

Finance 5.0: Reimagining Financial Ecosystems in an Era of AI, Sustainability and Global Uncertainty – Corporate Finance: Working Capital Management

Kashish Rohra

PGDM Student (2026-28 BATCH)
Indus Business Academy (IBA)
Bangalore – 560082
Mobile: 7000764053
Emails: kashishrohra8@gmail.com
Fpb2628.146.kashish@iba.ac.in

Raja Babu

PGDM Student (2026-28 BATCH)
Indus Business Academy (IBA)
Bangalore – 560082
Mobile: 8102269351
Emails: rb8277173@gmail.com
Fpb2628.039.raja@iba.ac.in

Bijay Krishna Bhattacharya

Professor – Finance
Indus Business Academy
Bangalore – 560082
Emails: bijay.kb@iba.ac.in
babunsampa@gmail.com
Mobiles: 9831334839 and 7892216480

Abstract

Finance 5.0 is changing the traditional role of corporate finance by merging artificial intelligence, predictive analytics, automation, digital financial infrastructure, sustainability and stakeholder orientation with financial decision making. The importance of this transition is particularly relevant for working capital management (WCM), which has always addressed the trade-off between liquidity and profitability through the management of cash, inventories, receivables and payables. The article discusses the potential of Finance 5.0 to transform working capital management in the light of technology disruption, environmental, social and governance (ESG) objectives, supply chain volatility and global economic uncertainties. The article adopts a comprehensive secondary research methodology, drawing on academic literature, legislative reforms and institutional evidence, with a special focus on the Indian corporate environment. The study is based on the Working Capital Theory, Resource Based View, Dynamic Capabilities Theory, and Stakeholder Theory. The study proposes an integrated framework for the role of AI-enabled digital financial capacity and ESG-oriented working-capital practices in improving working-capital efficiency and organisational resilience. Uncertainty and supply-chain risk have countervailing impacts on precautionary liquidity and inventory buffers. The present studies indicate that the efficiency of working capital is correlated with the profitability and performance of the business. New evidence reveals that supply chain risk can materially affect inventory, receivables, payables and net working capital policies. The analysis reveals a significant gap in the literature. AI, ESG, uncertainty, and WCM are explored in the literature somewhat separately

and not as part of an integrated corporate finance system. Research indicates Finance 5.0 is not about financial automation. But it is in the mix of predictive intelligence, responsible finance, stakeholder concerns and resilience management, that it adds more to an adaptive working capital architecture that can support liquidity, profitability and sustainable long term value.

Keywords: *Finance 5.0; working capital management; artificial intelligence; ESG; digital financial capacity; supply-chain risk; corporate finance*

JEL Classification: G31, G32, M15, O33, Q56

Introduction

The global financial environment is undergoing a fundamental transition driven by artificial intelligence, digitisation, sustainability requirements and elevated economic and geopolitical uncertainty. Corporate finance, historically centred on investment decisions, financing decisions, risk management and shareholder-wealth maximisation, is increasingly expected to perform a wider strategic role. Financial managers now operate in data-rich environments where predictive technologies, real-time information systems, digital payments, environmental and social obligations and increasingly complex supply chains influence day-to-day financial decisions. This transition provides the context for Finance 5.0. Finance 5.0 may be understood as an intelligent, digitally enabled, sustainable and human- and stakeholder-oriented model of financial management. Earlier stages of financial digitisation largely automated transactions but Finance 5.0 aspires to mix technology with strategic judgement, sustainability, resilience and responsible wealth creation. In this framework, finance is no longer merely a recorder and allocator of funds or a manager of financial risks; it becomes a strategic function supporting organisational resilience, profitability and sustainability. Working capital management is one of the areas in which this transformation is especially important. Working capital represents the financial resources committed to the day-to-day operating cycle of a business. Cash balances, inventories, trade receivables and trade payables are individually short-term accounts, yet collectively they determine liquidity, operating continuity, financing requirements and a firm's capacity to withstand disruption. Traditional WCM therefore involves a fundamental trade-off. Excessive working capital locks funds into low-return liquid assets and may reduce profitability, whereas insufficient working capital can create shortages of inventory, delayed payments, lost sales and financial distress. Research supports the concept of an optimal rather than universally minimal working-capital level. Baños-Caballero, García-Teruel and Martínez-Solano (2014), for example, identify a non-linear relationship between working-capital investment and corporate performance, while Aktas, Croci and Petmezas (2015) show that firms moving toward their optimal working-capital position can improve operating and stock-market performance. Finance 5.0 introduces additional dimensions to this conventional liquidity-profitability trade-off. AI and machine learning can improve cash-flow forecasts, payment-risk assessment, inventory optimisation and receivables collection. Cloud systems, enterprise-resource-planning platforms and digital-payment infrastructure can provide real-time visibility over working-capital positions. Sustainability adds another dimension by requiring firms to consider supplier relationships, responsible procurement, customer treatment and the ESG characteristics of the value chain. Global uncertainty simultaneously encourages businesses to maintain precautionary cash and inventory buffers and diversify suppliers. The issue is particularly relevant in India. Indian companies operate within a rapidly expanding digital financial ecosystem while sustainability reporting requirements for major listed entities have also expanded. The Business Responsibility and Sustainability Reporting (BRSR) framework strengthens the importance of ESG information and value-chain responsibility. This paper therefore examines Finance 5.0 through the specific lens of corporate working capital and argues that future WCM effectiveness will depend not simply on shortening the cash conversion cycle but on intelligently managing liquidity, data, sustainability, stakeholder relationships and resilience simultaneously.

