous capital blocking in order to reduce financing costs. Short-term assets and liabilities on the other hand are key components of total assets and must be carefully examined. WCM is thus vital for the firm's profitability, risk, and value, hence it needs to be thoroughly investigated (Smith, 1980). The strategies used to manage current assets and liabilities have a big role in determining the ideal amount of working capital (Dong and Su, 2010).

The present study tries to investigate the efficiency of working capital management of non-financial firms listed in BSE SENSEX as on 19 January 2021 for a period of 10 years spanning from 2010-11 to 2019-20. The efficiency of working capital was investigated by the Y-Score model developed by S.S. Srivastava and. R.A.Yadav based on 78 companies. This model is the composition of four ratios: V1 (Current ratio); V25 (Cash flow to total tangible assets); V31 (Net sales to total tangible assets); V35 (Defensive assets to total operating expenses). The current study is likely to help to a better understanding of the working capital management efficiency of rising economies such as India. The paper is organised as follows: The second portion discusses some pertinent literature in a concise manner. Section III discusses the methodology used, sample and data collection, followed by empirical analysis in section IV. The study's conclusion and discussion are presented in the final part.

Literature Review

The significance of WCM is indeed not new to the financial literature and a study of earlier literature demonstrates utilising alternative variable selection for analysis. There is a considerable relationship between performance and working capital management. Alsulayhim (2019) looks on the link between working capital management and profitability in 67 non-financial companies listed in the Saudi Stock Exchange. RCP, INP, APP NTC, and current ratio are the proxies used to represent working capital. Net operating profit, return on capital employed, gross operating profit, return on equity, and return on assets are all used as proxies to represent profitability. The study re-

vealed that different companies have varied optimum levels of working capital, which necessitates diverse tactics to boost profitability, and also working capital and profitability are positively associated. While Mousa (2018) built two models including working capital management and profitability, as well as working capital management and firm value, and discovered a positive relationship between firm value, profitability, and working capital management. Muhammad and Waqas (2016) in their case study on Pakistani tobacco industry, for 2005-2014 signify a substantial strong negative link between working capital management and profitability. They also discovered that by properly designing and implementing working capital management and keeping each component at optimal levels, managers may produce value for shareholders.

However, the study done by Paul and Mitra (2018) on Indian steel industry for a period of 17 years ranging from 2000-2016 found a significant impact of working capital represented by CR, QA, DTR, FGTR on profitability represented by ROTA whilst Farhan et al. (2021) observed that all enterprises in different states of India adopt a conservative financing and investment policy using a fixed and random effects model on working capital policies and profitability. Their finding shows that a conservative investment policy has a favourable impact on return on assets but a conservative financing policy has a negative impact on return on assets. Regulators, investors, and financial managers in Indian manufacturing enterprises are recommended to pursue a conservative investment and financing policies that are effective and efficient in increasing firm profitability and achieving financial goals. Prempeh and Amankona (2020) reveal concave quadratic relationship between the profitability and WCM. The study also reveals that when working capital is at an optimal level, firms may optimise profitability, and managers must ensure that they are functioning within optimum limits in order to adopt effective and efficient working capital management policies in 11 Ghanaian firms from 2011 to 2017.

The cash conversion cycle had been widely used as a major component that represents working capital. The study done by Al-Mawsheki and Nordin (2019) for a period of 6 years spanning from 2010-2016 of 143 manufacturing firms in Malaysia found that firms can improve their profitability by reducing the cash conversion cycle and firms can improve their profitability by adopting a investment policy of working capital. The study also finds that cash conversion cycle is having a negative impact on working capital. Similar to this study, done by Alipour (2011) depicts significant relation between working capital measured by cash conversion cycle and profitability by using the sample of 1063 firms listed in Tehran Sock exchange for a time realm of 2001-2006. The study also shows that managers can create the value for their shareholders by decreasing receivables and inventory. Recent studies done by Lahiani and Michel (2020) found a negative effect of cash conversion cycle on profitability of French wine firms but the cash conversion cycle was not at optimum level to increase the profitability. The study also showed that global financial crises had made a significant effect on association between profitability and WCM of wine firms in France and Siedleck et al. (2021) found that higher profitability correlates with longer cash conversion cycle and that operating activities are financed by way of profits in 77 hospitals for a period of three years from 2015 to 2018 in Poland.

