Audit Financiar, XXIV, No. 4(184)/**2026**, *788-798*
ISSN on-line: 1844-8801

Environmental Management Accounting Costing Techniques and Long-Term Financial Liquidity in Manufacturing Firms

Abstract

Since the introduction of environmental management accounting (EMA), firms have applied it at different levels, with some using it for managing financial performance. However, prior studies focused on other financial performance measures, such as profitability, with limited attention given to long-term financial liquidity in firms. Moreover, studies on EMA costing techniques tend to examine them in isolation. This paper covers three costing techniques popular in the EMA literature: activity-based costing (ABC), life cycle costing (LCC), and material flow cost accounting (MFCA). Thus, this paper aims to determine the effect of EMA costing techniques on long-term financial liquidity in manufacturing firms. The study used quantitative research method and selected 22 manufacturing firms listed on Johannesburg Stock Exchange. The paper collected secondary data on debt-to-asset ratio, total sales revenue and asset turnover ratio on the sampled firms' audited financial statements for 12 years (2013-2024). Additionally, quantitative primary data on activity-based costing, life cycle costing and material flow cost accounting was collected from Finance Managers and Chief Financial Officers of the sampled firms. The data was analysed with Ordinary Least Squares.

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To cite this article:
Malatji, S. E., Ngwakwe, C. C. (2026), Environmental Management Accounting Costing Techniques and Long-Term Financial Liquidity in Manufacturing Firms, *Audit Financiar*, vol. XXIV, no. 4(184)/2026, pp. 788-798,
DOI: 10.20869/AUDITF/2026/184/026

To link this article:
http://dx.doi.org/10.20869/AUDITF/2026/184/026
Received: 13.11.2025
Revised: 20.03.2026
Accepted: 28.09.2026

The findings show a positive (yet significant) relationship between ABC and long-term financial liquidity. In addition, the findings indicate a negative (yet insignificant) relationship between LLC and long-term financial liquidity. Moreover, the findings show a positive (yet insignificant) relationship between MFCA and long-term financial liquidity. These findings suggest that the sampled firms did not use EMA costing techniques in managing their long-term financial liquidity and majority of their long-term assets are financed by long-term debts. At the theoretical level, this paper contributes to filling the existing gap in EMA literature by combining the three EMA costing techniques in one study to explain long-term financial liquidity challenges in firms. At practical level, this paper calls for manufacturing firms to reduce reliance on long-term debt providers and increase the extent of applying EMA costing techniques to attract equity investors.

Key words: *activity-based costing; environmental management accounting; costing techniques; life cycle costing; liquidity; material flow cost accounting;*

JEL Classification: *C12, C33, C83, C89, E21, L25, L66, M41, N67, Q56*

1. Introduction

Long-term financial liquidity (LFL) is essential for the sustainability of every firm (Onyedikachi, 2025), as it reflects access to long-term funding necessary for the continuous operation of the business. Firms are expected to maintain a healthy balance between debts compared to equity. At the same time, firms' assets should be financed properly using either long-term debts or equity. However, firms that rely on long-term debts are more likely to encounter long-term liquidity challenges (Ayoush et al., 2021), since creditors may withdraw their financing if contractual conditions are breached. Furthermore, the ability of firms to attract investments is influenced by factors such as firms' profitability and integration of environmental factors in running the business (Egiyi & Okafor, 2022). Consequently, firms adopt various strategies to enhance their profitability, while incorporating environmental and social concerns (Fatah & Hamad, 2022; Wiredu et al., 2023). Among these strategies, environmental management accounting (EMA) costing techniques have gained prominence, particularly in manufacturing firms for improving financial performance (Murti, 2023; Najihah & Indriastuti, 2020). This paper aims to examine the effect of EMA costing techniques on LFL in manufacturing firms. Specifically, it focuses on the most widely discussed techniques in the EMA literature: activity-based costing (ABC), life cycle costing (LCC) and material flow cost accounting (MFCA) (Fakoya & Imuezerua, 2020a; Nyakuwanika et al., 2021; Van der Poll, 2024).

