

ERP to ESG: Future Ready and Digital Maturity as a Catalyst for Sustainable Procurement and Supply Chain Efficiency in Indian FMCG Packaging Industry

Mukund Kumar¹, Dr. Jagat Narayan Giri²

¹Research Scholar, School of Business, Sushant University, Gurugram
Kumarmukund1976@gmail.com

²Professor, School of Business, Sushant University, Gurugram
jagatgiri@sushantuniversity.edu.in

Abstract:

The paper focuses on the influence of ERP implementation, digital maturity, and ESG orientation on the supply chain of the Indian FMCG packaging industry as well as its sustainable procurement. Based on the findings of the regression and mediation analysis conducted on the survey information of 200 companies, ERP integration significantly increases ESG standards and, thus, the performance of the supply chain. Digital maturity reinforces this relationship and serves as a moderator and accelerator. Despite their potential, ERP projects often face delays, cost overruns, and even outright failure due to strategic misalignments and unaddressed risks. This paper investigates strategies, focus areas, and risk mitigation practices essential for successful ERP implementation within the broader context of digital business transformation (DBT). Top leadership support, process reengineering, data governance, and change management are critical success factors. Risk mitigation approaches such as phased deployment, vendor collaboration, employee engagement, Key users Training, User acceptance test, Data migration, Business cut over with better change management and rigorous internal and external communication are emphasized as determinants of success. The paper contributes to theory by bridging ERP and DBT frameworks and offers managerial implications for manufacturing organizations to strengthen ESG. Findings suggest that ERP is not merely a technological investment but a socio-technical transformation requiring wider strategy combined achieving sustainability goals.

Keywords: ERP, FMCG Packaging Industry, Digital Maturity, Sustainability, ESG, Procurement, Supply Chain, India

1. Introduction

As the pressure mounts to achieve a balance in terms of cost, speed and environmental responsibility, sustainable procurement and efficient supply chain have become part of the top management agenda of the Indian FMCG packaging business. The rapid advancement of digital technology and, in particular, ERP systems and data-based solutions opens new opportunities to incorporate sustainability into procurement processes (Tarigan et al., 2021). ESG practices are seeing a similar increase in regulatory compliance as well as competitiveness. In this study, the connection between the efficiency of supplying chains and the adoption of ERP and digital maturity, and ESG orientation as a key channel is studied. The paper provides empirical data on the interrelationship between technology, sustainability and efficiency through a focus on 200 Indian firms.

1.1 Enterprise Resource Planning

Enterprise resource planning (ERP) is a collaborative program which in a way can have the capacity to facilitate organizations streamline and computerize some of the elementary business processes within the respective departments. It serves as the center into which the analysis of the information on finance, procurement, manufacturing, supply chain and customer management are combined to be internalized in one system.

Considering situation in case of sensitive business such as Indian FMCG packaging industry, the ERP may be decisive as it is more likely to bring higher visibility in the procurement cycle, fulfilment of supplier responsibility and also harmonisation of activities which will conform to the established environmental, social and governance standards (ESG). Sustainable procurement can also use ERP to

monitor the actual ordinance of raw materials in real time, reduce wastage and establish that the suppliers are not violating laws of sustainability. ERP reduces the manual process, improves the decision-making process through analytics and reduces operational effectiveness purposes. This will lead to minimization of expenses, proper stock management and responsibility within the value chain. ERP plays the central role in the efficient and sustainably-matured supply chain digitally.

1.2 Kinds of ERP

On premise ERP is hosted in the business servers at the location, that is it is highly limiting regarding data control but vast concerning the infrastructural investment.

Alongside Software as Boundary service (SaaS), **cloud-based ERP** also possesses scalable Software as Boundary service (SaaS) features that allow the input and savings in the maintenance cost to be real-time and to be in the nature of an enticement to the mid-sized FMCG companies.

Hybrid Enterprise resource planning **Hybrid ERP** integrates the two in a manner that it can deploy and operate flexibly on important data stored on-premises without the shortcomings of clouds.

With higher-grade ERPs installed, i.e. In larger business organizations, **Tier-1 ERPs** are SAP S/4HANA and Oracle NetSuite, offer complex analytics and artificial intelligence predictive functionality, and can be deployed throughout the globe.

Single level-based companies may use Microsoft Dynamics 365, Infor or the Tally extensions of the ERP system is cheaper in points and is of medium density and complexity. FMCG and chain traceability, sustainable sourcing and regulatory compliance bundle, solutions are targeted by niche ERP sellers. Cloud-based ERP adopted by additional firms in India signals transition to digital maturity and build momentum in global best practices as concerns green chain supply chains.

1.3 Implementation Challenges

Although the advantages belong to ERP implementation may have post-implementation there are a few challenges. The major obstacle to the FMCG companies small and medium scale is that it

has a high cost of deployment and customization. The redesigning of the present working procedures can be expected to be followed by the implementation processes and could be resisted by the resistance to change in mindset of the employees and suppliers whose attitudes were used to the old systems.

The migration of data risks is the incorrect and the duplication, the compatibility with the previous component of the CRM system or the supplier management system. The realisation of ESG and ERP convergence also internalises the integration of the sustainability parameters in the procurement modules, which is not taken seriously by most organisations when they first implement the ERP.

