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Bangladesh Civil Service Administration Academy



Bangladesh Civil Service Administration Academy
Shahbagh, Dhaka-1000
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Aligning Civil Service Training with Workplace Competencies: Examining the Law and Administration Course in Bangladesh

Dr. Mahmudul Hassan¹, Md. Forkan Elahi Anupam², Sabrina Afrin Mustafa³

Abstract

This article examines the extent to which the Law and Administration Course (LAC) aligns with the workplace competencies required of entry-level officers (ELOs) in the Bangladesh Civil Service (Administration) cadre. Conducted by the Bangladesh Civil Service Administration Academy, the LAC is the principal professional course intended to prepare newly recruited officers for early-career responsibilities in field administration and secretariat work. The study is situated within the literature on competency-based training, learning transfer, public service capability, and results-oriented training evaluation. Using a mixed-methods design, the article draws on survey responses from 120 LAC participants, assessments from 30 supervising officers, focus group discussions, interviews with faculty members, and documentary analysis of course materials, duty charters, and relevant public administration policy documents. The findings indicate that the LAC is broadly relevant to statutory and procedural responsibilities, especially in legal literacy, land administration, service rules, and administrative procedure. However, notable gaps remain in analytical reasoning, applied legal interpretation, decision-support drafting, digital governance, managerial coordination, and the handling of complex cases under time constraints. These weaknesses appear to stem less from content irrelevance than from the absence of explicit competency benchmarks and from assessment practices that emphasise knowledge acquisition more than applied performance. The article argues that a concise competency framework, stronger job-linked simulations, and results-based assessment feedback would enhance the course's practical value and strengthen the transition from formal training to workplace performance.

Keywords: competency-based training; civil service training; public administration; workplace competencies; Bangladesh Civil Service; Law and Administration Course

¹email: hassan8173443@gmail.com; ²email: forkan3139@gmail.com;

³email: sabrinamustafa13@gmail.com

1. Introduction

In contemporary public administration, training is no longer treated merely as an institutional ritual or a formal requirement for confirmation in service. Increasingly it is judged by how well it equips public officials with the competencies needed for actual workplace performance. This shift has gained urgency as governments confront more complex policy problems, rising citizen expectations, digital transformation, and stronger demands for accountability. Training is therefore expected to produce not only knowledge, but also judgement, professional conduct, analytical reasoning, and the ability to apply rules in real administrative situations (Aguinis & Kraiger, 2009; OECD, 2017).

Competency-based training offers a useful lens for examining this relationship between training and work. Competencies are observable combinations of knowledge, skills, attitudes, behavioural attributes, and professional judgement that enable effective performance in a defined role (Boyatzis, 2008; Campion et al., 2011). A competency-based approach therefore links course objectives, curriculum design, pedagogy, assessment, and feedback to clearly defined role expectations. It is especially relevant to public administration, where officials must operate within legal and procedural frameworks while also exercising discretion in complex, often time-sensitive situations (Horton, 2000; Lodge & Hood, 2003).

Within the Bangladesh Civil Service (BCS), entry-level officers of the Administration cadre occupy a critical position in the machinery of government. In their early postings, they are expected to process official files, prepare notes, interpret rules, assist in decision making, coordinate across offices, support land and revenue administration, and communicate with citizens and other public agencies. These are not purely clerical tasks: they demand legal awareness, administrative discipline, analytical judgement, drafting competence, ethical conduct, and a sound understanding of institutional roles.

The Law and Administration Course, conducted by the Bangladesh Civil Service Administration Academy, is intended to provide foundational professional preparation for these responsibilities. The official description of the course identifies it as a five-month course for newly appointed BCS Administration cadre officers and highlights criminal law, public administration, management, economics, language, information technology, behavioural science, civil service conduct, values, and practical learning

methods as important course components (Bangladesh Civil Service Administration Academy, n.d.). The Public Administration Training and Higher Education Policy 2023 also emphasises needs-based, interactive, and dynamic training to improve public service capacity (Ministry of Public Administration, 2023).

Despite this importance, the LAC does not appear to be anchored in a formally articulated competency framework of the kind recommended in the modern public-sector training literature. Its design has evolved through administrative practice, course revision, and participant feedback, but there is limited evidence of a documented mapping between early-career workplace responsibilities and measurable competency outcomes. This study examines that problem by asking not only whether participants find the course useful, but whether it develops the capabilities their initial postings actually require. The study addresses three research questions. First, what competencies are required for effective performance in entry-level administrative positions within the BCS Administration cadre? Second, to what extent does the LAC contribute to the development of these competencies among newly recruited officers? Third, where do gaps exist between competencies emphasised in the course and those demanded in workplace practice?