The ABC method assist in minimizing costs through allocation of the resources with accuracy in the production process (Ahmad & Sulaiman, 2023; Okpe et al., 2024). In addition, the MFCA method allows for the tracing material and energy flows in the production process in physical and monetary terms (Fakoya & Imuezerua, 2020a). Moreover, the LCC method calculates total product cost for the entire life cycle (Dong et al., 2022). However, literature relating to the EMA costing techniques remain split with studies focusing on the effect of the implementation of ABC, LCC and MFCA methods on firms' financial performance in isolation. Furthermore, despite the importance of LFL towards the manufacturing firms' sustainability, most prior studies focus on other financial performance indicators, such as profitability, return on assets and return on equity (Fatah & Hamad, 2022; Malapa & Ngwakwe, 2025). To address this gap, the study integrates the three EMA costing techniques (ABC, LCC and MFCA) into a single study and assesses its impact on LFL in manufacturing firms. This paper measures LFL using debt to asset ratio (DAR), which illustrates the portion of the firm's long-term assets financed by means of long-term debt (Markonah et al., 2020). The fewer the assets that are financed by debt, the better as the affected assets are often used as collateral for debt provided. This paper measured LFL using DAR because the firm strength is linked to the long-term assets it owns. The DAR inversely explains the debt-to-equity ratio (DER) because if major firm's long-term assets are financed through debts, it signals low equity levels and reliance of long-term financiers for operational continuity. Therefore, this study seeks to achieve the following objectives:

1. To analyse the effect of the implementation of ABC method on LFL in manufacturing firms.
2. To assess the effect of the implementation of LCC method on LFL in manufacturing firms.

3. To evaluate the effect of implementation of MFCA method on LFL in manufacturing firms.

The remainder of the paper is organised as follows: section 2 presents the theoretical framework and literature review, section 3 outlines the research methodology, section 4 analyses and interpret the results, and section 5 provides conclusions to the paper.

2. Literature review

This section outlines the theoretical background and reviews the relevant literature relating to the study.

2.1 Theoretical Foundation

This paper is grounded on the shareholder theory, which posits that a firm's primary objective is to increase profits that maximize shareholder wealth (Friedman, 1970; Jouber, 2023; Nyikahadzoi et al., 2022). On the other hand, responsible investors are increasingly attracted by firms initiatives such as the implementation of EMA costing techniques that lead to obtaining a more sustainable world (Brandon et al., 2022). The paper adopts the shareholder theory because improved profits by adopting EMA costing techniques attract investors, who brings more equity investments to the business, which reduce reliance on long-term debts and strengthen firms' LFL.

2.2 Activity-Based Costing and Long-term Financial Liquidity

Mwila et al. (2022) analysed the relationship between ABC system, cost control, and financial performance of small and medium-sized firms operating in Zambia, finding a positive association between the ABC method, cost reduction and profitability. Likewise, Jumaah and Mashkoor (2023) assessed the ability of green ABC method to minimize expenditure in Iraq oil refinery firm. The findings revealed that green ABC method could reduce long-term product costs such as liquid gas from 514 377 to 191 766 Iraqi dinars, a decrease of approximately 168%. Furthermore, Okpe et al. (2024) analysed the impact of ABC method application on Nigerian mattress and foam manufacturing firms. A sample size of ten firms was used and eighty questionnaires were administered to research participants, and a response rate of 100% was obtained. Ordinary least squares (OLS) was adopted for data analysis. The findings revealed a significant and positive association between the adoption of ABC method and profitability. Similarly, Onyedikachi (2025) analysed the effect of applying an integrated methodology that includes ABC method on firms' profitability and liquidity in Nigeria. The findings show that ABC method enabled the firm to derive higher profits through accurate cost allocation, leading to enhanced liquidity.

On the other side, Paradzal et al. (2023) evaluated the effect of ABC method implementation on financial performance in Zimbabwe brick manufacturing firms. The findings show a negative and insignificant relationship between ABC method and financial performance. Similarly, Zoubiri and Amara (2023) observed a negative relationship between ABC method and cost reduction in an Algerian bread manufacturing firm. They found that ABC method implementation is associated with increase in costs.