Despite the fact that the cash conversion cycle played a major role in the most of prior studies but selecting a ratio or set of ratios might be difficult task due to the lack of proper theory of cash conversion cycle Bhattacharya (1977). In order to resolve the difficulties associated with cash conversion cycle, S.S.Srivastava and R.A.Yadav developed the alterative model called Y-Score model for analysing the efficiency of working capital management. Instead of using variety of accounting ratios, they found only four to be useful in predicting the efficiency of working capital. Kalpana and Muthusamy (2020) use this model in selected airlines companies in India and found

that selected airlines companies perform well in managing the working capital so the need arises to explore this model in other sectors also. The present study also employs Y-Score model to assess the efficiency of working capital in non-financial firms listed in BSE-SENSEX for a period of 10 years spanning from 2010-2011 to 2019-2020.

Methodology

The current study is based on the sample of 30 firms listed in BSE SENSEX. Because of the specific nature of business, banking and financial services companies were excluded from the sample and the companies who are having incomplete data were also excluded from the study. As a result, 20 companies were chosen as a sample across a 10 year period, from 2010-11 to 2019-20. The required data were collected from the financial statements of the firms and were extracted from the CMIE Prowess. In order to analyse the efficiency of working capital management, Y-Score model as developed by S.S.Srivastava and R.A.Yadav by using the data of 78 companies were calculated as follows:

$$V2 = \text{Cash flow to total Tangible Assets} = \frac{\text{Cash Flow}}{\text{Total Tangible Assets}}$$

$$V25 = \text{Current assets to Current Liabilities} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$V31 = \text{Net Sales to Total Tangible Assets} = \frac{\text{Net Sales}}{\text{Total Tangible Assets}}$$

$$V35 = \text{Defensive Assets to total operating expenses} = \frac{\text{Defensive Assets}}{\text{Total Operating Expenses}}$$

It established a 1.7068 as cut-off rate for evaluating working capital performance. If the company's Y-Score is above this threshold, its working capital efficiency is good; otherwise, it is not.

Furthermore, regression models were also used to assess the firm's efficiency in obtaining the target level of efficiency during the period of study.

$Y_i = \alpha + \beta X_{it} + \varepsilon$

Where,

$Y_i = Z_t - Z_{t-1}$

$Xi = Z_t - Z_{t-1}$

Z = Y Score at time't' for the firm

$Z^* t$ = Average Y Score of the Industry at t-1

The regression coefficient (β) indicates how quickly a firm increases its efficiency in order to satisfy industry requirements. In this situation, $\beta = 1.7068$ denotes that a firm's efficiency in managing the working capital management is equal to the industry's average efficiency level. $\beta < 1.7068$ suggests that the company's working capital management needs to be improved. The Y-Score is compared to industry norms in order to determine the performance. The mean value was used as the target industry standards for this study to provide outlier control, as suggested by Robert & Morris Associates and Dun & Bradstreet (1975).

Results and Discussion

The V1 (Cash Flow to Total tangible Assets) along with descriptive statistics analysis are shown in table 1. Cash flow to total tangible assets is an efficiency ratio that rates actually cash flows to the company tangible assets without being affected by income recognition or income measurements. Generally higher the ratio, more efficient the company is. The cash flow to total tangible assets on an average ranged from 0.04 to 0.36. The maximum value of cash flow to total tangible

assets is found in Tata Consultancy Services Ltd. (0.49) which shows the efficiency of companies listed in BSE SENSEX in utilizing its tangible assets where as the minimum value of cash flow to total tangible assets is found in sun Pharmaceuticals Inds Ltd (-0.37) followed by Bharti Airtel Ltd (-0.13).

Table 1. V1 (Cash Flow to Total Tangible Assets)

