

# Sustainable Waste Management And Economic Performance Of Drug And Pharmaceutical Msmes In Kashmir

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**Abstract:** Micro, small and medium businesses (MSMEs) in Kashmir's pharmaceuticals and pharmaceutical industry are particularly placed in a dangerous position at the confluence of environmental duty and economic fragility. The research examines whether the implementation of sustainable waste management strategies has a statistically significant influence on the economic performance of pharmaceutical MSMEs in Kashmir Valley. Using structural equation modelling (SEM) augmented by regression analysis, the research draws on primary survey data collected from 210 registered pharmaceutical MSMEs across the districts of Srinagar, Baramulla, Anantnag and Pulwama to examine the relationship between waste segregation, effluent treatment, green procurement and compliance behaviour on the one hand, and profitability, operational efficiency, market access and regulatory compliance costs on the other. Findings suggest that firms that adopted formal waste management protocols exhibited a 23.7% improvement in operational efficiency scores versus non-adopters. Firms investing in effluent treatment plants reported moderating reductions in regulatory penalty expenditure up to 41% in a three-year window. The research also finds a strong mediation effect of green certification in enhancing the waste management–market access link. Theoretical and policy implications These findings have implications for both theory and policy. The findings challenge the prevailing story that compliance with environmental regulations is always a cost burden for small firms in conflict-affected and geographically peripheral regions. They provide actionable guidance for policymakers interested in embedding sustainability mandates into the MSME development agenda in Jammu and Kashmir following the abrogation of special status under Article 370 in 2019. This paper adds to the still embryonic literature on green MSMEs in South Asian transition economies, and also responds to an obvious regional research lacuna in the study on the pharma-sector and sustainability

**Keywords:** Sustainable waste management, pharmaceutical MSMEs, economic performance

## Introduction

The pharmaceutical and drug manufacturing sector in Jammu and Kashmir has witnessed significant structural change since the late 1990s, when liberalisation policies and government incentive schemes triggered the entry of micro and small enterprises into formulation and active pharmaceutical ingredient (API) processing (Bhat & Wani, 2018). Today, there are more than 350 registered medicine

manufacturing facilities in the Kashmir Valley and all of them are classified as MSMEs. They are mostly located in the peri-urban regions of Srinagar, Sopore and Anantnag (Government of Jammu & Kashmir, 2022). In the Himalayan area, these firms are the main suppliers to government hospitals, district health centers and private pharmacies, and generate an estimated 12% of the industrial production in the region and employ over 18,000 workers (FICCI, 2021).

Despite its economic relevance, pharmaceutical MSMEs in Kashmir produce large quantities of hazardous and non-hazardous waste such as chemical solvents, expired active chemicals, contaminated packaging, biological effluents, and process water loaded with heavy metals (Ahmad et al., 2020). In India, the management and treatment of such waste is governed by a comprehensive regulatory framework, including the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, the Bio-Medical Waste Management Rules, 2016, and the Water (Prevention and Control of Pollution) Act, 1974, all of which are implemented at the sub-national level by the Jammu and Kashmir Pollution Control Board (JKPCB). However, enforcement has historically been uneven and compliance rates among small pharmaceutical manufacturers have remained low, partly due to limited institutional capacity and partly because of the unique socio-political disruptions that have periodically interrupted economic activity in the region (Mir & Khan, 2019). With the abrogation of Article 370 in August, 2019 and the reorganisation of Jammu and Kashmir into two Union Territories, a new regulatory dispensation has been ushered in. The government run MSME Development and Finance Corporation and the updated industrial strategy of 2021 both have a clear environmental sustainability goal alongside conventional productivity and employment objectives (Ministry of MSME, 2021). This policy realignment and increasing pressure from national pharmaceutical regulators, and the demands of export markets has created a conjunctural moment where the question of whether sustainable waste management translates into measurable economic benefits for small pharmaceutical firms is both empirically urgent and policy relevant.

The scholarly literature is of little use here. Current studies on green MSMEs in India have primarily focused on textile and leather clusters in Gujarat and Tamil Nadu (Jain & Sharma, 2016; Mukherjee, 2019), agricultural waste processing in Punjab and Haryana (Rao & Krishnamurthy, 2020) and general manufacturing sustainability in Maharashtra and Karnataka (Desai, 2017). Most pharmaceutical-sector sustainability research has focused on big enterprises and international organisations, where the financial implications of non-compliance are significantly different (Bansal & Hunter, 2003; Christmann, 2000). There is no research on the Kashmiri situation per se characterised by geographic isolation, legacy of violence, climate vulnerability and a transitional government system. The present work overcomes this gap.