The objectives of the study are: (1) to identify the core competencies required for effective performance in entry-level administrative roles; (2) to assess the extent to which the LAC develops these competencies among trainee officers; and (3) to examine the alignment between competencies developed through the course and those required in workplace settings, with particular attention to areas of mismatch and competency gaps.

2. Literature Review

2.1 Competency-based training and public service performance

Competency-based training is one of the dominant approaches in contemporary human resource development because it starts from the requirements of the work itself rather than from an inherited syllabus. Under this approach, training is not judged by coverage, attendance, or satisfaction alone; it is judged by whether learners can demonstrate capabilities that are meaningful in the role for which they are being prepared (Armstrong, 2020; Dubois & Rothwell, 2004; Lucia & Lepsinger, 1999).

The significance of this approach for the public sector is clear. Governments invest in training because officials are expected to implement law, manage

resources, coordinate institutions, and deliver services. A competency framework can clarify what effective performance looks like, provide a common language for course design, and connect recruitment, induction, supervision, appraisal, and career development (Campion et al., 2011; OECD, n.d.). When competencies remain implicit, however, training may appear relevant while still leaving important performance gaps unmeasured and unaddressed.

This distinction matters in bureaucratic systems, where public officials work within rules but rule-bound work does not eliminate discretion. Officers must often interpret legal provisions, distinguish relevant facts from irrelevant details, prioritise files, draft reasoned recommendations, and communicate decisions in institutionally acceptable language. Such performance depends on more than knowing the rules; it requires the capacity to apply knowledge in context (Horton, 2000; Lodge & Hood, 2003).

2.2 Training design, transfer of learning, and assessment fit

Training design concerns the deliberate arrangement of learning objectives, content, teaching methods, sequencing, practice opportunities, and assessment. Research on training transfer has long shown that learning is more likely to influence workplace performance when the training environment resembles the actual workplace and when trainees receive opportunities to practise, receive feedback, and apply learning under realistic conditions (Baldwin & Ford, 1988; Blume et al., 2010; Burke & Hutchins, 2007).

In bureaucratic settings, this means that case exercises, simulations, note-writing practice, file-based analysis, legal interpretation drills, and structured feedback may matter more than content coverage alone. A course may be full of relevant material and still fail to produce strong workplace performance if participants are not required to apply knowledge under constraints similar to real work. Salas et al. (2012) similarly emphasise that effective training depends on evidence-based design, practice, feedback, and post-training conditions that support application.

Assessment is equally important. Kirkpatrick and Kirkpatrick's (2016) model remains influential because it distinguishes reaction, learning, behaviour, and results. In civil service training, this implies that participant satisfaction or written examination performance is not enough. If the desired outcome is workplace capability, assessment should test applied reasoning, drafting, decision-support capacity, and professional judgement. Noe (2017) similarly

treats assessment and transfer as integral parts of training effectiveness rather than as administrative afterthoughts.

2.3 Civil service training in Bangladesh and the research gap

The literature on public administration training in Bangladesh has examined institutional development, training effectiveness, and the broader relationship between civil service training and administrative reform. Earlier scholarship traces administrative training to colonial-era legacies and the post-independence search for a development-oriented bureaucracy (Aminuzzaman, 1992; Zafarullah, 2007), while other work has examined training effectiveness and institutional constraints, including the role of the BCS Administration Academy (Ehsan & Imam, 2020).

Recent Bangladesh-specific work has moved closer to the present article's concern. Hassan et al. (2025) argue that the LAC would benefit from contextualised pedagogy and stronger integration of real-world tasks, institutional objectives, and adult learning principles. Their analysis of LAC modules also indicates that some course components have immediate relevance to field administration, while others have weaker direct applicability to early-career duties. This reinforces the need to examine not only whether training exists, but whether its content, methods, and assessments fit the work officers actually perform.

The issue is also visible in broader policy and evaluation documents. The Public Administration Training and Higher Education Policy 2023 calls for stronger, needs-based public administration training (Ministry of Public Administration, 2023). More recently, UNDP's Evaluation Framework for Government Training Institutes reported that Bangladesh's public-sector training institutions show strengths in infrastructure and delivery but still face gaps in outcome measurement, research, and learning impact; it recommends competency-based training, stronger monitoring, evaluation, and learning systems, faculty development, and phased reforms (UNDP, 2026).

A gap nonetheless remains. Much of the existing literature evaluates training in broad terms such as satisfaction, perceived utility, institutional capacity, or overall learning, and fewer studies systematically examine how a specific course design corresponds to the competency profile implied by actual early-career workplace duties. This gap matters particularly for the LAC, given its central role in the professional formation of entry-level officers in the BCS Administration cadre. The present study addresses it by analysing competency alignment directly, rather than training effectiveness in the

abstract.