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Asian Paints Ltd.	0.27	0.24	0.22	0.23	0.24	0.27	0.24	0.21	0.20	0.24	0.24	0.02	0.20	0.27
Bharti Airtel Ltd.	0.11	0.07	0.07	0.08	0.13	0.06	-0.06	0.00	-0.01	-0.13	0.03	0.08	-0.13	0.13
Dr. Reddy'S Laboratories Ltd.	0.11	0.10	0.11	0.14	0.11	0.10	0.10	0.04	0.10	0.20	0.11	0.04	0.04	0.20
H C L Technologies Ltd.	-0.07	0.22	0.25	0.28	0.24	0.21	0.25	0.27	0.26	0.21	0.21	0.10	-0.07	0.28
Hindustan Unilever Ltd.	0.25	0.31	0.40	0.38	0.40	0.36	0.39	0.36	0.39	0.37	0.36	0.05	0.25	0.40
I T C Ltd.	0.25	0.27	0.27	0.29	0.27	0.25	0.28	0.28	0.28	0.34	0.28	0.02	0.25	0.34
Infosys Ltd.	0.23	0.24	0.23	0.22	0.22	0.20	0.25	0.28	0.24	0.24	0.24	0.02	0.20	0.28
Larsen & Toubro Ltd.	0.09	0.08	0.09	0.09	0.08	0.06	0.07	0.06	0.07	0.06	0.08	0.01	0.06	0.09
Mahindra & Mahindra Ltd.	0.24	0.21	0.21	0.19	0.17	0.14	0.15	0.15	0.15	0.04	0.17	0.05	0.04	0.24
Maruti Suzuki India Ltd.	0.12	0.07	0.09	0.10	0.12	0.24	0.31	0.32	0.28	0.21	0.19	0.09	0.07	0.32
N T P C Ltd.	0.07	0.07	0.08	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.05	0.01	0.03	0.08
Nestle India Ltd.	0.33	0.22	0.22	0.20	0.23	0.12	0.19	0.22	0.29	0.36	0.24	0.07	0.12	0.36
Oil & Natural Gas Corpn. Ltd.	0.11	0.12	0.10	0.10	0.08	0.07	0.09	0.09	0.12	0.06	0.09	0.02	0.06	0.12
Power Grid Corpn. Of India Ltd.	0.04	0.03	0.04	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.00	0.03	0.04
Reliance Industries Ltd.	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.06	0.08	0.01	0.06	0.09
Sun Pharmaceutical Inds. Ltd.	0.33	0.35	0.10	-0.37	-0.11	-0.08	0.00	0.02	0.04	0.14	0.04	0.20	-0.37	0.35
Tata Consultancy Services Ltd.	0.37	0.38	0.35	0.35	0.31	0.43	0.49	0.46	0.43	0.42	0.40	0.05	0.31	0.49
Tech Mahindra Ltd.	0.23	0.14	0.18	0.20	0.16	0.19	0.18	0.23	0.24	0.22	0.20	0.03	0.14	0.24
Titan Company Ltd.	0.11	0.13	0.12	0.12	0.14	0.09	0.10	0.13	0.13	0.12	0.12	0.01	0.09	0.14
Ultratech Cement Ltd.	0.09	0.13	0.12	0.09	0.07	0.07	0.08	0.04	0.04	0.09	0.08	0.03	0.04	0.13

Table 2 presents V25 (Current Assets to Current Liabilities) of 20 companies for a period of 10 years. The V25 is nothing but current ratio. The V25 on an average is above the standard in Dr Redeye's Laboratories Ltd, HCL Technologies Ltd, ITC Ltd, Infosys Ltd, Sun Pharmaceuticals Inds Ltd, Tata Consultancy Services Ltd, and Titan Company Ltd which indicates that these companies are financially stable and may not face any liquidity problem during the period of study. The maximum value was found in Infosys Ltd. (17.06 times) followed by Sun Pharmaceuticals Inds Ltd (7.84 times) where as minimum value was found in Bharti Airtel Ltd. (0.24 times) followed by Reliance

Industries Ltd (0.32 times). The data seems to be spreading non-normal due to much variation in the minimum and maximum values.

Table 2. V25 (Current assets to Current Liabilities)