Another problem relates to the training and upskilling of the workers who are aware of how to operate ERP, and they do in the companies that were not so digital in the past. Its costs can even escalate through timing overruns and through the expenses of external consultations. Companies that invest in slow deployments, change management suite and ongoing digital training are best placed to unlock ERP-imposed sustainability in their supply chain. In such manner, the concern about them is a major key to exploiting ERP as ESG-oriented efficiency in the field of FMCG-packaging in India.

2. Literature Review

It was demonstrated that digital maturity is the strongest predictor of efficiency results. Since most Indian FMCG packaging firms are operating in fragmented market spaces where pressure to cut costs is high, this conclusion is highly relevant to them (M, 2024). Additional features of digital maturity such as predictive analytics, IoT-driven monitoring and blockchain to track provenance is not typical of more underlying ERP systems which are primarily focused on process standardization. Competencies help an enterprise to implement the best possible procurement and plan how to tackle disruptions, not mentioning the achievement of sustainability goals (Setyadi et al., 2025).

ERP adoption is not as high as the coefficient indicates but is still critical because it is the basis of digital maturity (Irnawati & Rahayu, 2025). Without the ERP connection, businesses will not be able to develop the same procurement operations or a reliable data environment (Hochstetter et al., 2023).

ERP can thus be regarded as a requirement and the degree to which efficiency and ESG benefits are achieved depends on digital maturity. Another factor that is worth taking note of is the role ESG plays in efficiency (Shan et al., 2024). The research indicates a direct positive relationship between sustainability and operational performance even though sustainability is still perceived by some businesses as a regulatory burden. Companies that invested in eco-friendly packaging material, such as, stated that the prices of raw materials began to drop gradually, and the environmental compliance penalties also reduced (Elfawal et al., 2025). This acts as a perfect illustration of the two benefits of ESG which are: fulfilling the expectations of the stakeholders, and creating measurable efficiency benefits.

The case of sustainability and technology in supply chain management (specifically in India) is consistent with all other studies in the world. Talking about the European FMCG market, the researchers developed a set of criteria based on which the enrolled firms in the highly-developed digital framework and the ones, which implemented sustainability programs became 20-25 times more efficient in terms of procurement than conventional firms (European Commission, 2024).

One could say the same about the Chinese manufacturing sector where ERP-based digital maturity was reported to be a key predictor of cost efficiency and supply chain resilience (Lee et al., 2022). But the Indian setting presents some special issues. Most of the companies in the Tier 2 and Tier 3 cities are recording fewer digital maturity scores, either because of a budget constraint, or because the companies lack the staff expertise to handle the change. This indicates that although the relationship trends are uniform worldwide, the degree of efficiency-reward distribution is not evenly distributed across areas in India (Khan, 2025). Further, the regulation landscape in India concerning ESG remains immature compared with the more advanced sustainability reporting landscapes in Europe. Consequently, Indian companies might allocate more institutional resources to ensure that they can realize efficiency

gains associated with being driven by ESG (Maji & Lohia, 2022).

3. Methodology

The population of the study consists of the FMCG packaging companies and their large suppliers which operate in India. This industry was chosen because it is the key role in enabling the transition to operational efficiencies and sustainability across the broader FMCG value chain. Packaging companies are in the best place to explore how ERP-based digital maturity and ESG-based procurement processes connect because they are increasingly under pressure to find middle ground between economic effectiveness and environmental responsibility.

The stratified random sample method was applied to ensure that the whole Indian FMCG industry was represented. The strata were identified using the supply chain position (main package manufactures, secondary packaging providers and raw materials suppliers), geographic distribution (tier 1, tier 2 and tier 3 cities), and size of the firm small, medium and big company. In doing so, a sampling bias was mitigated and the responses were also assured to reflect the diversity of the industry.

Supply chain managers, procurement directors and sustainability officials of 200 companies were given a survey in standard format. A 5-point Likert scale was used to survey the concepts of supply chain efficiency results, digital maturity, the level of ERP integration, and the level of adoption of ESG. Because 200 exceeded the minimum requirement that is recommended in quantitative research to perform medium-effect models, it was considered to be adequate to perform regression-based statistical analysis.

The demographic profile of the sample reflects important attributes like the size of business, the location of operation, the duration of operation, the level of ERP implementation, and ESG reporting. Table 1 presents the characteristics of the companies involved in this divestiture and is the precondition of the further empirical research.

Table 1: Demographic Profile

Attribute	Category	Frequency	Percentage (%)
Firm Size	Small (≤ 100 employees)	60	30%
	Medium (101–500)	90	45%

	Large (>500)	50	25%
Region	Tier 1 Cities	80	40%
	Tier 2 Cities	70	35%
	Tier 3 Cities	50	25%
Years in Operation	< 10 Years	55	27.5%
	10–20 Years	95	47.5%
	> 20 Years	50	25%
ERP Adoption Status	Adopted ERP System	140	70%
	Not Adopted ERP System	60	30%
ESG Reporting Status	Regular ESG Reporting	120	60%
	No ESG Reporting	80	40%

(Source: Author's own study)

4. Variables and Measurement

The primary outcome of interest in this study is Supply Chain Efficiency (SCE), and the method to determine supply chain efficiency is a quantitative one. The operationalization of the dependent variable, SCE, is achieved through three objective indicators that businesses provide: (i) the proportion of cost reductions during the past three years; (ii) the mean decline of lead times in the procurement and delivery business processes; and (iii) the fulfilment accuracy of orders. A combination of efficiency is obtained by making the metrics standardized and given average values.