2. Choice of the Study

The choice of working capital management within the broader Finance 5.0 theme is justified by both theoretical and practical considerations.

First, working capital is essential to everyday corporate survival. A profitable company may nevertheless experience serious financial difficulty if receivables remain uncollected, inventories become excessive or obligations mature before sufficient cash is available. Working capital therefore connects profitability with liquidity and operational continuity.

Second, AI and digital transformation are increasingly relevant to precisely the activities involved in WCM. Predictive systems can examine historic transactions, customer payment behaviour, procurement patterns, seasonality and macroeconomic information so that they can estimate short term cash requirements. They can support inventory planning, customer-credit assessment and payment scheduling, thereby improving the timing and quality of working-capital decisions.

Third, sustainability is changing the objectives of financial decisions. Payment terms imposed on small suppliers, procurement policies, inventory sourcing and supply-chain finance have financial as well as stakeholder consequences. A Finance 5.0 approach therefore requires managers to evaluate both direct financial efficiency and value-chain consequences.

Fourth, global uncertainty has made static working-capital policies increasingly inappropriate. Inflation, changing input prices, geopolitical tensions, trade disruption and uncertain market conditions can alter operating cycles and funding requirements. The convergence of these developments makes WCM a particularly useful corporate-finance setting in which to examine Finance 5.0.

Problem Statement

A substantial body of research establishes the relationship between working capital, liquidity, profitability and corporate performance. However, traditional WCM research is largely based on accounting measures such as the cash conversion cycle, inventory period, receivables period, payables period and net working capital.

This approach does not completely capture the emerging operating environment. Modern firms increasingly use AI, predictive analytics, automation and integrated digital systems to manage short-term financial decisions. Simultaneously, ESG responsibilities increasingly extend into procurement and supply chains, while global uncertainty forces companies to balance efficiency against resilience.

The underlying research problem is therefore that the conventional WCM framework is becoming too narrow to explain working-capital decisions in a Finance 5.0 environment. Existing literature has not sufficiently integrated four questions: whether AI-enabled financial capabilities improve working-capital efficiency; whether ESG-oriented working-capital policies influence liquidity and resilience; whether uncertainty and supply-chain risk systematically increase precautionary working capital; and whether digital capability and sustainability can mitigate the adverse working-capital consequences of external shocks.

The research gap is especially significant for India, where digital financial transformation and formal ESG reporting are developing rapidly but integrated empirical evidence connecting them with corporate WCM remains limited.

Objectives of the Study

- To help you understand how Finance 5.0 can change the way you manage traditional working capital.
- To assess the impact of AI enabled digital financial capabilities on working capital efficiency.
- To learn the impact of predictive analytics and automation on cash, inventory, receivables and payables management.
- To assess the feasibility of ESG and sustainability dimension in working capital choices.
- To gauge the impact of global uncertainty and supply chain disruption on conservative working capital.
- To evaluate the relevance of these relationships in the Indian corporate environment and propose a testable empirical framework for subsequent firm-level analysis.

Coverage of the Time Period

The principal contemporary coverage of the study is 2015-2026, a period that captures the accelerating convergence of digital finance, AI adoption, ESG reporting and supply-chain uncertainty. Earlier seminal theoretical literature is incorporated where necessary to establish the foundations of the Resource-Based View, Dynamic Capabilities Theory and Stakeholder Theory.

The selected period also covers significant structural developments such as rapid digital-payment expansion, post-pandemic supply-chain disruptions, rising geopolitical and trade-policy uncertainty, development of AI-based corporate-finance applications and the strengthening of sustainability-reporting frameworks in India.

Literature Survey / Review

Working Capital Management and Firm Performance

WCM research has traditionally concentrated on the relationship between working-capital investment and profitability. The basic argument is that working capital creates benefits by protecting firms from operating interruptions but carries an opportunity cost when excessive capital is locked into inventories and receivables.

Aktas et al. (2015) provide evidence that an optimal working-capital level exists and that convergence toward this level is associated with improved firm performance. The findings of the study suggest that good WCM does not imply a constant decrease in working capital. But the goal remains optimization. Prasad et al. (2019) review the WCM literature in a comprehensive manner and find that a considerable portion of the influential research has been focusing on the relationship between working capital and profitability and authors usually use similar proxies. Their review argues for more diversity in both WCM measurements and research questions. This observation strongly supports the need to incorporate technological, ESG and resilience variables into contemporary WCM research. Bagh et al. (2016) similarly demonstrate that inventory turnover, the cash conversion cycle, collection periods and payment periods can significantly influence corporate performance. Their work reinforces the proposition that individual components of the working-capital cycle have different effects and should not always be treated as a homogeneous aggregate.