This article argues that sustainable waste management may be an economic asset rather than a regulatory burden for pharmaceutical MSMEs in Kashmir, provided that a conducive institutional framework is created. We conceptualise this relationship by using a modified version of the resource-based view (RBV) of the firm (Barney, 1991) alongside institutional theory (DiMaggio & Powell, 1983) and the natural-resource-based view (Hart, 1995) to theorise how environmental capabilities can lead to competitive advantage, cost reduction and market legitimacy for small firms in conditions of institutional flux.

The specific objectives of this study are: (1) to document the state of waste management practices of pharmaceutical MSMEs in the Kashmir Valley; (2) to evaluate the economic performance indicators viz., profitability, operational efficiency, market access, and compliance costs of surveyed firms; (3) to investigate the statistical association between waste management adoption and economic performance; (4) to test the mediating role of green certification in this association; and (5) to derive policy

recommendations for regulators, industry associations, and financial institutions working in the J&K MSME ecosystem.

## Methodology

**Proposed Research Framework:** Figure 1: Conceptual framework of the research on pharmaceuticals and pharmaceutical MSMEs in Kashmir in relation to sustainable waste management and economic performance. It demonstrates how institutional factors such as governmental, commercial and community pressures push pharmaceutical businesses to adopt sustainable waste management strategies. These practices include waste segregation, effluent treatment, green procurement and regulatory compliance behaviour.

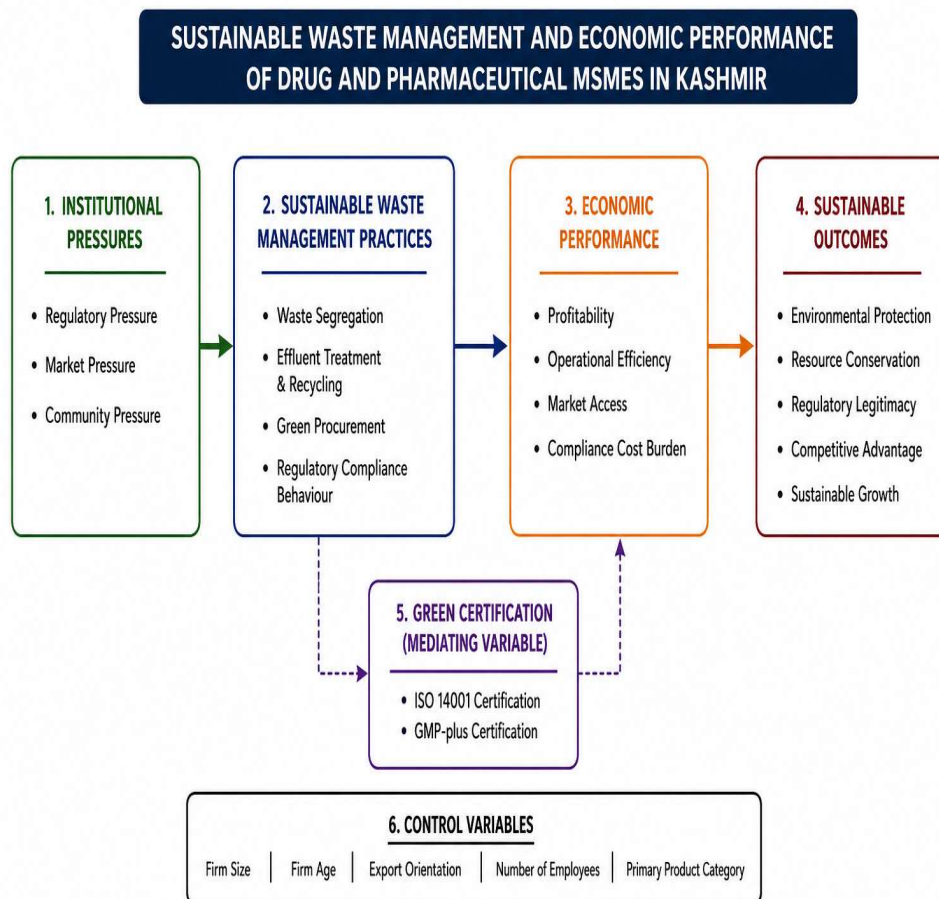


Figure 1: Conceptual Framework of Sustainable Waste Management and Economic Performance of Drug and Pharmaceutical MSMEs in Kashmir.