Studies reviewed on effect of the implementation of ABC method on financial performance found mixed results, with findings showing positive (Mwila et al., 2022) and negative effect (Paradzal et al., 2023). The mixed results are attributable to different research methodologies in various studies. Despite the mixed results most reviewed studies found a positive relationship between ABC method, cost reduction and profitability (Okpe et al., 2024; Onyedikachi, 2025). Significant cost reduction through ABC method application could contribute to improved profits, whereas, higher profitability could attract potential investors to the business, improving firms' LFL. These benefits could encourage firms to apply ABC method in managing LFL. Despite the ABC capability to improve firms' financial performance, prior studies did not measure financial performance using long-term liquidity ratios, which is critical for firms' sustained operations. Moreover, the reviewed literature was not grounded on any theories. This gap justifies objective 1 of this paper which aims to analyse the effect of ABC method on LFL in manufacturing firms. Based on the predominance of positive findings and studied reviewed that found a positive relationship between ABC method and financial performance and the shareholder theory that require shareholder's wealth maximisation in terms of improved profits, this paper proposes the following hypothesis:

H_1: ABC is positively and significantly associated with LFL.

2.3 Life Cycle Costing and Long-term Financial Liquidity

Nyakuwanika et al. (2021) evaluated the impact of LCC on the economic and environmental performance in Zimbabwean gold mining firm, and found that the LCC application result in cost savings. Nyahuna and Doorasamy (2022) evaluated EMA practices on financial sustainability in South African cement manufacturing firms. Findings revealed applying EMA practices is positively related to financial performance. Mura et al. (2024) evaluated an Italian wine firm's environmental and economic performance by integrating LCA and LCC techniques. The LCA-LCC was applied to packaging activities over five years, covering 2017 to 2021. Data was collected from the firm records, direct observation, and semi-structured interviews. The findings show that the integrated techniques could assist firms in saving economic costs up to a maximum of 63%.

On the other hand, Eramus (2021) assessed the influence of EMA costing techniques on financial performance of Nigerian Banks. Findings show that LCC is negatively related to financial performance, while, Robinson and Umo (2023) evaluated the application of EMA costing techniques in Nigeria and reported that applying LCC has a negative (yet immaterial) effect to financial performance.

Studies reviewed on LCC and LFL show mixed results with findings showing positive (Nyahuna and Doorasamy, 2022) and negative (Eramus, 2021) relationships. The contradicting results are associated with different methodologies applied in various studies. Despite the contradicting results, most reviewed studies found applying LCC reduces major costs (Mura et al., 2024; Nyakuwanika et al., 2021). Massive cost savings through LCC application could improve profits, attract investors, and improve firm's LFL. These advantages could also encourage LCC use in managing firms' LFL. Notwithstanding the LCC ability to improve firms' financial performance, prior studies did not measure financial performance using long-term liquidity ratios, which is critical for sustained operations. Moreover, the reviewed literature was not grounded on any theories. This gap justifies objective 2 of this paper which aims to assess the effect of LCC on LFL in manufacturing firms. Based on most studies reviewed that found a positive and significant relationship between LCC and financial performance and the shareholder theory that require shareholder's wealth maximisation in terms of improved profits, this paper proposes the following hypothesis:

H2: LCC is positively and significantly associated with LFL.

2.4 Material Flow Cost Accounting and Long-term Financial Liquidity

Fatah and Jaf (2023) assessed the application of green practices and MFCA on sustainability of firms using Iran Al-Mansour Pharmaceutical manufacturing firm. Sustainability was judged in terms of environmental, economic and social factors. The researchers adopted mixed-method research, including analyzing secondary and primary data from interviews. The findings reveal that applying MFCA significantly affects sustainability by reducing material losses hidden in waste. Fadjarenie et al. (2024) evaluated the relationship between MFCA and cost reduction in Indonesian manufacturing industries. The researchers used a sample of 230 manufacturing firms listed on the Indonesian Stock Exchange by extracting data from the annual and sustainability reports relating to 2016 to 2020. The findings show that MFCA application results in significant cost reduction, supported by improved return on assets. In addition, Fitriani et al. (2024) evaluated the effect of MFCA on a firm's value. The authors extracted secondary data from annual reports of manufacturing firms listed on the Indonesian Stock Exchange from 2018 to 2022. Multiple linear regression was used for data analysis. The findings show a significant positive association between MFCA application and firm value. Similarly, Najaf et al. (2024) applied MFCA in a brick manufacturing firm in Iraq. The findings show that firms implementing MFCA achieve high financial performance.