Financing Conditions and Working Capital

Working-capital policy is also strongly influenced by financing conditions. Chen and Kieschnick (2018) find that changes in bank-credit availability significantly affect several aspects of corporate working-

capital policy and that responses vary according to firms' dependence on bank financing. Their findings demonstrate that WCM cannot be isolated from the external financing environment.

Under Finance 5.0, this financing relationship becomes more complex because companies have access to digital credit assessment, supply-chain finance, dynamic discounting and data-driven liquidity forecasting. Technology therefore potentially affects both the amount of working capital required and the mechanisms available to finance it.

Artificial Intelligence and Digital Financial Capability

AI can alter WCM primarily through information quality and prediction. Traditional cash-flow forecasting frequently relies on spreadsheet-based historical extrapolation. AI-based systems can incorporate transaction-level information, customer behaviour, seasonal variation and external variables and continuously update predictions.

The Finance 5.0 framework therefore moves WCM from reactive control toward anticipatory management. Receivables can be segmented according to predicted payment risk; inventory requirements can be estimated using demand forecasts; supplier-payment schedules can be optimised around available liquidity; and treasury managers can receive early warnings regarding emerging cash deficits.

AI should therefore be regarded as a financial capability rather than merely a software investment. Its economic value depends on data quality, systems integration, employee capabilities and managerial judgement.

ESG, Sustainability and Responsible Working Capital

ESG considerations expand WCM beyond the boundaries of the individual firm. Gillan, Koch and Starks (2021) show that ESG/CSR profiles are associated with firm risk, performance and value, although important theoretical and empirical questions remain unresolved. For the managers of working capital, sustainability can affect vendor selection, procurement, supplier-credit conditions, inventory sourcing and financing. An aggressive extension of supplier-payment terms may improve the buying firm's cash conversion cycle but transfer liquidity strain to financially weaker suppliers. A Finance 5.0 approach therefore requires managers to evaluate both direct financial efficiency and value-chain consequences.

This consideration is increasingly relevant in India. BRSR Core gives formal recognition to value-chain ESG information and reinforces the principle that corporate sustainability cannot be assessed exclusively within organisational boundaries.

Global Uncertainty, Supply Chains and Working Capital

Supply-chain risk challenges conventional just-in-time working-capital strategies. Huynh and Le (2025) discovered that net working capital is positively and significantly associated with firm-specific supply-chain risk. Working capital as a cushion of resiliency. Firms with higher risk will build up inventories and receivables, and reduce payables. This finding has major implications for Finance 5.0. A purely efficiency-oriented algorithm might attempt to minimise inventory and working capital, while a resilience-oriented system may deliberately maintain strategic buffers. Finance 5.0 optimisation must therefore be conditional on uncertainty rather than based on a universal minimum-working-capital objective.

Indian Evidence

Kumar et al. examine 538 Indian listed firms using data for 2012-2020 and find that efficient WCM positively influences fundamental corporate strength. Efficient WCM improves profitability, operating

effectiveness, asset utilisation and cash-generation capacity, while inefficient working capital is associated with greater reliance on long-term debt.

The result establishes the continuing economic importance of WCM in India but leaves open a major contemporary question: what determines WCM efficiency in an increasingly digital, ESG-conscious and uncertainty-intensive environment?

Research Gap

Table 1. Major Research Gaps

Research dimension	Existing emphasis	Identified gap
Traditional WCM	Cash conversion cycle, profitability and liquidity	Limited integration of AI-enabled decision capability
Digital transformation	Technology adoption and automation	Limited direct examination of working-capital outcomes
ESG	ESG-performance and firm-value relationships	Insufficient analysis of ESG-linked receivables, payables and inventory decisions
Supply-chain risk	Operational disruption and inventory responses	Limited integration with AI and ESG capabilities
Global uncertainty	Macroeconomic and geopolitical effects	Working-capital resilience responses remain underexplored
Indian evidence	WCM efficiency and firm fundamentals	Limited Finance 5.0 framework combining AI, ESG and uncertainty
Methodology	Repeated use of conventional WCM proxies	Need for multidimensional digital, ESG and resilience indicators

The literature review also reveals repeated concentration of earlier WCM studies on a limited set of proxies and profitability outcomes. The principal contribution of the present study is therefore an integrated framework in which WCM is considered simultaneously as a liquidity mechanism, digital decision system, sustainability mechanism and resilience capability.

Hypotheses and Conceptual Framework

The theoretical foundation combines four complementary perspectives. Working Capital Theory explains the fundamental liquidity-profitability trade-off. The Resource-Based View (RBV) suggests that superior digital finance capability may constitute a valuable organisational resource. Dynamic Capabilities Theory explains how firms sense, respond to and reconfigure resources when markets and supply chains change. Stakeholder Theory supports the inclusion of suppliers, customers, employees and other stakeholders in responsible working-capital decisions. On this basis, the following testable hypotheses are proposed.