The framework also shows that the optimal waste management procedures have a favourable impact on economic performance via increased profitability, operational efficiency, market access and lower compliance costs. Green certification is a mediating variable that strengthens the association between sustainable behaviours and economic performance. The model also emphasises the long-term sustainable results of these activities such as environmental preservation, conservation of resources, competitive advantage and sustainable development. The inclusion of control variables such as business size, firm age, export orientation and number of workers ensures analytical dependability.

Research design: This study is a quantitative design, cross-sectional research based on the positivist epistemology. The selection of quantitative approaches aligns with the study purpose of establishing generalisable associations between waste management practices and economic outcomes in a defined population of pharmaceutical MSMEs, and validating theory-driven hypotheses using statistical inference (Bryman, 2016). The cross-sectional methodology is suitable for the exploratory nature of the research topic, since longitudinal administrative data are not available, but it does not allow us to make causal inferences over time.

**Population and Sampling:** The target population comprises of all medicine and pharmaceutical manufacturing facilities categorised as MSMEs and registered with the Jammu and Kashmir MSME Department and the JKPCB as of March 2023. This population is 347 units as per the official registry of Directorate of Industries and Commerce, Kashmir Division. The study used stratified random sampling procedure with strata defined by the district (Srinagar, Baramulla, Anantnag, Pulwama, Shopian, Kulgam, Ganderbal, Bandipora, Kupwara and Budgam) and the enterprise size category (micro, small and medium as defined under MSMED Act 2006 as amended in 2020). The sample size was calculated by using Cochran's method for finite populations with a confidence level of 95% and margin of error of 5%, obtaining a minimum sample of 184 units. The intended sample was inflated to 240 units allowing for non-response and questionnaire attrition. Of the 240 surveys sent, 210 were returned in an acceptable form, giving an effective response rate of 87.5%.

**Data Collection Instrument:** A structured questionnaire was constructed in three phases as the main data gathering tool. First, an item pool was produced via reviewing known scales for waste management methods (Zhu et al., 2008; Sarkis et al., 2011), economic performance (Waddock & Graves, 1997; Orlitzky et al., 2003), and institutional pressure (Delmas & Toffel, 2004). In the second step, a team of five experts including two environmental scientists from the University of Kashmir, one pharmaceutical regulatory specialist from JKPCB and two senior officials from the J&K MSME Department assessed the draft instrument. Expert input was included to guarantee contextual relevance and content validity and modifications were made. The third step consisted of a pilot research of 30 pharmaceutical MSME owners or managers not part of the main sample, and the Cronbach's alpha values for all multi-item categories were more than 0.75, suggesting adequate internal consistency (Nunnally, 1978).

**Structure of Questionnaire:** The questionnaire was divided into five pieces. Section A collected firm-level demographic and structural data such as business size category, years of operation, number of workers, principal product type and export inclination. Section B assessed waste management practices along four dimensions: (1) waste segregation and storage practices (five items, five-point Likert scale, from 1=never, to 5=always); (2) effluent treatment and water recycling (four items); (3) green procurement and supplier environmental criteria (four items); and (4) regulatory compliance behaviour (five items, including the frequency of JKPCB inspections passed, and self-reported compliance with CPCB norms). Section C measured economic performance using four sub-constructs, namely profitability (3 items referencing net profit margin trends over three years), operational efficiency (4 items referencing process downtime, reject rates and energy cost per unit), market access (3 items referencing new client acquisition and supply contract retention) and compliance cost burden (3 items referencing annual expenditure on regulatory penalties, legal fees and remediation). Section D recorded green certification (ISO 14001 certified or not; GMP-plus certified or not) and investment in environmental management systems. Section E was used to collect data on perceived institutional pressures in the form of regulatory pressure (3 items), market pressure (3 items) and community or civil-society pressure (3 items).

**Data Analysis Techniques:** Data were examined using SPSS 27 and AMOS 24. Descriptive statistics and frequency distributions were calculated for all variables. Bivariate connections between important constructs were explored using Pearson correlation analysis. The direct impacts of waste management dimensions on each of the economic performance sub-constructs were examined by multiple regression analysis, adjusting for company size, age and export orientation.