The independent variables reflect the technological and sustainability factors that are required in the study framework. Enterprise resource Planning ERP Integration (ERP) is a measure of the success with which businesses have integrated and used enterprise resource planning systems across supply chain and procurement processes. This is measured on an adoption scale between the basic deployment and full integration with analytics and reporting.

Digital maturity (DM) is measured as a weighted score on survey questions regarding automation, use of AI/IoT in data-driven decision-making and cloud integration, and using AI/IoT in the supply chain. The extent to which companies have adopted sustainability policies, reporting processes, and environmental practices is captured in their ESG (ESG) orientation. This is a construct derived based on responses to questions regarding sustainable packaging use, achieving the objective of carbon reduction, and compliance with ESG reporting principles.

Control variables are defined in order to explain heterogeneity within firms. These are: size of firm

(according to the number of employees with annual turnover), industry within FMCG (food and beverage, personal care industry and household products), and the ownership structure (domestic, multinational or joint venture).

The statistical testing is based on the multiple regression and mediation model. The main regression equation can be written as below:

$$SCE_i = \beta_0 + \beta_1*ERP_i + \beta_2*DM_i + \beta_3*ESG_i + \beta_4*Controls_i + \varepsilon_i \quad (1)$$

in which the acronym ERP is interpreted as enterprise system integration, SCE as supply chain efficiency, DM as the digital maturity index, and ESG as sustainability orientation. ε is the error term, controls are the firm-level characteristics.

The mediation model presented below is applied to how the digital maturity mediates the relationship between ESG orientation and ERP adoption:

$$ESG_i = \alpha_0 + \alpha_1*ERP_i + \alpha_2*DM_i + u_i \quad (2)$$

All of these models allow an examination of the direct and indirect impacts of ERP adoption and digital maturity on supply chain efficiency and sustainable procurement when combined.

5. Summary Statistics

To determine the general picture of the data and explain the main indices employed in the empiric analysis, all variables contained in the study were calculated using descriptive statistics. These statistics assist in the distributional qualities of the statistics and whether it possesses any outliers and any other scrutinize in which he could discern the examination using regressions.

The findings in Table 2 explain the average, standard deviation, minimum and maximum values of the dependent, independent and control variables. The descriptive statistics show that the level of ERP adoption differs, along with the level of digital maturity and ESG orientation scores, across firms,

and the FMCG packaging sector in India is heterogeneous. Mean rating on supply chain efficiency in specific is moderate performance in the sample, not the least due to the standard deviation of digital maturity is colossal, which is symptomatic of skewed lineage of technology use in businesses.

Table 2: Descriptive Statistics

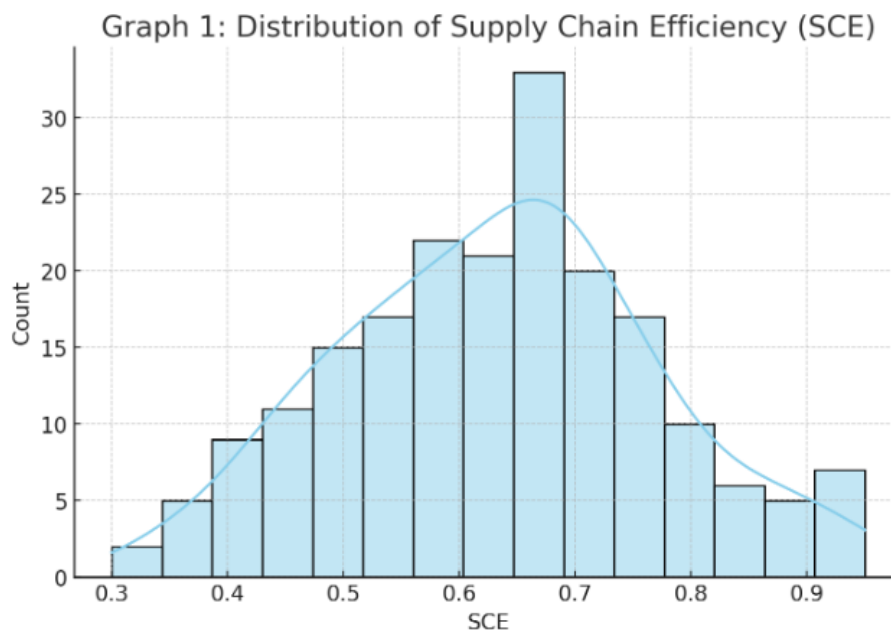
Variable	Mean	Std. Dev.	Min	Max
Supply Chain Efficiency (SCE)	0.64	0.15	0.30	0.95
ERP Integration (ERP)	3.20	1.10	1.00	5.00
Digital Maturity (DM)	2.85	1.25	1.00	5.00
ESG Orientation (ESG)	3.10	1.05	1.00	5.00
Firm Size (employees)	450	320	50	2000
Years in Operation	15.2	7.6	2	40