Studies reviewed applied different methodologies in assessing the effect of MFCA on financial performance. However, despite the variations in methodologies studies reviewed show MFCA ability to reduce material losses (Fatah & Jaf, 2023), significant costs (Fadjarenie et al., 2024), improves firms value (Fitriani et al., 2024) and high financial performance (Najaf et al., 2024) which is essential for enhancing firms' LFL. These benefits may encourage MFCA application to manage LFL in firms. At the same time, reviewed studies did not measure financial performance using LFL ratios and were not grounded on theories. This gap justifies objective 3 of this study which aim to evaluate the effect of applying MFCA on LFL in manufacturing firms. Based on most studied reviewed that found a positive relationship between MFCA and financial performance and the shareholder theory that require

shareholder's wealth maximisation in terms of improved profits, this paper proposes the following hypothesis:

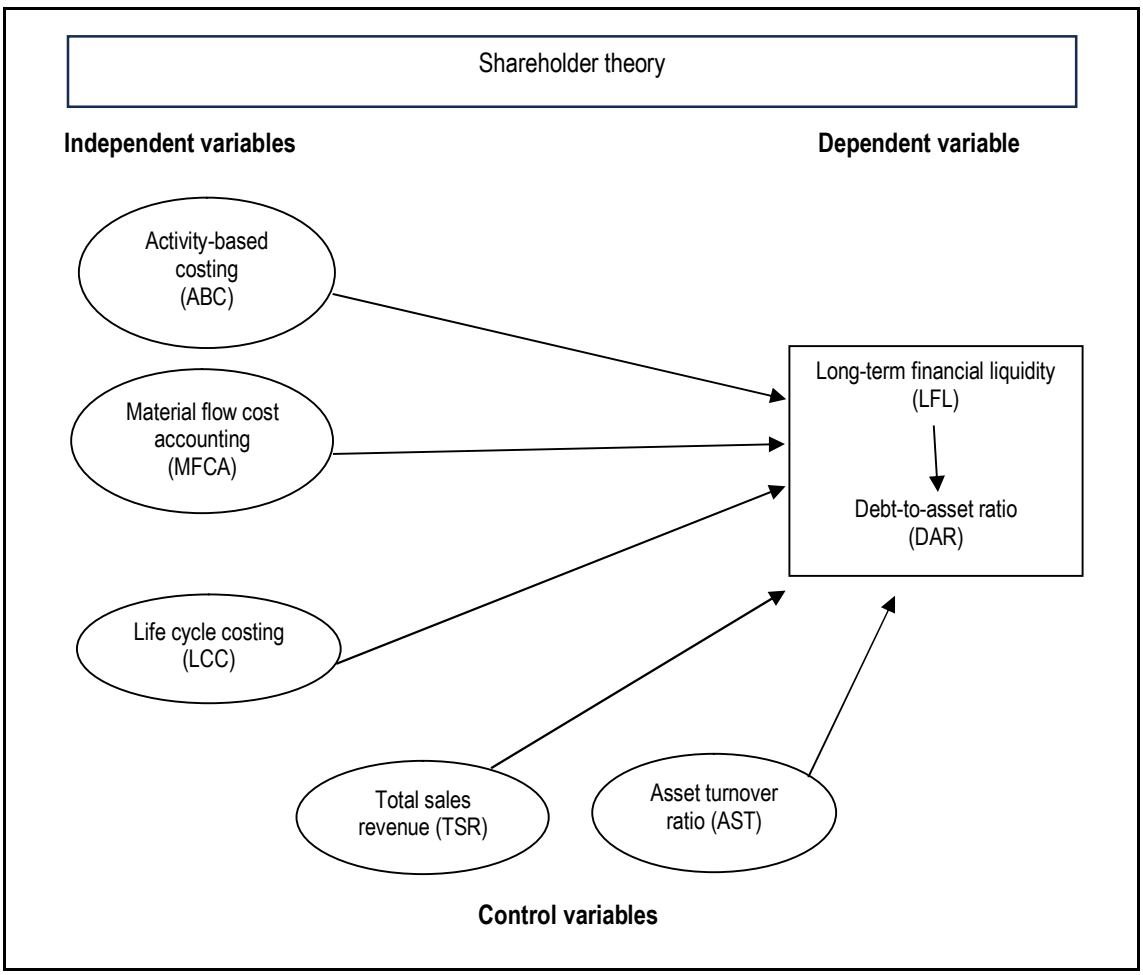
H3: MFCA is positively and significantly associated with LFL.