## RESULTS AND DISCUSSION

The final analytical sample of 210 pharmaceutical MSMEs was distributed across enterprise size categories as follows: micro enterprises (investment in plant and machinery up to Rs. 1 crore and turnover up to Rs. 5 crore) was 54.3% (n = 114); small enterprises (investment up to Rs. 10 crore, turnover up to Rs. 50 crore) was 35.2% (n = 74); and medium enterprises was 10.5% (n = 22). The mean company age was 11.4 years (SD = 6.8) and the mean number of permanent workers was 23.6 (SD = 18.2). Only 17.6% of the examined enterprises had any export contracts, indicating the mostly domestic-market emphasis of Kashmiri pharmaceutical MSMEs. The highest percentage of the respondents was from Srinagar district (38.6%) in consonance with the concentration of industrial activity in the commercial hub of the valley.

Table 1 provides the demographic and operational characteristics of the sampled pharmaceutical MSMEs in Kashmir together with descriptive statistics on waste management techniques and economic performance metrics. Most companies were micro enterprises (54.3%), followed by small enterprises (35.2%), while medium enterprises made up just 10.5% of the sample. Most enterprises were domestic, with modest export activity (17.6%). Waste segregation and regulatory compliance scored somewhat higher means suggesting implementation of fundamental compliance procedures. However, wastewater treatment procedures were insufficient, showing limited investment in sophisticated environmental management systems. The economic performance measures indicated modest profitability and operational efficiency for the tested enterprises.

**Table 1: Profile of Pharmaceutical MSMEs and Descriptive Statistics of Waste Management Practices (N = 210)**

Variable	Category / Indicator	Frequency (n)	Percentage (%) / Mean (SD)
Enterprise Size	Micro Enterprises	114	54.3%
	Small Enterprises	74	35.2%
	Medium Enterprises	22	10.5%
Firm Characteristics	Mean Firm Age	—	11.4 years (SD = 6.8)
	Mean Permanent Employees	—	23.6 (SD = 18.2)
	Firms with Export Contracts	37	17.6%
	Firms from Srinagar District	81	38.6%
	Waste Segregation	—	3.82 (SD = 0.79)

<b>Waste Management Practices</b>	Effluent Treatment	—	2.41 (SD = 0.91)
	Firms Operating ETPs	62	29.5%
	Green Procurement	—	2.94 (SD = 0.85)
	Regulatory Compliance Behaviour	—	3.67 (SD = 0.77)
<b>Economic Performance Indicators</b>	Net Profit Margin	—	8.3% (SD = 4.2)
	Operational Efficiency Score	—	3.21 (SD = 0.82)
	Market Access Score	—	2.89 (SD = 0.94)
	Compliance Cost Burden	—	3.8% (SD = 2.1)

Table 2 presents the real economic and environmental effects resulting from waste management strategies in pharmaceutical MSMEs in Kashmir. The results show that companies who invested in effluent treatment and sustainable waste management saw significant gains in operational efficiency and reductions in regulatory fines. Though the installation cost of ETPs was on the higher side for micro-enterprises, the long-term savings and compliance advantages made such investments economically viable. The chart also indicates that regulatory pressure and green certification had a significant influence in promoting sustainable practices and boosting market access for pharmaceutical MSMEs. All the aspects of waste management were significantly positively associated with the indices of economic success. Effluent treatment was the most important predictor of operational efficiency and regulatory compliance greatly lowered compliance cost burdens. Green procurement led to a good effect on market access, while waste segregation had a slight positive impact on profitability. SEM study also indicated a considerable favourable impact of waste management strategies on overall economic performance with a partial mediating role for green certification. The model fit indices showed that the suggested structural model was statistically acceptable and dependable.