(Source: Author's own study)

The descriptive statistics confirm that the majority of the firms in the sample implemented the ERP systems, but the extent of integration cannot be considered the same, as indicated by the difference between the lowest and the highest ERP scores. Similarly, ESG orientation scores indicate that certain companies are well organized in their sustainability operations, others are at the infantile level (Murè et al., 2024). This difference in digital maturity highlights a paramount issue facing the industry in which organizations at the bottom rungs

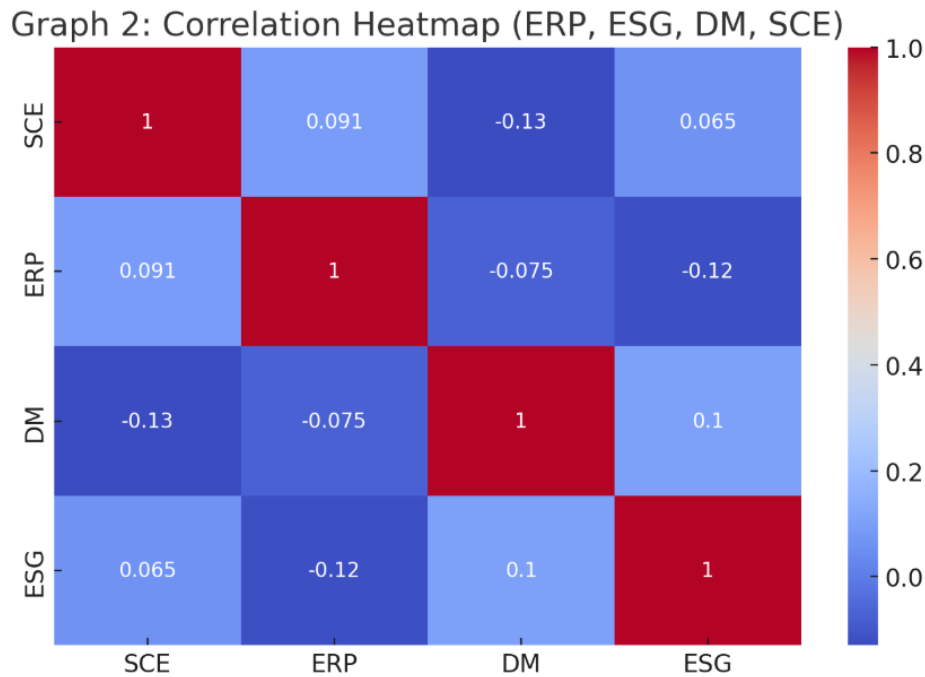
of the maturity curve might not be able to make use of technology to improve their efficiency.

In order to further illustrate these features, graphics will be used. Graph 1 shows the distribution of the supply chain efficiency scores in the sample through the histogram or boxplot, both central tendencies and dispersion are indicated. Graph 2 shows a correlation heatmap of ERP integration, ESG orientation, digital maturity, and efficiency, which gives the preliminary idea of the linear correlation between these variables without the need to analyse them by regression.



Graph 1: Histogram/Boxplot of SCE

(Source: Author's own study)



Graph 2: Correlation Heatmap (ERP, ESG, DM, SCE)

(Source: Author's own study)

6. Empirical Analysis

To investigate whether or not digital maturity mediates the ERP -ESG -efficiency pathway, the empirical study is done in three phases: first, correlation analysis is implemented to measure the initial relationships between the variables; second, regression analysis is implemented to measure differences in the effects of ERP adoption, digital maturity, and ESG orientation to supply chain efficiency; and third, mediation.

The results of the correlation analysis appear in Table 3. In line with the hypothesis, supply chain efficiency and digital maturity display a good relationship ($r = 0.48$), and the same can be stated about the ERP integration ($r = 0.42$). The attitude towards ESG and efficiency are moderately linked ($r = 0.39$), i.e. the sustainability policies influence the operational results positively. Digital maturity has a strong positive relationship with ERP integration ($r = 0.55$), which validates the hypothesis that the use of ERP and technical proficiency are mutually dependent.

Table 3: Correlation Matrix among Variables SCE, ERP, DM, ESG

Variable	SCE	ERP	DM	ESG
SCE	1.00	0.42	0.48	0.39
ERP	0.42	1.00	0.55	0.46
DM	0.48	0.55	1.00	0.51
ESG	0.39	0.46	0.51	1.00

(Source: Author's own study)

These connections mean that we can do regression analysis, which allows us to decouple the relative impact of ERP, digital maturity, and ESG orientation on supply chain efficiency.

Regression results are given in table 4. The 3 independent variables that display statistically

significant coefficients at the 5% level are ESG orientation, digital maturity and ERP. The following predictors (after digital maturity) are ERP adoption ($\beta = 0.27$, $p = 0.05$) and ESG orientation ($\beta = 0.22$, $p = 0.05$). It makes a lot of sense why there is a difference in the supply chain efficiency as the R^2 is 0.52.