2.5 Conceptual framework

A conceptual framework is used to explain the connection between the independent and dependent variable within a study (Atemo & Kamaara, 2024). **Figure no. 1** presents the conceptual framework adopted in this research.

In **Figure no. 1** the independent variables are proxied by ABC, LCC and MFCA and the dependent variable is represented by LFL measured by DAR. TSR and AST were used as control variables.

Figure no. 1. Conceptual framework



Source: authors' Creation

3. Research methodology

The paper aims to examine the effect of EMA costing techniques on LFL in manufacturing firms. These are the independent variables measured by ABC, MFCA and LCC, while TSR and AST are used as control variable. On the other hand, LFL represents the dependent variable measured by DAR. This paper follows a quantitative research method and correlational research design to determine the relationship between the study independent

and dependent variables. The population for this study is South African consumer goods manufacturing firms listed on the Johannesburg Stock Exchange (JSE). The paper selected the entire population of 22 manufacturing firms listed as a sample size. The selected firms were studied for 12 years (2013-2024).

The authors collected secondary data on DAR, TSR and AST in the sampled firms audited financial statements because this information was available for public use. Each firm was allocated a unique code to comply with anonymity and confidentiality ethical requirements. The data on DAR, TSR and AST was collected for the 12-year study period (2013-2024) and inserted in an Excel spreadsheet. However, the data relating to the application of ABC, LCC and MFCA were not available in the sampled firms annual, integrated reports and audited financial statements. Therefore, quantitative primary data on EMA costing techniques (ABC, LCC and MFCA) was collected from corporate executives (Finance Managers and Chief Financial Officers) of the sample firms using questionnaires administered through emails. The questionnaire was distributed to the Human resources departments of the selected firms after requesting permission to conduct research. Each firm were allocated with a unique firm code that align with the secondary data already collected that participants must use to enable the identification of the represented firm by only the authors to comply with anonymity and confidentiality ethical requirements. The authors requested the questionnaires to be completed by either Finance Managers or Chief Financial Officers of the selected firms. These participants were targeted because they work closely with financial statements and are implementing initiatives aimed to improve the financial longevity of firms.

The questionnaire included statements on a 5-point Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, and 5. Strongly agree) which was used to evaluate the effect of applying EMA costing techniques (ABC, LCC and MFCA). Therefore, primary data was combined with the secondary data relating to DAR, TSR and AST using the unique firm codes and the values of 1 to 5 derived from the 5-point Likert scale. For instance, where the participants selected values of 1, 2 and 3 on the application of ABC, LCC and MFCA from the 5-point Likert Scale, first the authors identified the unique firm code used and matched it with the secondary data already collected. Thereafter, the values of 1, 2 and 3 was taken and inserted in the Excel spreadsheet in the column for ABC, LCC and MFCA for the study period (2013-2024). The authors acknowledge that EMA costing techniques is not applied in the sampled firms in the same extent. Hence, the use of 5-point Likert scale was needed to provide research participants with opportunity to choose between positive, negative and neutral answer. The provision of multiple options in this paper indicates that authors did not coercive participants to answer in a particular way and reduced research bias.

The data is structured as a panel, as it combines cross-sectional and time-series dimensions. Moreover, data on ABC, LCC and MFCA were populated over 12 years, and analysed with ordinary least squares (OLS). The following models were estimated:

$$DAR_{it} = \alpha_{it} + \beta_1 ABC_{it1} + \beta_2 TSR_{it2} + \beta_3 AST_{it3} + \varepsilon \quad (1)$$

$$DAR_{it} = \alpha_{it} + \beta_1 LCC_{it1} + \beta_2 TSR_{it2} + \beta_3 AST_{it3} + \varepsilon \quad (2)$$

$$DAR_{it} = \alpha_{it} + \beta_1 MFCA_{it1} + \beta_2 TSR_{it2} + \beta_3 AST_{it3} + \varepsilon \quad (3)$$

4. Results and discussions

4.1. Descriptive statistics

Descriptive statistics are used to summarize and interpret the characteristics of the quantitative data set. The study comprises 264 observations derived from 22 sampled manufacturing firms over a 12-year period (2013-2024).