Table 2. Testable Hypotheses

Code	Alternative hypothesis	Expected relationship
H1	AI-enabled digital financial capability is significantly positively associated with working-capital efficiency.	Positive
H2	ESG-oriented working-capital practices are significantly positively associated with working-capital efficiency and resilience.	Positive
H3	Global economic uncertainty is significantly negatively associated with working-capital efficiency.	Negative
H4	Supply-chain risk is significantly negatively associated with conventional working-capital efficiency and increases precautionary working-capital requirements.	Negative
H5	AI-enabled financial capability significantly mitigates the adverse effect of uncertainty on working-capital efficiency.	Positive moderation
H6	ESG orientation positively strengthens the relationship between digital financial capability and resilient working-capital management.	Positive moderation

Corresponding null hypotheses state that each proposed relationship or moderating effect is not statistically significant.

$$WCME_{it} = \beta_0 + \beta_1 AIDIG_{it} + \beta_2 ESG_{it} + \beta_3 UNC_t + \beta_4 SCR_{it} + \beta_5 (AIDIG \times UNC)_{it} + \beta_6 (AIDIG \times ESG)_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where WCME represents working-capital-management efficiency; AIDIG represents AI/digital financial capability; ESG represents sustainability orientation; UNC represents global or macroeconomic uncertainty; SCR represents supply-chain risk; X represents firm-level control variables; μ_i represents firm-specific effects; λ_t represents time effects; and ε_{it} represents the error term. When the cash conversion cycle is used directly as the dependent variable, interpretation must be reversed because a shorter cycle ordinarily represents greater efficiency.

Database and Methodology

Research Design

The present article adopts a structured secondary-research and conceptual-analytical design. Academic research, institutional reports, regulatory material and Indian corporate-finance evidence are synthesised to develop a Finance 5.0 framework for WCM.

No original firm-level regression results are claimed in the present paper because a complete primary empirical database was not supplied. Instead, the study develops hypotheses, variables and an econometric specification capable of subsequent empirical testing.

Proposed Empirical Database

A subsequent empirical extension may use a panel of listed Indian non-financial companies. Financial institutions should preferably be excluded because the interpretation of working capital and liquidity differs substantially for banks and financial intermediaries.

Financial variables may be obtained from audited annual reports and established databases such as CMIE Prowess or Capitaline. AI and digital-transformation variables may be constructed using annual-

report disclosures, technology expenditure, AI-related patents, digital initiatives or a reproducible textual AI-disclosure index. ESG measures may be derived from BRSR/BRSR Core disclosures and consistent ESG-rating databases. Uncertainty may be measured through recognised economic-policy uncertainty, geopolitical-risk or volatility indices. Supply-chain risk may be proxied using supplier concentration, imports, inventory disruption measures or text-based risk disclosures.

Table 3. Proposed Variable Measurement

Construct	Possible measurement
Working-capital efficiency	Cash conversion cycle; net working capital/sales; operating cash flow/current liabilities
AI/digital capability	AI-disclosure index; digital expenditure; AI patents; analytics/automation disclosures
ESG orientation	BRSR indicators; ESG score; sustainable procurement and value-chain indicators
Uncertainty	Economic-policy uncertainty; geopolitical-risk index; market volatility
Supply-chain risk	Supplier concentration; import dependence; disruption disclosures
Profitability	ROA; ROE; operating margin
Financial controls	Firm size; leverage; sales growth; firm age; industry

Econometric Procedure

Empirical testing should begin with descriptive statistics and correlation analysis followed by pooled OLS, fixed-effects and random-effects estimations. The Hausman test may determine the preferred panel estimator. Firm-clustered standard errors should be used to address within-firm correlation.

Multicollinearity may be examined using variance-inflation factors. Continuous accounting variables may be winsorised to reduce the influence of extreme values. Robustness tests should employ alternative WCM measures, lagged AI and ESG variables, sector subsamples and alternative uncertainty indicators.

Endogeneity deserves particular attention because financially stronger firms may be more capable of investing in AI and sustainability, creating reverse causality. Lag structures, instrumental-variable approaches or dynamic-panel methods may therefore be considered where data availability permits. The conventional decision criterion may be $p < .05$, supplemented by consideration of economic significance, coefficient stability and model validity.

Data Interpretations and Evidence-Based Findings

Because the current paper is based on secondary evidence rather than a newly estimated firm-level panel, this section interprets the accumulated research rather than reporting fabricated statistical estimates.

Table 4. Evidence-Based Interpretation

Finance 5.0 dimension	Evidence	Interpretation
Working-capital optimisation	Optimal WCM positions are associated with better corporate performance	WCM should be optimised rather than mechanically minimised
Bank-credit conditions	Credit availability changes WCM policies	External finance remains an important determinant of liquidity strategy
AI and analytics	Digital tools improve prediction and information processing	WCM can move from reactive to predictive management
ESG	ESG is related to corporate risk, performance and stakeholder outcomes	WCM should incorporate supplier/customer sustainability consequences
Supply-chain risk	Risk exposure increases precautionary net working capital	Resilience may require deliberate liquidity and inventory buffers
Indian evidence	Efficient WCM improves corporate fundamentals	Finance 5.0 applications can have substantial relevance for Indian firms

Three broader interpretations emerge. First, working-capital efficiency is conditional rather than absolute. Lower inventory is not always better; longer supplier-payment periods are not always value-enhancing; and minimum cash holdings are not necessarily optimal. External risk alters the appropriate level of financial buffers.