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Asian Paints Ltd.	1.31	1.43	1.46	1.35	1.60	1.28	1.48	1.18	1.23	1.71	1.40	0.17	1.18	1.71
Bharti Airtel Ltd.	0.27	0.37	0.30	0.27	0.26	0.24	0.26	0.28	0.24	0.47	0.30	0.07	0.24	0.47
Dr. Reddy'S Laboratories Ltd.	2.68	2.44	3.58	3.75	3.78	3.21	3.00	2.56	2.81	3.30	3.11	0.49	2.44	3.78
H C L Technologies Ltd.	2.40	1.90	1.92	2.92	3.28	4.45	2.88	2.58	2.87	2.05	2.73	0.77	1.90	4.45
Hindustan Unilever Ltd.	0.96	0.95	0.89	0.89	0.97	1.05	0.80	0.95	1.04	1.20	0.97	0.11	0.80	1.20
I T C Ltd.	1.90	1.99	2.32	2.47	3.14	2.76	2.01	1.58	1.87	2.02	2.21	0.47	1.58	3.14
Infosys Ltd.	16.32	17.06	13.90	10.23	9.21	5.65	4.67	3.75	2.73	2.98	8.65	5.54	2.73	17.06
Larsen & Toubro Ltd.	1.06	1.32	1.21	1.36	1.37	1.33	1.12	1.09	1.18	1.16	1.22	0.12	1.06	1.37
Mahindra & Mahindra Ltd.	0.86	1.04	1.03	1.19	1.12	0.96	0.95	0.82	0.94	1.22	1.01	0.13	0.82	1.22
Maruti Suzuki India Ltd.	1.46	1.18	1.02	0.67	0.57	0.49	0.40	0.34	0.47	0.53	0.71	0.38	0.34	1.46
N T P C Ltd.	2.82	2.86	2.80	2.13	1.83	1.37	1.21	1.49	1.29	1.82	1.96	0.66	1.21	2.86
Nestle India Ltd.	1.19	1.07	1.12	1.49	1.24	1.19	1.50	1.78	1.63	1.35	1.36	0.23	1.07	1.78
Oil & Natural Gas Corpn. Ltd.	1.25	1.74	2.23	1.88	2.17	2.18	2.24	1.48	1.57	1.68	1.84	0.35	1.25	2.24
Power Grid Corpn. Of India Ltd.	0.91	0.74	0.57	0.64	0.50	0.61	0.61	0.67	0.87	0.93	0.70	0.15	0.50	0.93
Reliance Industries Ltd.	1.51	2.13	2.11	1.41	0.82	0.43	0.37	0.41	0.42	0.32	0.99	0.73	0.32	2.13
Sun Pharmaceutical Inds. Ltd.	7.84	5.90	4.16	3.98	1.41	1.30	1.43	1.76	1.60	2.01	3.14	2.27	1.30	7.84
Tata Consultancy Services Ltd.	3.06	3.75	3.58	4.61	3.79	2.74	2.65	2.47	2.83	2.61	3.21	0.70	2.47	4.61
Tech Mahindra Ltd.	1.41	1.11	1.43	1.83	1.93	2.42	1.84	1.81	1.30	2.22	1.73	0.41	1.11	2.42
Titan Company Ltd.	1.33	1.37	1.41	2.06	1.98	1.88	3.02	2.73	2.93	3.04	2.17	0.70	1.33	3.04
Ultratech Cement Ltd.	0.94	0.89	0.93	0.94	0.86	1.35	1.17	0.84	0.80	0.73	0.94	0.18	0.73	1.35

Table 3 depicts V31 (net sales to total tangible assets) along with the descriptive statistics. The V31 averagely varies between 0.41 to 2.67. The net sales to total tangible assets ratio is below 1 in eight out of twenty firms which indicates that these companies can improve their ratio by increasing their sales faster than tangible assets. The minimum value of V31 was found in HCL Technologies Ltd in 2010-11 where as maximum value was found in Maruti Suzuki India Ltd in 2017-18. The variability in data shows that the data is clustered towards the mean.

Table 4 demonstrates the V35 (Defensive Assets to Total Tangible Assets) along with the descriptive statistics analysis. V35 is considered as more liquid measure as compared to the quick and current ratio as it compares actual assets with actual expenses rather than liabilities. Defensive Assets to Total Tangible assets on an average vary from 0.05 to 1.28 during the period of study. The minimum number of days that companies can operate relying only on liquid assets is 0.03 days and

the maximum number of days that companies can take relying only on liquid assets is 1.87 days. Generally high defensive assets to total tangible assets are preferred.