The ABC, LCC and MFCA represent the independent variables, while TSR and AST are the control variable. The dependent variable is proxied by LFL (DAR). **Table no. 1** represent the summary of descriptive statistics.

Table no. 1 shows that ABC has a mean of 3.36 and a maximum of 5, indicating more usage in the sampled firms. ABC's standard deviation (1.33) shows that data is not centered around the mean, indicating different application in the sampled firms. LCC has a mean of 2.81

and a maximum of 5, indicating usage above 50% in the sampled firms. LCC's standard deviation (1.26) indicates that data is dispersed far from the mean, suggesting various applications in the sampled firms. MFCA has a mean of 3.22 and a maximum of 5, indicating more usage in the sampled firms. MFCA's standard deviation (1.16) suggests that data is dispersed far from the mean, suggesting applications at various levels. TSR has a mean of 42488.62 and a maximum of 727913. TSR's standard deviation (115 835) shows that data is disbursed far from the mean, indicating different revenue earned by the sampled firms with different sizes, hence this variable is controlled. AST has a mean of 1 and a maximum of 2.68. AST's standard deviation (0.57) shows that the data is near the mean. However, this variable is controlled because firms with high assets are likely to have high turnover. DAR has a mean of 0.69 and a maximum of 67.71, implying that on average, 69% of the sampled firms' assets are financed by long-term debts. DAR's standard deviation (4.15 shows) that data is spread far from the mean, indicating different financial structures of the sampled firms.

Table no. 1. Summary of descriptive statistics

Variable	Obs.	Mean	Std.dev	Min.	Max.
ABC	264	3.3636	1.3355	1	5
LCC	264	2.8106	1.2676	1	5
MFCA	264	3.2272	1.1673	1	5
TSR	264	42 488.62	115 835.8	0	727913
AST	264	1.001	0.5734	0	2.6847
DAR	264	0.6997	4.1582	0	67.7130

Source: STATA results

4.2. Normality test

Normality test is critical in statistical regressions to assess if the data set is normally distributed or close to normal. This study tested normal distribution using skewness and kurtosis and results are displayed in **Table no. 2**.

Table no. 2. Skewness and Kurtosis test for normally

Variable	Obs	Pr (Skewness)	Pr (Kurtosis)
ABC	264	0.1305	0.0000
MFCA	264	0.6417	0.0000
LCC	264	0.1311	0.0000
TSR	264	0.0000	0.0000
AST	264	0.0003	0.2452
DAR	264	0.0004	0.0000

Source: STATA results

The skewness values between -0.5 and 0.5 show that data is symmetrical, -1 and – 0.5 or 0.5 and 1 indicate moderately skewed data, and less than -1 or greater than 1, portrays highly skewed data (Hatem et al., 2022). Kurtosis values of close to 0 indicate a normal distribution, less than 0 suggest light distribution tails and greater than 0 shows heavier distribution tails (Hatem et al., 2022). **Table no. 2** shows most skewness values between 0 and 0.5, suggesting that the data is nearly symmetrical. However, the MFCA value of greater than 0.5 indicates that the data is moderately skewed. On the other hand, despite most kurtosis values showing results of 0, the data shows heavier tails for AST, which is used as a control variable. However, the magnitude is trivial and does not indicate substantial non-normality.

4.3. Multicollinearity

Table no. 3. Variance inflation factors test for Multicollinearity

Variable	VIF	1/VIF
ABC	1.06	0.9433
MFCA	1.08	0.9259
LCC	1.02	0.9804
TSR	1.02	0.9804
AST	1.03	0.9670
Mean VIF	1.04	

Source: STATA results

Multicollinearity exists in a data set if the independent variables are closely related (Shrestha, 2020). This paper used variance inflation factors (VIFs) to test for multicollinearity. **Table no. 3** shows the multicollinearity results based on VIFs.

Table no. 3 shows VIFs that are less than 10, suggesting an absence of multicollinearity between the independent variables.