Second, AI changes the information architecture of WCM. The principal contribution of AI is not simply automation of existing processes. Its greater potential lies in forecasting events before they materially affect liquidity. A firm capable of predicting late customer payments, supplier disruption or demand changes can adjust financing and inventory policies before a liquidity problem develops.

Third, sustainability changes the objective function of working-capital management. Traditional WCM optimises the focal firm's cash cycle. Responsible WCM must additionally consider whether financial practices transfer excessive risk to weaker suppliers or undermine long-term supply-chain stability.

Finance 5.0 therefore suggests a movement from working-capital efficiency toward intelligent working-capital resilience, a concept that incorporates liquidity, profitability, prediction, sustainability, stakeholder relationships and adaptability.

Summary

This study examines working capital management as an important corporate-finance application of Finance 5.0. Traditional WCM literature establishes the importance of liquidity, inventory, receivables and payables for corporate performance. But today's corporate finance is more and more affected by AI, real-time digital systems, ESG responsibilities and global instability.

The review shows that efficient working-capital management contributes to profitability and operating effectiveness, financing conditions influence working-capital policies, and supply-chain shocks can increase precautionary working-capital requirements. It also demonstrates that sustainability considerations increasingly extend beyond the reporting firm into suppliers and customers.

The major contribution of the paper is therefore conceptual integration. Rather than analysing AI, ESG, working capital and uncertainty independently, the proposed Finance 5.0 framework connects them within a unified corporate-finance model.

Conclusion

Finance 5.0 represents a significant evolution in the philosophy and practice of corporate financial management. In the working-capital context, it replaces a predominantly accounting-based and historically reactive model with a potentially predictive, data-driven, sustainable and resilience-oriented system.

The central implication of the study is that the objective of modern WCM should not be to minimise working capital at all times. The appropriate objective is to maintain an optimal and adaptive working-capital position capable of supporting operational continuity, profitability and stakeholder value under varying levels of uncertainty.

Artificial intelligence can improve this process with forecasting, pattern identification, automated monitoring and real-time decision support. ESG issues foster more responsible relationships with suppliers and customers.

Dynamic financial capabilities allow firms to change cash, inventory and financing policies when conditions deteriorate. Together, these developments transform working capital from a routine treasury concern into a strategic corporate capability.

For India, the issue is especially significant because rapid financial digitisation coincides with expanding sustainability-reporting expectations and exposure to increasingly complex domestic and international supply chains. Finance 5.0 therefore offers an important framework through which Indian companies can strengthen both short-term financial performance and long-term organisational resilience.

The transformation, however, will not be automatic. AI models can produce poor decisions when underlying data are inaccurate or biased. Automation can encourage excessive reliance on algorithms, while sustainable WCM may sometimes require accepting short-term financial costs to preserve supplier resilience. Finance 5.0 therefore needs a good mix of technology, human judgment, governance and strategic rigour.

Recommendations

Corporate financial functions need to migrate from spreadsheet-based WCM to real-time integrated information infrastructures that link treasury, procurement, sales, inventory and customer-credit information.

- Concentrate on AI use cases that generate and track value such short term cash forecasts, appraisal of risk on receivables, forecasting of inventory, scheduling of payments and stress testing of liquidity rather than technology for technology's sake.
- Resilience measures should be presented with working capital presentations, along with standard efficiency measures. In some situations, a cash conversion cycle longer than specified above may be appropriate, if it provides supply continuity or strategic inventory reserves.
- Integrate ESG into supplier finance and payment policy decisions. The longer payment terms can cause a liquidity burden mismatch for smaller vendors and this is something big companies should be aware of.
- Inflation, interest rate, currency rate, geopolitical and supply chain shocks mean corporate treasurers should do scenario analysis and stress testing to identify the minimal cash and liquidity buffers they need.
- Boards and audit/risk committees should build governance structures for AI-driven financial decision-making. 5.0 Governance In finance, governance should be model validation, oversight

by humans, data quality controls, cyber security and explainability.

- BRSR information should be combined with financial decision tools such that sustainability becomes a part of operational financial management and not a separated annual reporting procedure. This guideline should be followed by Indian listed firms.
- Future empirical work should construct panel data sets to specifically examine the links discussed in this paper, especially the interactive effects of AI capabilities, ESG orientation, uncertainty and supply-chain risk.

Appendix

Explanation Of Jel Classification and Research Hypotheses

Finance 5.0 and Working Capital Management

AI, Sustainability, Resilience and Global Uncertainty

Purpose of this note. This explanatory note clarifies the JEL classification codes and the six testable hypotheses used in the research article on Finance 5.0 and Working Capital Management. It is intended to support conference presentation, methodology writing and interpretation of subsequent empirical results.