3. Conceptual Framework

The study proceeds from an inductive conceptual logic. In the absence of a formally published competency framework for the LAC, competency requirements are inferred from three sources: the duties of newly posted officers, expectations expressed by supervising officers, and the stated objectives and contents of the LAC. This approach is consistent with competency modelling literature, which treats role analysis and expert judgement as important foundations for identifying performance-relevant competencies (Campion et al., 2011; Lucia & Lepsinger, 1999).

Seven competency domains emerge with particular clarity: (1) legal and regulatory literacy; (2) land administration competency; (3) administrative procedure and file-management competency; (4) development, policy, analytical, and decision-support capacity; (5) managerial and coordination competency; (6) digital governance competency; and (7) communication, behaviour, and professional discipline.

The central analytical proposition is straightforward. If the content, pedagogy, and assessment methods of the LAC correspond closely to these competency domains, participants should demonstrate a reasonable level of workplace readiness after course completion. If the alignment is only partial because some competencies remain implicit or because assessment tests recall more than application, competency development is likely to be uneven. The study therefore treats competency alignment as a three-dimensional issue involving content relevance, pedagogical adequacy, and assessment fit.

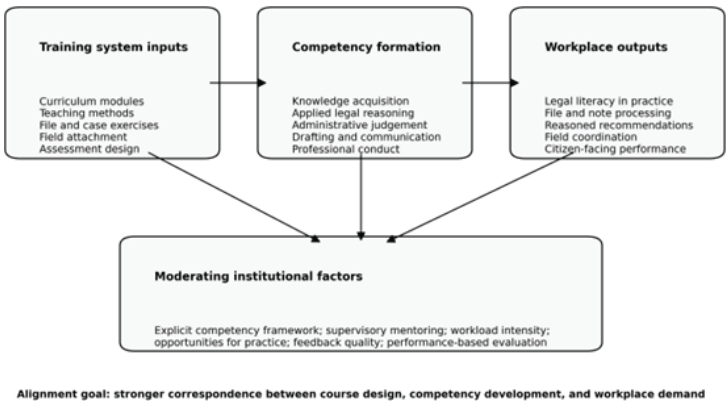


Figure 1. Competency alignment model for the Law and Administration Course

The model conceptualises training effectiveness as a linked process. Training system inputs shape competency formation; competency formation should then appear as workplace outputs. Institutional factors, including the presence or absence of an explicit competency framework, quality of supervision, workload intensity, and the assessment system, mediate this relationship.

4. Methodology

4.1 Research design and data sources

A mixed-methods design was used to support methodological triangulation. The quantitative component consisted of a structured survey administered to 120 participants from a single LAC cohort. The cohort was treated as a complete census for that batch. The time gap of more than one year between course completion and data collection was considered useful because it allowed respondents to assess the relevance of the course after exposure to workplace responsibilities.

The qualitative component consisted of focus group discussions with selected LAC graduates, interviews with BCSAA faculty members, and structured assessments from 30 supervising officers who had worked with the graduates for at least six months in field administration or secretariat positions. Documentary analysis was also conducted using course curricula, training schedules, official duty charters, and relevant public administration policy documents, including the Public Administration Training and Higher Education Policy 2023

4.2 Measures and analytical strategy

The survey asked respondents to assess the relevance of seven competency clusters using a five-point Likert scale. The clusters were derived from focus group evidence, faculty consultations, supervising officer expectations, and documentary analysis. Quantitative data were analysed using descriptive statistics, particularly mean scores and standard deviations across competency categories.

Qualitative data were analysed thematically. The analysis focused on recurring patterns in participant and supervisor accounts of preparedness, workplace demand, competency strengths, and competency gaps. The documentary analysis was used to compare stated course content and assessment practices with competencies implied by entry-level administra-

tive duties. The study does not claim causal attribution; rather, it evaluates perceived and documented alignment between training design and workplace demand.

4.3 Scope and limitations

The study is limited by its focus on a single LAC cohort. The survey data are descriptive and depend partly on respondents' perceptions. Supervising officer assessments provide an external perspective, but they also reflect variation in office contexts, supervisory expectations, and the nature of assignments given to new officers. The study should therefore be read as an evidence-based diagnosis of competency alignment rather than as a comprehensive evaluation of the entire LAC system across all cohorts.

A further limitation concerns outcome measurement. The study does not use direct observation of file work or independently scored performance tasks. Future studies should incorporate workplace performance records, standardised drafting tasks, and longitudinal follow-up to assess whether training-related competencies are retained and applied over time.