4.4. Heteroscedasticity

This study tested heteroscedasticity using the Wald test as depicted in **Table no. 4**.

Table no. 4. Heteroscedasticity - Wald test

(1)	ABC - MFCA	0	
(2)	ABC – LCC	0	
(3)	ABC – TSR	0	
(4)	ABC – AST	0	
	χ^2 (4)		2.68
	Prob>χ^2		0.5224

Source: STATA results

Table no. 4 indicates an insignificant p-value of greater than 5%, suggesting the assumption of homoscedasticity is satisfied.

Findings presentation and discussion: *Effect of EMA costing techniques on long-term financial liquidity*.

Table no. 5 presents the findings on the effect of EMA costing techniques (ABC, LCC and MFCA) on LFL (DAR). It also shows the results of the 3 regression results which cover the 3 objectives of this paper.

Table no. 5 shows the regression coefficients and t-values (denoted in parenthesis), with the significance level (p-values) shown using stars. One star indicates a significant level (p-value) of less than 10%, two stars 5%, and three stars 1%. Social sciences researchers often accept R^2 values from 0.10 to 0.30 to interpret the study results (Gupta et al., 2024). The authors accept the R-squared of 0.1330 (Regression 1), 0.1339 (Regression 2) and 0.1329 as significant to interpret this paper results.

Table no. 5. Effect of EMA costing techniques on long-term financial liquidity

	Regression Results (1)	Regression Results (2)	Regression Results (3)
	DAR	***DAR***	***DAR***
ABC	0.0474 (0.25)		
LCC		-0.0318 (-0.17)	
MFCA			0.123 (0.57)
TSR	0.0000*** (5.99)	0.0000*** (6.15)	0.0000*** (6.12)
AST	-0.309 (-0.72)	-0.362 (-0.82)	-0.284 (-0.67)
Number of obs	264	264	264
R-squared	0.1330	0.1339	0.1329

Source: STATA results

Effect of activity-based costing on long-term financial liquidity

Table no. 5 – ***Regression results 1*** findings show a positive (coefficient 0.0474) and insignificant relationship between ABC and DAR. The findings suggest that ABC and DAR move together in the same positive direction. However, relationship is not statistically strong to conclude that the movement in DAR is caused by ABC application. The positive and insignificant relationship between ABC and DAR found in this paper is unexpected as the alternative hypothesis predicted a positive and significant relationship. The findings contradict prior studies that found that applying the ABC technique reduces high costs, improves profitability and LFL (Jumaah & Mashkoor, 2023; Mwila et al., 2022; Okpe et al., 2023; Onyedikachi, 2025). Therefore, the paper findings suggest that the sampled firms did not use ABC to manage their LFL due to inability to reduce DAR. In addition, the findings highlight that a larger portion of the sampled firms' long-term assets are financed by long-term debts. This is challenging as long-term assets acquired through long-term debts are used as a collateral for that debt, making it accessible for the financial providers. A failure to adopt EMA costing techniques such as ABC in managing LFL is aligned with the shareholder theory that requires corporate executive to focus on profit-making to maximise shareholders wealth. The pressure to improve profits make corporate executive to disregard EMA initiatives to

minimise expenditure with the intention of improving short-term profits for shareholders. As such, applying techniques such as ABC was limited to traditional usage of overheads allocation, which is redistribution of costs already incurred. Given that the positive (yet insignificant) relationship between ABC and DAR, suggest a failure to improve LFL, the authors conclude based on the paper findings. Therefore, the authors reject the null hypothesis, indicating no relationship between ABC and LFL and accepts an alternative of positive and insignificant relationship between ABC and LFL.