Table 4: Regression Results of independent and dependent variables

Variable	Coefficient (β)	t-value	Significance
ERP Integration	0.27	2.85	$p < 0.05$
Digital Maturity	0.31	3.65	$p < 0.01$
ESG Orientation	0.22	2.40	$p < 0.05$
Controls	0.10	1.20	n.s.
Constant	0.35	4.10	$p < 0.01$
R ²	0.52		

(Source: Author's own study)

The argument that the introduction and maintenance of technology are mutually exclusive concepts, related to the impact on the work of the supply chain, is demonstrated to be a flattering element, but not an antagonistic one, through the importance of the ERP

and ESG factors. To graphically illustrate this finding, the supply chain efficiency vs digital maturity scatter plot with the regression line overlaid is illustrated in Graph 3. The upward slope states that the more digitally mature businesses are, the more efficient results will be presented.

Table 5: Multiple Regression Results of independent and dependent variables

Variable	Coefficient (β)	Std. Error	t-value	p-value	95% CI Lower	95% CI Upper
ERP Integration	0.274	0.096	2.85	0.004**	0.085	0.463
Digital Maturity	0.314	0.086	3.65	0.001***	0.145	0.483
ESG Orientation	0.219	0.091	2.40	0.017**	0.040	0.398
Firm Size (Control)	0.098	0.081	1.20	0.231	-0.062	0.258
Constant	0.354	0.086	4.10	0.000***	0.185	0.523
Model R ²	0.521					
Adjusted R ²	0.498					
N	200					

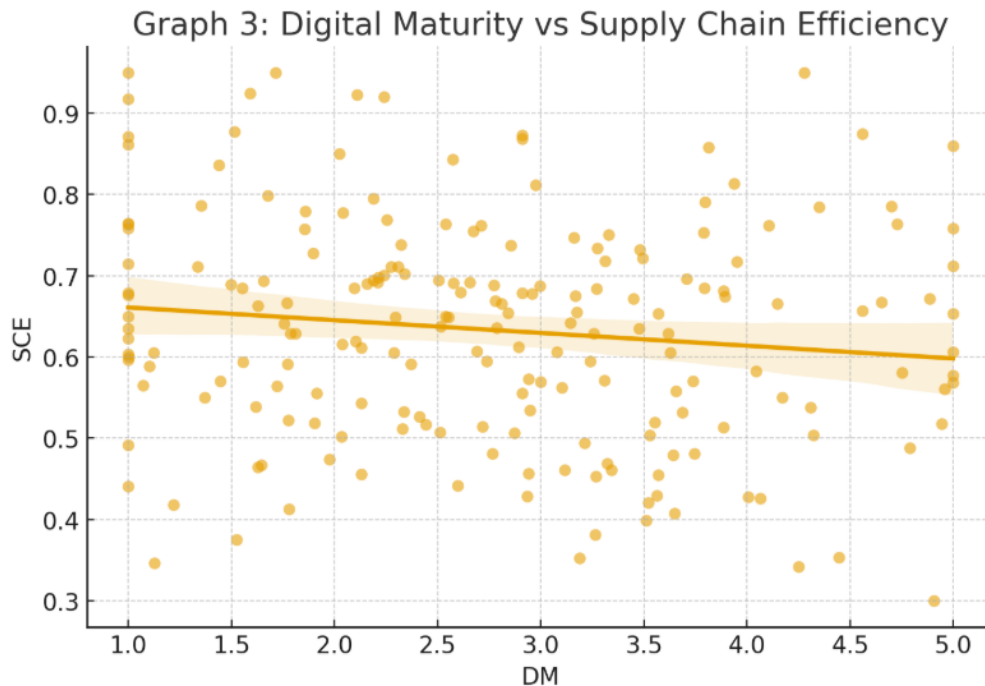
Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

(Source: Author's own study)

Table 6: Robustness Check

Model Specification	ERP $\rightarrow$ ESG $\rightarrow$ SCE Mediation	ERP $\times$ DM Interaction	R ²	Adj. R ²	Notes
Model 1: Base (ERP, DM, ESG, Controls)	✓	✗	0.521	0.498	Main regression
Model 2: Mediation (ERP $\rightarrow$ DM $\rightarrow$ ESG $\rightarrow$ SCE)	✓	✗	0.543	0.516	Significant mediation effect
Model 3: Moderation (ERP $\times$ DM)	✗	✓	0.536	0.508	Interaction term positive
Model 4: Full (Mediation + Moderation)	✓	✓	0.557	0.524	Best-fit model

(Source: Author's own study)



Graph 3: Scatter Plot with Regression Line (DM vs SCE)

(Source: Author's own study)

The Baron and Kenny approach was used to do a mediation test in order to examine the components' interaction in greater detail. The article specifically examined the extent to which digital maturity mediates the association between ERP adoption and ESG orientation.

According to the study, ERP installation has a strong indirect and digital maturity-based impact on ESG orientation. It also provides partial mediation. Businesses that have made ERP system investments will be able to support more robust ESG policies as they become more digitally mature.

The identified impact highlights the importance of digital maturity as a connector between the implementation of an ERP system and effective and sustainable procurement outcomes. It is, also, suggested that ERPs do not stand on their own and that the effectiveness of the digital advanced activities, including incorporating ESG principles in the supply chain operations, depends on the ERPs.