5. Findings

5.1 Perceived relevance of competency clusters

Based on focus group discussions, faculty consultations, supervising officer feedback, and documentary analysis, the course curriculum was organised into seven competency clusters. Respondents then rated the relevance of each cluster to their workplace responsibilities. Table 1 presents the descriptive statistics.

Table 1. Perceived relevance of core competency clusters in the LAC

Competency cluster	Mean	SD	Interpretation
Legal and regulatory competency	4.16	0.72	Strong alignment
Land administration competency	4.34	0.61	Very strong alignment
Administrative procedure and file management	3.99	0.78	Moderate to strong alignment
Development, policy knowledge, and decision support	3.66	0.81	Moderate relevance
Managerial and coordination competency	3.59	0.84	Weaker alignment
Digital governance competency	3.53	0.88	Weakest alignment
Communication, behaviour, and professional discipline	3.72	0.76	Moderate alignment

Note. n = 120. Scores are based on a five-point Likert scale, where higher scores indicate stronger perceived relevance to workplace responsibilities.

The results show clear variation across competency clusters. Land administration recorded the highest mean score (M = 4.34), followed by legal and regulatory competency (M = 4.16). These results indicate that

respondents perceive the traditional legal and administrative components of the LAC as highly relevant to the responsibilities performed by newly appointed officers. Administrative procedure and file management also recorded a relatively strong mean score ($M = 3.99$), suggesting that the course provides a useful procedural foundation.

By contrast, digital governance ($M = 3.53$) and managerial and coordination competency ($M = 3.59$) received the lowest mean scores. These domains also showed comparatively higher standard deviations, indicating less consensus among respondents. The variation may reflect differences in workplace assignments, unequal exposure to digital tools, and differing supervisory expectations. The broader pattern is that the LAC is strongest in traditional statutory and procedural domains, while its alignment is weaker in newer or more practice-dependent domains of administrative work.

5.2 Workplace context and early-career role demands

The majority of LAC graduates were posted to field administration shortly after completing the course, primarily as Assistant Commissioners (Land) or Assistant Commissioners in Deputy Commissioners' offices. A smaller proportion were posted to the Secretariat. These initial postings required routine application of legal, administrative, drafting, coordination, and analytical competencies.

Supervising officers reported that new officers were expected to process official files, prepare notes and draft decisions, examine records, interpret laws and government rules, and provide reasoned recommendations for senior decision makers. These tasks required not only technical knowledge but also accuracy, prioritisation, procedural discipline, and the ability to convert learning into administratively useful outputs.

5.3 Areas of strong alignment

The evidence indicates that the LAC is broadly aligned with the statutory and procedural dimensions of early-career administrative work. Participants reported moderate to high levels of competency development in legal literacy, administrative procedure, service rules, and land-related laws. Land administration modules were especially valued, which is unsurprising given the centrality of land matters in field administration.

Supervising officers broadly confirmed this assessment. They observed that LAC graduates generally arrived with a reasonable command of relevant rules, basic procedural discipline, and awareness of official formats. These

strengths matter. In bureaucratic practice, legal awareness and procedural compliance are not peripheral capabilities; they are foundational to administrative legitimacy, record integrity, and public trust.

5.4 Persistent competency gaps

The more difficult question is whether the LAC develops higher-order competencies once officers move beyond rule recognition into applied judgement. Here the findings are more qualified. Participants reported weaker preparation in analytical decision support, applied problem solving, and the handling of complex or ambiguous cases.

Supervising officers, while generally satisfied with basic preparedness, repeatedly identified deficiencies in analytical reasoning, prioritisation, anticipatory judgement, and decision-support drafting. These concerns were most visible in high-pressure field contexts, where officers face large volumes of files, tight timelines, inter-agency coordination problems, and cases that do not fit neatly into standard procedural templates. Under such conditions, competence depends not only on what an officer knows, but on how effectively the officer can sort facts, interpret rules, weigh alternatives, and draft concise recommendations.

5.5 Curriculum relevance, balance, and assessment practice

A further finding concerns curriculum balance. Documentary evidence and respondent feedback suggest that some areas of the course are closely aligned with immediate workplace responsibilities, while other components appear more general or indirectly relevant. This does not mean that general learning, language skills, or broader public administration content have no value. Rather, the issue is one of priority within a finite professional course whose mandate is to prepare newly appointed officers for immediate administrative work.