Table 3. V31 (Net Sales to Total Tangible Assets)

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Asian Paints Ltd.	2.53	2.34	2.18	2.40	2.52	2.51	2.15	1.59	1.51	1.55	2.13	0.42	1.51	2.53
Bharti Airtel Ltd.	0.56	0.53	0.64	0.64	0.55	0.49	0.40	0.32	0.25	0.20	0.46	0.16	0.20	0.64
Dr. Reddy'S Laboratories Ltd.	0.74	0.73	0.74	0.70	0.66	0.76	0.70	0.68	0.84	0.80	0.73	0.05	0.66	0.84
H C L Technologies Ltd.	-0.41	1.02	0.88	0.77	0.65	0.59	0.69	0.82	0.81	0.75	0.66	0.39	-0.41	1.02
Hindustan Unilever Ltd.	2.26	2.65	2.89	2.91	3.07	2.91	3.01	2.43	2.48	2.10	2.67	0.34	2.10	3.07
I T C Ltd.	1.52	1.52	1.53	1.52	1.39	1.39	1.53	1.12	1.05	1.05	1.36	0.21	1.05	1.53
Infosys Ltd.	0.91	0.90	0.94	0.95	0.85	0.87	1.07	1.06	1.19	1.24	1.00	0.14	0.85	1.24
Larsen & Toubro Ltd.	1.03	0.94	0.92	0.94	0.89	0.82	0.85	0.82	0.78	0.75	0.87	0.08	0.75	1.03
Mahindra & Mahindra Ltd.	2.35	2.50	2.73	2.13	2.02	1.89	1.98	1.73	1.65	1.45	2.04	0.40	1.45	2.73
Maruti Suzuki India Ltd.	2.08	1.74	1.82	1.71	1.84	2.87	3.30	3.34	3.18	2.78	2.47	0.69	1.71	3.34
N T P C Ltd.	0.43	0.44	0.39	0.39	0.36	0.32	0.32	0.32	0.28	0.32	0.36	0.05	0.28	0.44
Nestle India Ltd.	2.59	1.78	1.77	1.71	1.99	1.74	1.82	1.84	2.07	2.34	1.96	0.29	1.71	2.59
Oil & Natural Gas Corpn. Ltd.	0.40	0.39	0.41	0.41	0.40	0.37	0.40	0.41	0.50	0.42	0.41	0.04	0.37	0.50
Power Grid Corpn. Of India Ltd.	0.11	0.11	0.11	0.10	0.10	0.11	0.13	0.15	0.12	0.14	0.12	0.01	0.10	0.15
Reliance Industries Ltd.	1.05	1.41	1.39	1.42	1.19	0.77	0.75	0.78	0.90	0.76	1.04	0.29	0.75	1.42
Sun Pharmaceutical Inds. Ltd.	0.47	0.51	0.47	0.39	0.63	0.57	0.48	0.45	0.47	0.54	0.50	0.07	0.39	0.63
Tata Consultancy Services Ltd.	1.43	1.33	1.32	1.24	1.22	1.60	1.94	1.79	1.76	1.67	1.53	0.25	1.22	1.94
Tech Mahindra Ltd.	1.67	1.64	1.67	1.23	1.39	1.26	1.37	1.39	1.51	1.44	1.46	0.16	1.23	1.67
Titan Company Ltd.	1.75	1.91	1.73	1.79	2.03	1.39	1.73	1.80	1.77	1.62	1.75	0.17	1.39	2.03
Ultratech Cement Ltd.	0.91	1.07	1.02	0.94	0.86	0.79	0.82	0.60	0.61	0.63	0.82	0.17	0.60	1.07

Table 4. V35 (Defensive Assets to total operating expenses)