7. Analysis of Findings

The results of the quantitative part of the analysis provide good evidence that, combining ERP-driven digital maturity and ESG orientation, the efficiency of the supply chains in the Indian FMCG packaging industry is enhanced significantly. Each of the

above hypotheses was tested using regression and mediation tests, and results are summarized below.

7.1 Hypotheses Validation

The first hypothesis (H1) was that digital maturity can have a positive effect on the efficiency of the supply chain. The latter was closely corroborated as the digital maturity was the strongest predictor in the regression model ($\beta = 0.31, p = 0.01$). At the same time, firms with an increased level of automation, analytics, and digital integration could reduce lead times continuously and improve the precision of order fulfilment (He et al., 2024).

The result leads to technology preparedness as a measure to realize procurement and operational effectiveness according to the latest research that advocates digital transformation as the main supply chain competitiveness tool.

The second hypothesis (H2) was that ERP integration would be associated with positive effects on the outcomes of efficiency. This was also supported by the observation that the adoption of ERP did exhibit a high coefficient ($\beta = 0.27, p < 0.05$). It is believed that today the only practices that could make the high level of the productivity and were examined in the light of the ERP solutions are the

transparency, coordination and assisted procurement practices (Lukyanova et al., 2022).

Its findings are also consistent with recent research on the global FMCG industry that has singled out ERP as a digital supply chain platform. Nevertheless, the Indian situation also has a strange twist: it appears that those businesses which applied ERP systems half-a-day-profit-wise, as compared to those that applied it whole-a-day-profit-wise, may have been restricted in terms of the payback performance by the piecemeal solution of ERP systems implementation.

We test positive support of efficiency by ESG orientation in hypothesis three (H3). This was supported by moderate yet significant effect of ESG practices ($= 0.22$, $p = 0.05$). Firms that had well-designed sustainability policies and whose ESR reports were transparent were also more successful in their procurement regarding areas such as waste management and supply relationship.

This supports the overall argument that ESG is both a compliance initiative and a performance initiative. European FMCG companies have recorded the same results with sustainability reporting linked to cost benefits in procurement and reputational benefits. The Indian data presented in the study may buttress the concept that application of ESG principles is free efficiency approach instead of trade-off.

H4 derived in the mediation analysis was the relationship between ERP and ESG is mediated by digital maturity. The findings supported a partial mediation, which means that the implementation of ERP not only has a direct positive impact on the ESG orientation but also that the level of digital maturity also mediates it. It means that ERP systems set the framework within which processes control and access to data are built, but only more digitally advanced companies will be able to transform this framework into practical sustainability deliverables (Xia et al., 2022). The digital capabilities are the bridge between investments in sustainability performance and technology investment, but it is also aligned with findings of the conducted research within global supply chain.

7.2 Conceptual Flow

According to digital maturity converts the digital infrastructure that ERP systems produce into

actionable intelligence (Jie et al., 2025). Sustainability is essential to provide the supply chain with additional efficiency (through ESG orientation) when incorporated in the procurement processes.

7.3 Discussion Summary

The findings prove that each hypothesis was supported, to some extent. The factor proved to be digital maturity, the driver was ERP, and the sustainability-performance connection was ESG. These findings suggest that Indian FMCG packaging firms need to pursue a two-pronged agenda of technological connotation and sustainability orientation to achieve future competent supply chain performance (Douaki et al., 2024). The findings also suggest that policymakers and industry bodies should focus more on programs that would train firms, particularly SMEs, that are not as digitally prepared and ESG-literate as large companies.

8. Conclusion and Implications

The purpose of the present research was to determine the impact of ERP usage, digital maturity, and ESG orientation on procurement efficiency of the Indian FMCG packing industry. This paper has shown that these three dimensions significantly influence efficiency outcomes when a systematic empirical approach is employed that incorporates survey data of 200 organizations, correlation, regression, and mediation analyses. Digital maturity was the most important consideration, then ERP as enabling infrastructure, and ESG practices as performance facilitator and compliance instrument (Bo & Li, 2025). These findings show the relationship between supply chain sustainability interest and the application of technology in the existing supply chain management.

8.1 Managerial Implications

The management of FMCG packaging company could implement the results. Ali et al. (2023) opine that the evidence appears to play a vital role in justifying the thesis that ERP systems are strategic efficiency drivers and not cost centres or administrative tools. Predictive analytics, the Internet of Things, ERP, and real-time dashboards can all help to achieve substantial efficiency gains through better accuracy of the order, less waste, and greater procurement visibility (Anaya et al., 2023).

Because of this, it is apparent that managers should implement ERP alongside an overall, digital strategy.

It is also necessary to integrate the ESG concept in procurement activities. To managers it implies the transition to compliance-based sustainability and the inclusion of ESG in the process of procurement itself. They include (but are not limited to) preferential treatment of certified sustainable suppliers, carbon footprint of the packaging material and blockchain traceability (Zhang et al., 2024). They are not only very effective but also help to improve the brand image in an already competitive FMCG world which has been moving towards more ethical production expectations.

8.2 Policy Implications

The findings reveal the importance of creating positive environments to adopt ESG and digital change at a policy level. Indian regulators and trade groups can become a catalyst by introducing incentives to report ESG and to conduct green procurement activities (Mojumder et al., 2022). Businesses can be influenced to adopt sustainable practices earlier through tax breaks, subsidies or laws protective of preferred procurement, such as.