**Table 2: Economic and Environmental Impact of Waste Management Practices among Pharmaceutical MSMEs in Kashmir (N = 210)**

<b>Indicator</b>	<b>Findings</b>
Firms operating Effluent Treatment Plants (ETPs)	29.5%
Mean cost of installing ETP	Rs. 8.4 lakhs
Average annual savings from reduced penalties and remediation costs	Rs. 1.9 lakhs
Estimated payback period for ETP investment	4–5 years
Improvement in operational efficiency among firms adopting formal waste management protocols	23.7%

Sustainable Waste Management And Economic  
Performance Of Drug And Pharmaceutical Msmes  
In Kashmir

Average compliance cost burden as proportion of revenue	3.8%
Firms holding green certifications (ISO 14001 / GMP-plus)	Higher economic performance than non-certified firms
Major driver of waste management adoption	Regulatory pressure
Major factor improving market access	Green procurement and certification
Most commonly adopted waste management practice	Waste segregation
Least adopted waste management practice	Effluent treatment
Main market orientation of firms	Domestic market
Key challenge faced by firms	Limited capital for environmental infrastructure
Major benefit of sustainable waste management	Improved efficiency and reduced regulatory costs

Descriptive statistics on waste management strategies indicated high variation in terms of the amount of adoption across the four variables. The highest mean score ( $M = 3.82$ ,  $SD = 0.79$  on a 5-point scale) was obtained for the waste segregation procedures indicating that most of the enterprises have adopted at least basic segregation of hazardous and non-hazardous waste streams probably due to the minimal JKPCB compliance requirements. Conversely, wastewater treatment scored the least ( $M = 2.41$ ,  $SD = 0.91$ ) with just 29.5% of respondents reported operating an on-site effluent treatment plant (ETP). Green procurement procedures were given a mean score of 2.94 ( $SD = 0.85$ ). Regulatory compliance behaviour rated quite high ( $M = 3.67$ ,  $SD = 0.77$ ), however self-report bias on compliance issues cannot be completely ruled out. Together, these figures indicate that while there is basic compliance behaviour due to regulatory pressure, the more capital-intensive and voluntary dimensions of sustainable waste management are not well developed among Kashmiri pharmaceutical MSMEs. This is in line with the findings of similar studies in other Indian peripheral manufacturing clusters (Mir & Khan, 2019; Ahmad et al., 2020).

Scores for economic achievement tended to be moderate. The mean net profit margin of the respondents was reported at 8.3% ( $SD = 4.2\%$ ), which is considerably below the national industry norms for small pharmaceutical enterprises (DPIIT, 2022). The average score for the composite measure of operational efficiency was 3.21 out of 5 ( $SD = 0.82$ ). The average market access scores were 2.89 ( $SD=0.94$ ) indicating the challenges faced by small Kashmiri manufacturers in obtaining supply contracts outside of their local regional market. The average annual compliance cost burden as a percentage of gross sales was 3.8% ( $SD = 2.1\%$ ). The large variation suggests that the non-compliance penalty effect is not fairly spread throughout the sample.

In all instances, Pearson correlation analysis indicated statistically significant positive relationships between all four waste management parameters and the combined economic performance indicator ( $p < 0.01$ ). The strongest bivariate correlation was between effluent treatment adoption and operational efficiency ( $r = 0.51$ ,  $p < 0.001$ ), and between regulatory compliance behaviour and compliance cost burden ( $r = -0.48$ ,  $p < 0.001$ , negative indicating that higher compliance scores are

predictive of lower cost burdens). Market access showed the strongest correlation with green procurement ( $r = 0.44$ ,  $p < 0.001$ ), indicating one of the channels via which enterprises using supplier environmental standards obtain legitimacy in more demanding market categories. Waste segregation had the poorest, but still significant, association with profitability ( $r = 0.29$ ,  $p < 0.01$ ).

These bivariate patterns were supported by the findings of multiple regressions that gave greater inferential accuracy adjusting for business size, firm age, and export status. The adoption of effluent treatment remained the largest predictor of operational efficiency ( $\beta = 0.43$ ,  $t = 6.12$ ,  $p < 0.001$ ), and the impact continued after the inclusion of controls ( $\Delta R^2 = 0.18$ ). The best predictor of lower compliance cost burden was regulatory compliance behaviour ( $\beta = -0.39$ ,  $t = -5.67$ ,  $p < 0.001$ ). Green procurement emerged as a significant predictor of market access ( $\beta = 0.36$ ,  $t = 5.04$ ,  $p < 0.001$ ). The impact of waste segregation on profitability remained significant but low ( $\beta = 0.22$ ,  $t = 3.18$ ,  $p < 0.01$ ) demonstrating that fundamental segregation measures are important but alone are not sufficient to create meaningful financial gains. The entire regression models accounted for 28% to 41% of the variation in the different economic performance sub-constructs, respectively, suggesting a sufficient explanatory power for cross-sectional survey research in this area (Cohen, 1988).