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Asian Paints Ltd.	0.07	0.09	0.10	0.10	0.09	0.10	0.12	0.14	0.13	0.15	0.11	0.02	0.07	0.15
Bharti Airtel Ltd.	0.12	0.13	0.12	0.12	0.14	0.13	0.11	0.20	0.18	0.43	0.17	0.10	0.11	0.43
Dr. Reddy'S Laboratories Ltd.	0.40	0.50	0.55	0.68	0.67	0.58	0.55	0.50	0.44	0.59	0.55	0.09	0.40	0.68
H C L Technologies Ltd.	0.62	0.59	0.77	1.17	1.19	1.51	1.06	0.62	0.80	0.54	0.89	0.33	0.54	1.51
Hindustan Unilever Ltd.	0.14	0.13	0.12	0.12	0.12	0.15	0.11	0.18	0.18	0.23	0.15	0.04	0.11	0.23
I T C Ltd.	0.12	0.13	0.15	0.17	0.22	0.20	0.12	0.19	0.27	0.28	0.19	0.06	0.12	0.28
Infosys Ltd.	1.07	1.09	1.03	0.89	0.97	0.98	0.73	0.70	0.61	0.57	0.87	0.20	0.57	1.09
Larsen & Toubro Ltd.	0.62	0.75	0.62	0.74	0.81	0.90	0.75	0.77	0.78	0.81	0.76	0.09	0.62	0.90
Mahindra & Mahindra Ltd.	0.10	0.11	0.11	0.15	0.14	0.13	0.12	0.16	0.17	0.19	0.14	0.03	0.10	0.19
Maruti Suzuki India Ltd.	0.09	0.10	0.08	0.05	0.03	0.03	0.02	0.03	0.04	0.04	0.05	0.03	0.02	0.10
N T P C Ltd.	0.58	0.60	0.61	0.51	0.42	0.36	0.32	0.43	0.40	0.53	0.47	0.10	0.32	0.61
Nestle India Ltd.	0.06	0.05	0.04	0.10	0.06	0.08	0.12	0.17	0.17	0.13	0.10	0.05	0.04	0.17
Oil & Natural Gas Corpn. Ltd.	0.35	0.46	0.47	0.42	0.41	0.43	0.45	0.35	0.32	0.34	0.40	0.06	0.32	0.47
Power Grid Corpn. Of India Ltd.	1.68	1.32	1.08	1.34	1.11	1.27	0.97	0.77	1.87	1.36	1.28	0.32	0.77	1.87
Reliance Industries Ltd.	0.18	0.18	0.17	0.12	0.05	0.06	0.04	0.08	0.06	0.10	0.11	0.06	0.04	0.18
Sun Pharmaceutical Inds. Ltd.	0.93	0.76	0.56	0.63	0.29	0.29	0.37	0.63	0.62	0.73	0.58	0.21	0.29	0.93
Tata Consultancy Services Ltd.	0.53	0.58	0.55	0.66	0.64	0.45	0.36	0.41	0.49	0.48	0.52	0.10	0.36	0.66
Tech Mahindra Ltd.	0.39	0.35	0.38	0.61	0.48	0.57	0.46	0.46	0.45	0.47	0.46	0.08	0.35	0.61
Titan Company Ltd.	0.18	0.13	0.13	0.10	0.04	0.03	0.09	0.06	0.08	0.04	0.09	0.05	0.03	0.18
Ultratech Cement Ltd.	0.06	0.05	0.06	0.08	0.06	0.19	0.16	0.09	0.09	0.08	0.09	0.05	0.05	0.19

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Table 5 shows overall Y-Score of the companies listed in BSE SENSEX. Over the period of 10 years, the Y-Score was more than benchmark fixed (1.7068) in all the companies except in Bharti Airtel Ltd, NTPC Ltd, Power Grid Corpn of India Ltd and Sun Pharmaceuticals Inds Ltd., which indicates that these companies are not managing their working capital efficiently and effectively. The minimum value of Y-Score was found in Sun Pharmaceuticals Inds Ltd followed by Bharti Airtel Ltd. whereas maximum value of Y- Score was found in Tata Consultancy Services Ltd followed by Hindustan Uniliver Ltd. In summary, the overall working capital was good as per Y-Score model during the period of study. The highest variation was found in Sun Pharmaceutical Inds Ltd. which indicates that data is not spreading close towards the mean.