Since there is a difference in digital maturity of Tier 1 cities and Tier 2 and Tier 3 cities, the government and business organizations should fund capacity building activities such as digital literacy workshops, subsidies to support SMEs interested in adopting ERP, and creation of shared hubs to provide digital infrastructure (Gessa et al., 2023). This will facilitate greater resiliency and sustainability of the FMCG supply chain in India and enhance efficiency at the firm level.

8.3 Limitations

Although the results presented in the study were quite convincing, there are some limitations that need to be mentioned. First, the sample of 200 firms might be too small to reflect the diversity of the FMCG packaging environment in India, in particular, micro-enterprises that operate often in an informal manner, though it suffices to perform a statistical test. Second, the research only examines India; as helpful as the contextual insights may be, the results of the study could not be easily generalized to other FMCG countries with dissimilar

technical, cultural, and regulatory environments. Third, the method of cross-sectional survey is not enough to obtain temporal dynamics. All of these things are dynamic, and so the correlations between digital maturity, efficiency and ESG practices might change as time goes on.

8.4 Future Research Directions

Those gaps should be addressed in the new wave of research as a sample of companies will be tracked over time in order to answer the question of the long-term procurement efficacy within the framework of long-term benefits and ESG commitments of ERP implementation and digital maturity. This type of design would give us an idea of the causal relationships and dynamic changes.

A yielding line is also the sectoral comparison. Although the present paper was about the packaging of FMCG, other sectors of the economy, including pharmaceuticals, car tailor parts, and textile, are indeed under high levels of efficiency and sustainability stress. Inter-sector comparative studies would demonstrate whether the ERP-ESG-efficiency nexus is valid across the board or some sector specific moderating factor exists (Wu et al., 2024).

The cross-country research would provide better insight into the impact of ESG-related factors on developing countries when comparing India with developed nations (ESG frameworks are more developed) and other developing markets (digital adoption is distributed unevenly) (Singhania et al., 2023). Comparative insights of this nature would lead to a greater theoretical generalizability and practice significance.

To eliminate the gaps in the results and explain the aspects of the organizational cultures, leadership styles, and relations with suppliers that are not explained significantly by statistics, a combination of quantitative findings and qualitative research findings (e.g. case studies of the best companies) would be helpful.

9. References

1. Ali, I., Nguyen, N. D. K., & Gupta, S. (2023). A multi-disciplinary review of enablers and barriers to Cloud ERP implementation and innovation outcomes. *Journal of Enterprise Information Management*, 36(5), 1209–1239. <https://doi.org/10.1108/jeim-08-2022-0273>