JEL Classification: Meaning and Relevance

JEL stands for the Journal of Economic Literature Classification System. It is an internationally used subject-classification framework that helps readers, editors, reviewers and indexing services identify the principal academic areas addressed by a research paper. A research article may legitimately use more than one JEL code when it combines several domains, as this study does.

JEL Code	Meaning	Relevance to the Study
G31	Capital Budgeting; Fixed Investment and Inventory Studies; Capacity	Captures the investment and inventory dimension of working capital, including decisions on inventory holdings and operating assets.
G32	Financing Policy; Financial Risk and Risk Management; Capital and Ownership Structure; Firm Value	Represents the core corporate-finance dimension: liquidity, short-term financing, cash needs, credit dependence and financial resilience.
M15	IT Management	Covers the management use of AI, predictive analytics, automation, blockchain, cloud systems, ERP and digital payments in financial decision-making.
O33	Technological Change: Choices and Consequences; Diffusion Processes	Addresses adoption and economic consequences of AI and other digital technologies in corporate finance.
Q56	Environment and Development; Sustainability	Covers ESG, sustainability, responsible procurement, value-chain considerations and sustainable financial decision-making.

G31 - Capital Budgeting, Investment and Inventory

Although the paper concentrates on working capital rather than long-term capital budgeting, G31 is relevant because inventory is a major component of working capital and represents funds committed to operating assets. The study asks how much inventory a firm should hold, how uncertainty changes the desired inventory buffer, and how AI can improve inventory forecasting.

- A firm holding too much inventory ties up funds and may incur storage, obsolescence and financing costs.
- A firm holding too little inventory may experience stock-outs, production delays and lost sales.
- Under supply-chain uncertainty, an apparently “high” inventory level may be a deliberate resilience buffer rather than evidence of poor management.

Accordingly, G31 captures the investment-allocation aspect of working-capital management and the idea that the objective is an optimal, context-dependent inventory position rather than a mechanically minimal inventory level.

G32 - Financing Policy and Financial Risk Management

G32 is the most central JEL code for the paper because working-capital management is fundamentally a corporate-finance problem. Firms must finance cash requirements, inventories, receivables and other current assets while controlling liquidity risk and the cost of short-term funding.

- Receivables that grow faster than cash collections can create a financing gap.
- Inventory accumulation can increase borrowing needs and interest costs.
- Bank-credit conditions may alter how aggressively or conservatively a firm manages working capital.
- Precautionary cash and liquidity buffers become more important during uncertainty and supply-chain disruption.

Hence, G32 represents the paper’s corporate-finance foundation: liquidity, financing policy, risk management and firm resilience.

M15 - IT Management

M15 is relevant because Finance 5.0 is strongly technology-enabled. The study considers how corporate finance functions can use AI, machine learning, predictive analytics, automation, blockchain, the Internet of Things, cloud-based systems, enterprise-resource-planning platforms and digital payments to improve working-capital decisions.

The key conceptual shift is from reactive management to predictive management. For example, instead of discovering a late customer payment only after the due date, an AI-based system may estimate default or delay risk in advance and allow the firm to adjust collections, credit limits or liquidity arrangements.

O33 - Technological Change

O33 provides a broader innovation perspective. Whereas M15 concerns the management and organisational use of information technology, O33 focuses on the adoption, diffusion and consequences of technological change. It is therefore suitable for analysing whether the adoption of AI and digital finance changes forecasting quality, working-capital behaviour, risk management and financial resilience.

AI adoption → better information and forecasting → better working-capital decisions →
stronger liquidity and resilience

Q56 - Sustainability

Q56 captures the sustainability and ESG dimension of the research. Conventional working-capital management focuses largely on liquidity and profitability. Finance 5.0 expands the objective to include stakeholder resilience and sustainability. A policy may improve the focal firm's cash position while imposing liquidity stress on suppliers, particularly smaller suppliers.

For example, extending supplier-payment terms from 30 days to 90 days may shorten the buying firm's cash requirement but transfer financial pressure to the supplier. Sustainable working-capital management therefore asks whether a policy is financially efficient and also responsible toward suppliers, customers and the wider value chain.

Traditional WCM: Liquidity + Profitability

Finance 5.0 WCM: Liquidity + Profitability + Sustainability + Stakeholder Resilience

Conceptual Model and Variable Meaning

The hypotheses are organised around a panel-data model in which working-capital-management efficiency is influenced by digital capability, ESG orientation, uncertainty and supply-chain risk, together with interaction effects and control variables.

$$WCME_{it} = \beta_0 + \beta_1 AIDIG_{it} + \beta_2 ESG_{it} + \beta_3 UNC_t + \beta_4 SCR_{it} + \beta_5 (AIDIG \times UNC)_{it} + \beta_6 (AIDIG \times ESG)_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Symbol	Meaning
WCME	Working Capital Management Efficiency
AIDIG	AI-enabled / digital financial capability
ESG	Environmental, Social and Governance orientation
UNC	Global or macroeconomic uncertainty
SCR	Supply-chain risk
X	Control variables such as size, leverage, profitability, sales growth and industry
μ_i	Firm-specific effects
λ_t	Time effects
ε_{it}	Error term