Table 5. Y-Score

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Asian Paints Ltd.	6.20	5.67	5.15	5.51	5.81	6.24	5.45	4.52	4.28	4.97	5.38	0.66	4.28	6.24
Bharti Airtel Ltd.	2.23	1.64	1.69	1.88	2.48	1.46	-0.49	0.44	0.23	-1.42	1.01	1.27	-1.42	2.48
Dr. Reddy'S Laboratories Ltd.	2.63	2.47	2.70	3.17	2.70	2.59	2.49	1.59	2.55	4.05	2.69	0.62	1.59	4.05
H C L Technologies Ltd.	-0.90	4.59	5.06	5.66	5.03	4.71	5.01	5.18	5.07	4.07	4.35	1.89	-0.90	5.66
Hindustan Unilever Ltd.	5.74	6.87	8.45	8.15	8.65	7.87	8.41	7.50	7.99	7.32	7.70	0.88	5.74	8.65
I T C Ltd.	4.99	5.31	5.37	5.61	5.25	5.00	5.51	5.26	5.27	6.06	5.36	0.31	4.99	6.06
Infosys Ltd.	5.04	5.21	5.04	4.74	4.70	4.50	5.12	5.51	5.01	5.09	5.00	0.29	4.50	5.51
Larsen & Toubro Ltd.	2.72	2.55	2.54	2.72	2.56	2.37	2.35	2.19	2.34	2.17	2.45	0.20	2.17	2.72
Mahindra & Mahindra Ltd.	5.68	5.31	5.53	4.67	4.27	3.77	4.05	3.86	3.72	2.04	4.29	1.08	2.04	5.68
Maruti Suzuki India Ltd.	3.58	2.64	2.95	2.95	3.43	5.97	7.46	7.52	6.88	5.56	4.89	1.99	2.64	7.52
N T P C Ltd.	1.88	1.82	1.93	1.61	1.39	1.27	1.10	1.18	1.13	1.15	1.45	0.33	1.10	1.93
Nestle India Ltd.	7.14	4.81	4.76	4.52	5.15	3.25	4.47	4.95	6.10	7.39	5.25	1.27	3.25	7.39
Oil & Natural Gas Corpn. Ltd.	2.17	2.49	2.16	2.17	1.85	1.73	1.99	1.98	2.42	1.47	2.04	0.31	1.47	2.49
Power Grid Corpn. Of India Ltd.	1.95	1.64	1.48	1.60	1.40	1.56	1.40	1.26	2.14	1.78	1.62	0.27	1.26	2.14
Reliance Industries Ltd.	2.25	2.58	2.50	2.47	2.24	1.94	1.97	1.99	1.98	1.68	2.16	0.30	1.68	2.58
Sun Pharmaceutical Inds. Ltd.	5.90	6.14	2.30	-4.53	-0.85	-0.44	0.70	1.11	1.45	3.05	1.48	3.17	-4.53	6.14

COY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	μ	SD	MIN	MAX
Tata Consultancy Services Ltd.	7.05	7.17	6.64	6.77	6.10	7.98	9.16	8.60	8.15	7.99	7.56	0.96	6.10	9.16
Tech Mahindra Ltd.	5.16	3.81	4.39	4.50	3.96	4.31	4.16	4.97	5.21	4.86	4.53	0.50	3.81	5.21
Titan Company Ltd.	3.34	3.62	3.40	3.41	3.83	2.50	3.07	3.57	3.47	3.23	3.34	0.36	2.50	3.83
Ultratech Cement Ltd.	2.08	2.81	2.65	2.15	1.76	1.86	1.99	1.25	1.15	1.87	1.96	0.52	1.15	2.81

Table 6 shows the year wise average of companies listed in BSE SENSEX. The overall Y-Score model is above 1.7068 in all the years of the study which shows the efficiency of management in managing the working capital. The maximum value of Y-Score was found in 2011-12 at 3.96 followed by 2010-11 (3.84), 2018-139 (3.83) and minimum value was found in 2013-14 (- 4.53) followed by 2015-16 (3.52), 2014-15 (-0.9).

Table 6. Firms Average (2010 – 11 to 2019-20)

Year	Y-Score		
	Mean	Max	Min
2010-11	3.84	7.14	-0.9
2011-12	3.96	7.17	1.64
2012-13	3.83	8.45	1.48
2013-14	3.49	8.15	-4.53
2014-15	3.59	8.65	-0.85
2015-16	3.52	7.98	-0.44
2016-17	3.77	9.16	-0.49
2017-18	3.72	8.6	0.44
2018-19	3.83	8.15	0.23
2019-20	3.72	7.99	-1.42

Table 7 shows the number of efficient firms by taking into consideration the overall Y-Score model of working capital management. On an average, 2010-11 was the significant year for the companies listed in BSE SENSEX when the large number of firms were efficient (19 firms, 95 percent) while 2017-18 was the insignificant year for the companies listed in BSE SENSEX when the number of efficient firms was less (14 firms, 70 percent).

Table 7. No. of Efficient Firms on the basis of Y Score (>1.70)

Year	No. of Firms	Efficient Firms	Percentage
2010-11	20	19	95
2011-12	20	18	90
2012-13	20	18	90
2013-14	20	17	85
2014-15	20	17	85

Year	No. of Firms	Efficient Firms	Percentage
2015-16	20	17	85
2016-17	20	16	80
2017-18	20	14	70
2018-19	20	16	80
2019-20	20	16	80

Industry Norms as a target level of efficiency

In financial analysis, the average performance of an industry is used as a standard for analysing company performance within that industry group. Any measure of central tendency, such as mean or median values, can be used to compute the industry norm. The mean value of the Y-Score was used as an industry norm in this analysis, as proposed by Robert & Morris Associates and Dun & Bradstreet.