Effect of life cycle costing on long-term financial liquidity

Table no. 5 – ***Regression results 2*** findings show a negative (coefficient -0.0318) and insignificant relationship between LCC and DAR. The findings suggest that LCC and DAR moves in opposite direction. However, the movement is not statistically strong to conclude that the movement in DAR is caused by applying LCC. The negative and insignificant relationship between LCC and DAR found in this paper is unexpected as the alternative hypothesis predicted a positive and significant relationship. Therefore, the findings contract studies that found a positive and significant relationship between LCC and LFL through cost savings and improvement of financial performance (Nyahuna & Doorasamy, 2022; Mura et al., 2024). However, the findings concur with studies that found a negative (yet insignificant) relationship between LCC and LFL (Robinson & Umo, 2023). The paper findings suggest that the sampled firms did not use LCC to manage their LFL and their long-term assets are financed mainly by long-term debts. The findings also show failure to attract longevity investors that are motivated by incorporation of EMA costing techniques in achieving firms' financial performance. A failure to adopt EMA costing techniques such as LCC in managing LFL is aligned with the shareholder theory that focus of profit-making for shareholders. The pressure to improve profits make corporate executives to disregard EMA costing techniques to minimise expenditure with the intention of improving short-term profits for shareholders. Given that the negative (yet insignificant) relationship between LCC and DAR shows a failure to improve LFL, the authors conclude based on the paper findings. Therefore, the authors reject the null hypothesis, indicating no relationship between LCC and LFL and accepts an alternative of negative and insignificant relationship between LCC and LFL.

Effect of material flow cost accounting on long-term financial liquidity

Table no. 5 – ***Regression results 3*** findings show a positive (coefficient 0.123) and insignificant relationship between MFCA and DAR. The findings suggest that MFCA and DAR move together in the same positive direction. However, the relationship is not statistically strong to conclude that movement in DAR is caused by MFCA application. The positive and insignificant relationship between LCC and DAR found in this paper is unexpected as the alternative hypothesis predicted a positive and significant relationship. Therefore, the findings contract studies that found a positive and significant relationship between MFCA and LFL, through significant cost reduction and improvement of financial performance (Fadjarenie et al., 2024; Najaf et al., 2024). The paper findings suggest that the sampled firms did not use MFCA to manage their LFL due to lack of improvement in DAR. Moreover, the findings suggested that the sampled firms' long-term assets are mainly financed by long-term debts. Therefore, the sampled firms failed to attract responsible investors who are motivated by implementing EMA costing techniques in making firms' profits (Brandon et al., 2022). A failure to adopt EMA costing techniques such as MFCA in managing LFL is aligned with the shareholder theory that require corporate executives to focus of profit-making to increase shareholders wealth. The pressure to improve profits make corporate executives to disregard EMA costing techniques such as MFCA to minimise expenditure and align themselves with traditional shareholders' needs. Given that the positive (yet insignificant) relationship between MFCA and DAR shows a failure to improve LFL, the authors conclude based on the paper findings. Therefore, the authors reject the null hypothesis, indicating no relationship between MFCA and LFL and accepts an alternative of positive and insignificant relationship between MFCA and LFL.

5. Conclusions

This paper evaluated the effect of EMA costing techniques on LFL in manufacturing firms. A quantitative research method was adopted using a sample size of 22 South African manufacturing firms listed on the JSE. Quantitative primary and secondary data were collected to reach the study objectives. OLS was used to analyse the data. The paper covered three objectives: 1. to analyse the effect of

ABC on LFL in manufacturing firms, to assess the effect of LCC on LFL in manufacturing firms and 3. to evaluate the effect of MFCA on LFL in manufacturing firms. The findings reveal a positive (yet insignificant) relationship between ABC and LFL, showing that the sampled firms did not use ABC to manage their LFL. In addition, the findings indicate a negative (yet insignificant) relationship between LCC and LFL, highlighting that the sampled firms did not use LCC to manage their LFL. Moreover, the findings show a positive (yet insignificant) relationship between MFCA and LFL, suggesting that the sampled firms did not use MFCA in managing their LFL. The inability to use EMA costing techniques (ABC, LCC and MFCA) suggest that corporate executives of the sampled firms prioritise making short-term profits for shareholders consistent with the shareholder theory. At the theoretical level, this paper contributes to filling the gap in the existing literature by combining the three EMA costing techniques (ABC, MFCA and LCC) in one study to evaluate its impact on firms' long-term liquidity levels. At the practical level, this paper encourages manufacturing firms to reduce reliance on long-term debt providers and increase the extent of applying EMA costing techniques to attract responsible equity investors to boost their LFL. The limitations of this paper include focusing on only consumer goods manufacturing firms listed on the JSE. Future research could consider exploring the combined effect of EMA costing techniques using different sectors of activity and employing qualitative approaches to understand the hinderances of adopting EMA techniques in firms.

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