Detailed Explanation of the Six Hypotheses

Hypothesis 1: AI-Enabled Digital Capability and Working-Capital Efficiency

Null hypothesis: H_{01} : AI-enabled digital financial capability is not significantly positively associated with working-capital-management efficiency.

$$H_{01}: \beta_1 \leq 0$$

Alternative hypothesis: H₁: AI-enabled digital financial capability is significantly positively associated with working-capital-management efficiency.

$$H_1: \beta_1 > 0$$

Expected sign: Positive (+)

Economic rationale. Higher AI capability should improve the quality and speed of information available to treasury and finance managers. Better forecasts and earlier warning signals should support better inventory, receivables, payables and cash decisions.

The relationship can operate through:

- cash-flow forecasting;
- inventory-demand forecasting;
- identification of slow-moving inventory;
- customer-credit and payment-risk assessment;
- prediction of delayed receivables;
- optimisation of payment schedules; and
- real-time liquidity monitoring.

Empirical interpretation. If β_1 is positive and statistically significant at $p < .05$, H₁ is supported. This would indicate that firms with stronger AI/digital capability have significantly better working-capital efficiency.

Hypothesis 2: ESG Orientation and Working-Capital Efficiency/Resilience

Null hypothesis: H₀₂: ESG-oriented working-capital practices are not significantly positively associated with working-capital efficiency and resilience.

$$H_{02}: \beta_2 \leq 0$$

Alternative hypothesis: H₂: ESG-oriented working-capital practices are significantly positively associated with working-capital efficiency and resilience.

$$H_2: \beta_2 > 0$$

Expected sign: Positive (+)

Economic rationale. ESG can strengthen working-capital resilience by improving relationships with suppliers and customers and reducing the likelihood that short-term financial policies undermine the stability of the value chain.

The relationship can operate through:

- responsible supplier relationships;
- sustainable procurement practices;
- better value-chain stability;
- improved stakeholder confidence;
- lower disruption risk; and
- more responsible inventory and payment policies.

Empirical interpretation. If $\beta_2 > 0$ and $p < .05$, H2 is supported. A positive result suggests that ESG-oriented firms manage working capital in a way that supports both financial efficiency and resilience.

Hypothesis 3: Global Uncertainty and Working-Capital Efficiency

Null hypothesis: H₀₃: Global economic uncertainty does not significantly reduce working-capital efficiency.

$$H_{03}: \beta_3 \geq 0$$

Alternative hypothesis: H₃: Global economic uncertainty is significantly negatively associated with working-capital efficiency.

$$H_3: \beta_3 < 0$$

Expected sign: Negative (–)

Economic rationale. Uncertainty can increase the amount of cash, inventory and financing needed to maintain operations. This tends to reduce conventional measures of working-capital efficiency even where the additional buffer is economically sensible.

The relationship can operate through:

- delayed customer payments;
- higher inventory requirements;
- supply-chain interruptions;
- higher financing costs;
- exchange-rate and interest-rate volatility;
- uncertain customer demand; and
- greater precautionary cash requirements.

Empirical interpretation. If $\beta_3 < 0$ and $p < .05$, H3 is supported. The result would imply that greater uncertainty significantly weakens conventional working-capital efficiency.

Hypothesis 4: Supply-Chain Risk and Working Capital

Null hypothesis: H₀₄: Supply-chain risk does not significantly adversely affect working-capital efficiency.

$$H_{04}: \beta_4 \geq 0$$

Alternative hypothesis: H₄: Supply-chain risk significantly reduces conventional working-capital efficiency and increases precautionary working-capital requirements.

$$H_4: \beta_4 < 0$$

Expected sign: Negative (–)

Economic rationale. Higher working capital under supply-chain risk should not automatically be labelled inefficient. Under Finance 5.0, a higher buffer may be a purposeful resilience strategy that protects production continuity and customer service.

The relationship can operate through:

- maintain additional strategic inventory;
- hold more precautionary cash;
- diversify suppliers;
- provide more flexible terms to strategic customers;
- reduce dependence on supplier credit; and
- maintain financing buffers.

Empirical interpretation. If $\beta_4 < 0$ and $p < .05$, H4 is supported when WCME is defined so that higher values represent greater efficiency. The substantive interpretation is that supply-chain risk imposes a working-capital cost and encourages precautionary buffers.

Hypothesis 5: AI as a Moderator of Uncertainty

Null hypothesis: H₀₅: AI-enabled financial capability does not significantly moderate the relationship between uncertainty and working-capital efficiency.

$$H_{05}: \beta_5 \leq 0$$

Alternative hypothesis: H₅: AI-enabled financial capability significantly reduces the adverse effect of uncertainty on working-capital efficiency.

$$H_5: \beta_5 > 0$$

Expected sign: Positive interaction (+)

Economic rationale. This is a moderation hypothesis. It does not merely ask whether AI directly improves efficiency. It asks whether AI changes the strength of the uncertainty–WCM relationship. The expected positive interaction means that firms with stronger AI capability should experience a smaller deterioration in WCM efficiency when uncertainty rises.