Table 8. Regression Analysis of Y-Score

Company	Constant	β	t-value	F-Value	R^2
Asian Paints Ltd.	-0.41	-0.03	-0.09	0.01	0.00
Bharti Airtel Ltd.	1.30	0.31	0.93	0.86	0.10
Dr. Reddy'S Laboratories Ltd.	-0.87	-0.21	0.38	0.38	0.05
H C L Technologies Ltd.	-5.11	-0.68	-2.62*	6.85*	0.46
Hindustan Unilever Ltd.	-2.61	-0.45	-1.44	2.07	0.21
I T C Ltd.	-0.15	-0.07	-0.21	0.04	0.01
Infosys Ltd.	1.28	0.68	2.64*	6.98*	0.47
Larsen & Toubro Ltd.	-3.97	-0.62	-2.25*	5.05*	0.39
Mahindra & Mahindra Ltd.	3.58	0.63	2.30*	5.30*	0.40
Maruti Suzuki India Ltd.	-0.61	-0.05	-0.13	0.02	0.00
N T P C Ltd.	0.71	0.32	0.97	0.94	0.10
Nestle India Ltd.	6.05	0.69	2.73*	7.46*	0.48
Oil & Natural Gas Corpn. Ltd.	-0.68	-0.26	-0.77	0.59	0.07
Power Grid Corpn. Of India Ltd.	0.57	0.32	0.95	0.91	0.10
Reliance Industries Ltd.	1.53	0.68	2.63*	6.89*	0.46
Sun Pharmaceutical Inds. Ltd.	18.10	0.87	5.01*	25.15*	0.76
Tata Consultancy Services Ltd.	-1.58	-0.29	-0.86	0.74	0.08
Tech Mahindra Ltd.	-1.35	-0.37	-1.11	1.23	0.13
Titan Company Ltd.	0.74	0.31	0.93	0.86	0.10
Ultratech Cement Ltd.	3.31	0.66	2.48*	6.13*	0.43

In terms of Y-Score model, Sun Pharmaceutical Inds. Ltd. with the Beta value 0.87 is the most efficient firm in achieving the industrial efficiency with R^2 76 percent and is significant at 5 percent level of significance followed by Nestle India Ltd (β 0.69) with R^2 48 percent, Reliance Industries Ltd (β 0.68) with R^2 46 percent each whereas least efficient firm in achieving the industrial efficiency is HCL Technologies Ltd with Beta value -0.68 and R^2 46 percent followed by Larsen & Toubro Ltd β-0.62 with 39 percent.

Conclusion

In this study, Working capital management efficiency of non-financial firms listed in the BSE SENSEX was evaluated for a period of 10 years, from 2010-2011 to 2019-2020. Insted of employing typical ways to examine working capital, the current study employs Y- Score model to measure and monitor the effectiveness of working capital management. The model consists of four ratios representing V2 = Cash flow to total Tangible Assets; V25 = Current assets to Current Liabilities; V31 = Net Sales to Total Tangible Assets; V35 = Defensive Assets to total operating expenses. In determining the speed with which the goal might be achieved, the industry average was employed as a target degree of efficiency.

Based on the analysis, the study discovered that V25 is above standard in Dr Reddy's Laboratories Ltd, HCL Technologies Ltd, ITC Ltd, Infosys Ltd, Sun Pharmaceutical Inds Ltd, Tata Consultancy Services Ltd, and Titan Company Ltd, whereas V31 is below 1 in eight out of twenty companies, implying that companies can improve their sales by increasing sales faster than tangible assets. It is also discovered that V35 is less than one in all firms except Power Grid Corpn of India Ltd. The V1 of the companies listed in the BSE SENSEX is low, indicating that the companies should increase their cash flows. The overall Y-Score model shows that the firms listed in the BSE SENSEX perform well in managing working capital during the study period. While achieving the target level of efficiency by the firms, the Sun Pharmaceutical Inds Ltd was the only successful firm followed by Nestle India Ltd, Reliance Industries Ltd to achieve the target level of efficiency. The study suggests that companies listed in the BSE SENSEX should improve their sales faster than tangible assets and also firms should improve their cash flows.

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