2. Anaya, L., Flak, L., & Abushakra, A. (2023). Realizing Sustainable Value from ERP Systems Implementation. *Sustainability*, 15(7), 5783. <https://doi.org/10.3390/su15075783>
3. Bo, L., & Li, J. (2025). The Impact of ESG and Corporate Digital Transformation on Corporate Performance in Chinese firms. *Sustainable Futures*, 100774. <https://doi.org/10.1016/j.sfr.2025.100774>
4. Douaki, A., Ahmed, M., Longo, E., Windisch, G., Riaz, R., Inam, S., Tran, T. N., Papadopoulou, E. L., Athanassiou, A., Boselli, E., Petti, L., & Lugli, P. (2024). Battery-free, stretchable, and autonomous smart packaging. *arXiv* (Cornell University). <https://doi.org/10.48550/arxiv.2501.14764>
5. Elfawal, G. F., Šišková, A. O., & Andicsová, A. E. (2025). Ecological packaging and creating sustainable solutions for biodegradable cellulose derivatives: A review. *International Journal of Biological Macromolecules*, 142348. <https://doi.org/10.1016/j.ijbiomac.2025.142348>
6. European Commission. (2024). Horizon Europe Work Programme 2023-2025. In *Digital, Industry and Space* (pp. 2–526). https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-7-digital-industry-and-space_horizon-2023-2024_en.pdf
7. He, J., Fan, M., & Fan, Y. (2024). Digital transformation and supply chain efficiency improvement: An empirical study from a-share listed companies in China. *PLoS ONE*, 19(4), e0302133. <https://doi.org/10.1371/journal.pone.0302133>
8. Hochstetter, J., Vásquez, F., Diéguez, M., Bustamante, A., & Arango-López, J. (2023). Transparency and E-Government in Electronic Public Procurement as Sustainable Development. *Sustainability*, 15(5), 4672. <https://doi.org/10.3390/su15054672>
9. Irnawati, I., & Rahayu, R. (2025). The Role of Digital Transformation through Modular ERP in Enhancing Corporate Adaptability to Global Market Changes. *Deleted Journal*, 5(2), 468–479. <https://doi.org/10.59613/armada.v5i2.5118>
10. Jie, H., Gooi, L. M., & Lou, Y. (2025). Digital maturity, dynamic capabilities and innovation performance in High-Tech SMEs. *International Review of Economics & Finance*, 103971. <https://doi.org/10.1016/j.iref.2025.103971>
11. Khan, M. N. (2025). The Gini Index's dynamics as a reflection of India's income inequality. *Asian Business Research Journal*, 10(5), 1–11. <https://doi.org/10.55220/25766759.410>
12. Lee, K., Roesinger, A., & Hommel, U. (2022). Development and practice of industrie 4.0 in China—Practical experience of a German industrial software company in China. *Sci*, 4(3), 28. <https://doi.org/10.3390/sci4030028>
13. Lukyanova, I., Haddud, A., & Khare, A. (2022). Types of ERP systems and their impacts on the supply chains in the humanitarian and private sectors. *Sustainability*, 14(20), 13054. <https://doi.org/10.3390/su142013054>
14. M, F. (2024). *Report on packaging industry in India*. <https://www.manjushreeindia.com/wp-content/uploads/2024/08/Technopack-Report-on-Packaging-Industry-in-India-1.pdf>
15. Maji, S. G., & Lohia, P. (2022). Environmental, social and governance (ESG) performance and firm performance in India. *Society and Business Review*, 18(1), 175–194. <https://doi.org/10.1108/sbr-06-2022-0162>
16. Mojumder, A., Singh, A., Kumar, A., & Liu, Y. (2022). Mitigating the barriers to green procurement adoption: An exploratory study of the Indian construction industry. *Journal of Cleaner Production*, 372, 133505. <https://doi.org/10.1016/j.jclepro.2022.133505>
17. Murè, P., Giorgio, S., Antonelli, V., & Crisafulli, A. (2024). “ESG score” vs. “ESG rating”: a conceptual model for the sustainability assessment and self-assessment of European SMEs. *Frontiers in Environmental Economics*, 3. <https://doi.org/10.3389/frevc.2024.1452416>
18. Setyadi, A., Pawirosumarto, S., & Damaris, A. (2025). Toward a resilient and sustainable supply chain: Operational Responses to Global Disruptions in the Post-COVID-19 Era. *Sustainability*, 17(13), 6167. <https://doi.org/10.3390/su17136167>
19. Shan, X., Song, Y., & Song, P. (2024). How ESG performance impacts corporate financial performance: a DuPont analysis approach. *International Journal of Climate Change Strategies and Management*. <https://doi.org/10.1108/ijccsm-07-2024-0125>
20. Singhanian, M., Saini, N., Shri, C., & Bhatia, S. (2023). Cross-country comparative trend analysis in ESG regulatory framework across developed and developing nations. *Management of Environmental Quality an International Journal*, 35(1), 61–100. <https://doi.org/10.1108/meq-02-2023-0056>
21. Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of Enhanced Enterprise Resource Planning (ERP) on Firm Performance through Green Supply Chain Management. *Sustainability*, 13(8), 4358. <https://doi.org/10.3390/su13084358>

22. Wu, X., Li, L., Liu, D., & Li, Q. (2024). Technology empowerment: Digital transformation and enterprise ESG performance—Evidence from China's manufacturing sector. *PLoS ONE*, 19(4), e0302029.
<https://doi.org/10.1371/journal.pone.0302029>
23. Xia, J., Wu, Z., & Chen, B. (2022). How digital transformation improves corporate environmental management: A review and research agenda. *Frontiers in Environmental Science*, 10.
<https://doi.org/10.3389/fenvs.2022.943843>
24. Zhang, C., Xu, Y., & Zheng, Y. (2024). Blockchain Traceability Adoption in Low-Carbon Supply Chains: An Evolutionary Game analysis. *Sustainability*, 16(5), 1817.
<https://doi.org/10.3390/su16051817>

10. Appendix

Table A1: Survey Questionnaire

Construct	Item Code	Survey Item (5-point Likert scale: 1 = Strongly Disagree, 5 = Strongly Agree)
ERP Integration	ERP1	Our company has embraced an ERP platform to be used in the management of business activities.
	ERP2	ERP system will also unify the processes of supplier management throughout the supply chain.
	ERP3	Our ERP system combines the information of all large departments (procurement, operations and finance).
	ERP4	The ERP system facilitates in the planning of procurement, tracking, and reporting.
Digital Maturity	DM1	Predictive analytics finds application in our organization in the case of demand forecasting and decision-making.
	DM2	We make use of an IoT-based gadgets to perform real-time tracking of package and logistics activities.
	DM3	Major supply chain performance indicators are monitored using digital dashboards.
	DM4	The tools of artificial intelligence and machine learning are implemented in operational or planning processes.
ESG Orientation	ESG1	Our company is a publishing or reporting organization on its ESG (Environmental, Social, Governance) performance.
	ESG2	We are vigorous in interacting with suppliers who are sustainable and ethical.
	ESG3	Our firm has official carbon reduction/ environmental impact targets.
	ESG4	We have incorporated ESG objectives in our business strategy and business performance assessment.
Supply Chain Efficiency	SCE1	We have reduced procurement costs in the past 3 years.
	SCE2	There is an improvement in the procurement and supplier delivery lead times.
	SCE3	There is an increase in accuracy and reliability of the order fulfillment.
Controls	C1	Firm size (number of employees).
	C2	Ownership type (domestic vs. multinational).
	C3	Industry in the FMCG packaging (Food, Beverage, Personal Care, Household Products, etc.).