The relationship can operate through:

- predict cash shortages earlier;
- detect payment delays sooner;
- identify supply-chain disruptions faster;
- adjust inventory more accurately;
- perform real-time scenario analysis; and
- generate earlier risk-warning signals.

Empirical interpretation. If $\beta_5 > 0$ and $p < .05$, H5 is supported. For example, if uncertainty reduces WCME by 10% in low-AI firms but by only 4% in high-AI firms, AI has mitigated the adverse effect.

Without strong AI: Uncertainty → larger deterioration in WCM efficiency

With strong AI: Uncertainty → smaller deterioration in WCM efficiency

Hypothesis 6: ESG as a Moderator of Digital Capability

Null hypothesis: H₀₆: ESG orientation does not significantly strengthen the relationship between digital financial capability and resilient working-capital management.

$$H_{06}: \beta_6 \leq 0$$

Alternative hypothesis: H_6 : ESG orientation significantly strengthens the positive relationship between digital financial capability and resilient working-capital management.

$$H_6: \beta_6 > 0$$

Expected sign: Positive interaction (+)

Economic rationale. The hypothesis proposes complementarity between digital capability and ESG. AI can improve efficiency by itself, but AI embedded within a strong ESG orientation may also improve the quality and responsibility of supplier, customer and inventory decisions.

The relationship can operate through:

- sustainable procurement analytics;
- responsible supplier-payment policies;
- supplier-risk identification;
- value-chain ESG monitoring;
- sustainable inventory policies; and
- better alignment of technology with stakeholder outcomes.

Empirical interpretation. If $\beta_6 > 0$ and $p < .05$, H_6 is supported. This means that the value of digital capability for resilient WCM is stronger when ESG orientation is also high.

AI alone → higher financial efficiency

AI + strong ESG → financial efficiency + stakeholder responsibility + resilience

Consolidated Hypothesis Table

Hypothesis	Relationship Tested	Expected Sign	Economic Interpretation
H1	AI/Digital Capability → WCM Efficiency	+	AI improves prediction, information quality and working-capital decisions.
H2	ESG → WCM Efficiency/Resilience	+	Responsible practices strengthen supplier/customer relationships and value-chain resilience.
H3	Global Uncertainty → WCM Efficiency	–	Uncertainty increases liquidity, inventory and financing pressure.
H4	Supply-Chain Risk → WCM Efficiency	–	Disruption encourages precautionary working-capital buffers and raises the cost of maintaining continuity.
H5	AI × Uncertainty → WCM Efficiency	+	AI mitigates the adverse effect of uncertainty.
H6	AI × ESG → Resilient WCM	+	ESG strengthens the value of digital financial capability for resilient working-capital management.

Important Methodological Note: Dependent-Variable Coding

The signs stated above assume that WCME is constructed so that a higher value represents better working-capital-management efficiency. If the researcher instead uses the Cash Conversion Cycle (CCC) directly as the dependent variable, some signs may reverse because a lower CCC generally indicates greater efficiency.

Higher WCME = better efficiency

Lower CCC = generally better efficiency

Example: if AI improves efficiency by reducing the Cash Conversion Cycle, AI has a positive economic relationship with working-capital efficiency but may have a negative regression coefficient when CCC itself is the dependent variable.

AI improves WCM efficiency → CCC decreases → coefficient on AI in a CCC regression

may be $\beta_1 < 0$

Therefore, the paper should define the dependent variable and its direction before stating expected coefficient signs. This avoids a common interpretation error in working-capital research.

6. Decision Rule for Empirical Testing

For each hypothesis, statistical significance should ordinarily be evaluated at the 5% level, subject to model validity and economic significance.

- If $p < .05$ and the coefficient has the expected sign, the corresponding alternative hypothesis is supported.
- If $p \geq .05$, there is insufficient statistical evidence to support the proposed relationship.
- If $p < .05$ but the coefficient has the opposite sign, the hypothesised directional relationship is not supported, even though a statistically significant relationship exists.
- For H5 and H6, interpretation must focus on the interaction term and, ideally, marginal effects or interaction plots, not only the individual coefficients of AI, ESG or uncertainty.
- Economic significance should be discussed alongside statistical significance; a very small coefficient can be statistically significant in a large sample but economically unimportant.

Concluding Clarification

Taken together, the JEL codes and hypotheses position the paper at the intersection of corporate finance, information-technology management, technological change and sustainability. The six hypotheses operationalise the central Finance 5.0 argument: AI-enabled capability and ESG orientation are expected to improve working-capital outcomes, global uncertainty and supply-chain risk are expected to create adverse pressure, and AI/ESG capabilities are expected to improve resilience by moderating these pressures.

The framework therefore moves beyond the traditional objective of merely shortening the cash conversion cycle. It evaluates whether firms can use technology and responsible financial practices to achieve an optimal, adaptive and resilient working-capital position under changing business conditions.

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