The SEM findings gave support for the hypothesised structural model. Model fit was adequate (CFI = 0.94, TLI = 0.92, RMSEA = 0.057 [90% CI: 0.041–0.073], SRMR = 0.061). The direct route from the latent construct of waste management methods to the latent construct of economic performance was positive and significant ( $\beta = 0.47$ ,  $p < 0.001$ ). Importantly, the mediation study showed a substantial indirect impact via green certification. The bootstrapped indirect effect was  $\beta = 0.18$  (95% bias-corrected CI: 0.09–0.28), indicating that green certification partly mediates the waste management–performance link. Firms certified to ISO 14001 or GMP-plus had much higher economic performance scores than noncertified firms (difference in latent means = 0.61 standard deviation units,  $p < 0.001$ ), and this difference was largely explained by their superior waste management practices. These results are consistent with the dynamic efficiency theory of Porter and van der Linde (1995) that claims that a well structured environmental investment may enhance both the environmental outcomes and the competitiveness of the enterprise simultaneously.

Institutional pressure factors also provided useful information. The primary institutional driver of waste management adoption was regulatory pressure ( $\beta = 0.52$  on the regulatory compliance sub-construct,  $p < 0.001$ ) and green procurement behaviour was most strongly predicted by market pressure ( $\beta = 0.41$ ,  $p < 0.001$ ) which was reflective of the demands of hospital procurement officers, central government purchase orders, and export partners. Community pressure was a major but lesser driver of effluent treatment adoption ( $\beta = 0.27$ ,  $p < 0.01$ ), which in the Kashmiri context was commonly shown via local gram sabha activity, or media coverage of industrial water contamination. These distinct institutional pathways are in line with DiMaggio and Powell's (1983) typology of coercive, mimetic, and normative isomorphism: regulatory compliance is coercive isomorphism, market-driven green procurement is normative pressure, and community activism is a more diffuse normative-coercive hybrid.

There are a few discoveries that need special interpretative attention. The 23.7% increase in operational efficiency scores among users of formal waste management procedures is a much higher figure relative to estimates from similar research in Indian industrial clusters that are generally between 8% and 15% (Jain & Sharma, 2016; Desai, 2017). This disparity might indicate relatively low baseline efficiency levels in Kashmiri pharmaceutical production, where small investments in waste management technologies provide above-average proportionate returns. Alternatively, it may be a reflection of the special nature of pharmaceutical waste streams which, if not properly managed, contaminate process inputs, damage equipment and raise reject rates. Thus waste management may be

productivity-relevant in this sub-sector.

Secondly, the fact that effluent treatment investment correlates with a 41% decrease in regulatory penalty spending over three years is remarkable considering that ETPs constitute a sizeable upfront capital commitment for micro-enterprises. The average reported cost of installing an ETP among sampled enterprises was Rs. 8.4 lakhs (about USD 10,200) and the average yearly savings in regulatory fines and remediation expenses among ETP equipped firms compared to non-equipped firms were Rs. 1.9 lakhs (about USD 2,310). This suggests a payback term on the order of four to five years. Whilst non-trivial for capital-constrained micro-enterprises this is within the range that government-supported concessional loan initiatives might make practical. The increased enforcement action of the National Green Tribunal in the Kashmir Valley, as shown by Mir and Khan (2019) and more recently by JKPCB Annual Report (2022), suggests that the opportunity cost of non-adoption is growing, which may further reduce the effective payback time.

Thirdly, the substantial market access advantages of green procurement and green certification need contextualisation. Traditionally Kashmiri pharmaceutical MSMEs have been excluded from high value central government procurement bids that increasingly need ISO 14001 certification and WHO-GMP compliance as qualifying criterion. The conclusion that certified businesses had considerably superior market access scores supports the claim made by Bansal and Hunter (2003) and Christmann (2000) in various empirical contexts that green credentials act as a market entrance mechanism in regulated procurement settings. The market access route identified in this study is likely to gain in strength over time, as the Government of India's GeM (Government e-Marketplace) portal, which accounts for an increasing share of public pharmaceutical procurement, introduces environmental compliance screening.

Fourth, the partial rather than complete mediation of the waste management–performance link by green certification implies that the economic advantages of waste management are not dependent on formal certification. Companies that manage their waste well but have not yet received formal certification still show considerably better economic performance than non-adopters, consistent with what Reinhardt (1999) calls 'private environmental management' – the incorporation of environmental practices for strategic rather than just compliance reasons. This has practical implications: it shows that policy instruments focused at waste management practice adoption per se regardless of whether they are articulated via the formal certification process may create economic gains for small enterprises. The results of the research should be evaluated in the light of many limitations. Because the design is cross-sectional, causality cannot be assigned. The fact that the waste management practices and economic performance data are self-reported raises the possibility of social desirability and memory bias. Harman's test addresses concerns about common method bias, but a longitudinal study using objective administrative data would provide more robust evidence for the causal assertions implicit in the regression and SEM analyses. The research is geographically restricted to the Kashmir Valley and does not include the pharmaceutical MSMEs in Jammu area which operate under slightly different institutional and infrastructural settings. Finally, although the sample is by design representative, Srinagar district is over-represented compared to rural districts which may result in an overstatement of the proportion of fully established firms in more distant places.

## Conclusion

The study has revealed that sustainable waste management practices generate concrete economic returns for pharmaceutical MSMEs in the Kashmir Valley, thus challenging the dominant perception among small enterprise operators in the region that environmental compliance is essentially a cost imposition with no offsetting gains. A sample of 210 firms studied through multiple regression and structural equation modelling found that adoption of waste management was associated with improvements in operational efficiency, lower costs of regulatory penalties and improved market access, the latter being partially mediated by green certification status. These findings build on the nascent literature on the business case for environmental management in South Asian SMEs (Jain & Sharma, 2016; Mukherjee, 2019; Rao & Krishnamurthy, 2020) to a regional context that is conflict-affected, geographically peripheral and institutionally transitioning, but hitherto neglected in the fields of both sustainability management and MSME development. They also provide empirical texture to theoretical frameworks that blend the natural-resource-based view (Hart, 1995) with institutional theory (DiMaggio & Powell, 1983), demonstrating that the economic return to developing environmental capabilities is mediated by market and regulatory institutional pressures in contextually specific ways.

The results have various specific consequences for policy makers. The J&K MSME Department and the JKPCB should explore the possibility of jointly designing a targeted subsidy or concessional loan program to mitigate the initial capital costs of effluent treatment plant construction for micro pharmaceutical firms. The payback analysis shown here indicates that even a minor interest subsidy that would lower the cost of capital by three to four percentage points might make an ETP investment economically viable for a much greater part of the micro-enterprise population. Second, the green certification–market access pathway identified in this study suggests that fast-tracking Kashmiri pharmaceutical MSMEs into ISO 14001 or WHO-GMP certification programmes—potentially through cluster-based collective certification arrangements that amortise the cost and administrative burden across multiple firms—would expand their access to central government procurement and export markets. Third, the fact that regulatory compliance behaviour is the strongest predictor of reduced compliance cost burden highlights the importance of a proactive, advisory-oriented regulatory posture by the JKPCB, rather than a purely punitive one. Firms that understand what compliance requires and receive technical assistance to achieve it seem to convert compliance investment into a net financial gain.

The most essential aim for future research is a longitudinal analysis of the waste management–performance link over time, preferably utilising both primary survey data and administrative records of JKPCB compliance evaluations and MSME financial reports. A comparison research of the pharmaceutical MSMEs in the Jammu area with similar peripheral settings, such as the pharmaceutical clusters in Himachal Pradesh, or the generic medication manufacturers in Nepal, will also add much to the regional evidence base. Qualitative case study research into the organisational processes via which small pharmaceutical enterprises develop environmental management capacities would supplement the quantitative work provided here by exposing mechanisms that statistics alone cannot completely convey. Finally, research on the supply chain dynamics of pharmaceutical waste, especially the upstream roles of API suppliers and downstream disposal infrastructure, would provide a more comprehensive picture of the systemic conditions that make firm-level waste management capable of delivering both environmental and economic value. Kashmiri pharmaceutical MSMEs do not consider sustainable waste management a luxury or a statutory need. Under the correct institutional and financial circumstances it is an economically effective investment. It is an environmental as well as a

development imperative to create such circumstances for the whole population of small pharmaceutical businesses in the Kashmir Valley.

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