The evidence also suggests an assessment gap. Traditional written examinations and viva voce remain useful for testing knowledge, but they are less capable of measuring applied judgement unless they are designed around realistic administrative problems. If officers are expected to draft reasoned notes, interpret ambiguous legal provisions, prioritise files, and coordinate across offices, the assessment system should require them to demonstrate these capabilities. This is the point at which curriculum relevance, pedagogy, and assessment fit must be treated as a single alignment problem.

Table 2. Key competency gaps and recommended course-level responses

Observed gap	Workplace implication	Recommended response
Applied legal interpretation	Difficulty handling cases that do not fit routine templates	Use realistic case files requiring legal interpretation and reasoned recommendations
Analytical decision support	Weakness in sorting facts, weighing options, and advising senior officers	Introduce structured note-writing, problem analysis, and decision-memo exercises
Digital governance	Uneven confidence in e-services, digital records, and data-supported administration	Increase hands-on digital governance labs linked to actual administrative platforms
Managerial coordination	Difficulty coordinating across offices under time pressure	Use simulation exercises involving inter-office coordination, prioritisation, and stakeholder communication
Performance-based assessment	High knowledge scores may not translate into workplace capability	Add rubrics for file notes, case analysis, drafting quality, and judgement under constraints

Note. The recommendations are derived from the alignment analysis and are intended as course-design options rather than exhaustive reform proposals.

6. Discussion

The overall picture is one of partial, rather than incomplete, competency alignment. The LAC is neither irrelevant nor ineffective, it provides an important institutional foundation in legal knowledge, procedural familiarity, land administration, and professional discipline. The problem is more specific: the course is strongest in areas that can be taught and tested through conventional instruction, and weaker in areas that require structured practice, realistic simulation, and performance-based assessment.

This finding is consistent with the training-transfer literature: learning does not automatically move from classroom to workplace simply because the topic appears relevant (Baldwin & Ford, 1988; Blume et al., 2010). Transfer is more likely when training includes realistic practice, feedback, and conditions that support application (Burke & Hutchins, 2007; Salas et al., 2012). The LAC appears to transmit useful knowledge, but it does not yet convert all of that knowledge into consistently reliable workplace capability. The findings also support competency-based approaches to public-sector training. A competency framework need not be elaborate to be useful: even a concise framework defining expected entry-level performance in legal reasoning, file management, drafting, coordination, digital governance, and professional conduct would improve course planning and assessment. It would also make it easier to distinguish content that is broadly educational from content that is directly necessary for immediate workplace performance.

The Bangladesh context makes this issue especially pressing. Early-career officers often enter demanding field assignments where they must learn quickly while carrying real administrative responsibilities. Supervisory mentoring remains essential, but formal training should reduce, rather than simply transfer, the burden of initial capability development to the workplace. Where the gap between formal training and workplace demand remains too wide, the strategic value of the training itself is weakened.

7. Policy Implications

First, the BCSAA and the Ministry of Public Administration should develop a concise competency framework for the LAC. The framework should be derived from actual entry-level duties and should define the minimum expected level of performance in each competency domain. Such a framework would clarify course purpose, improve curriculum planning, and provide a stronger basis for evaluation.

Second, the pedagogical mix should move further toward applied and problem-based learning. Case studies should be designed around realistic field situations rather than simplified textbook scenarios. File-note drafting, supervised legal interpretation, prioritisation under workload pressure, and cross-office coordination exercises could be incorporated more deliberately. Field attachment would be more valuable if it were structured around specific competencies to be observed, practised, and reflected upon.

Third, assessment methods should be better aligned with workplace performance. Written examinations and viva voce can remain important, but they should be supplemented by tasks that test reasoning, drafting, and judgement in practical administrative situations. Rubrics should distinguish between familiarity with rules and the capacity to use rules intelligently in context.

Fourth, course revision should rely not only on participant and faculty feedback, but also on systematic evidence from supervisors and post-training workplace experience. This would close the loop between training design and workplace reality. It would also be consistent with the broader move toward results-oriented public-sector training evaluation emphasised in recent evaluation frameworks for government training institutions (UNDP, 2026).

8. Conclusion

This article examined the alignment between training design and workplace competencies in the LAC for entry-level officers of the Bangladesh Civil

Service (Administration) cadre. The evidence suggests that the course remains a relevant and important institutional foundation, developing legal literacy, procedural awareness, land administration knowledge, and professional discipline in ways that are clearly valuable to newly posted officers.

At the same time, the course does not develop all competencies with equal force. Analytical reasoning, applied legal interpretation, decision-support drafting, digital governance, managerial coordination, and realistic problem solving remain important areas of weakness. These weaknesses are not simply matters of missing content. They reflect a deeper alignment issue: competencies are not yet defined explicitly enough, and assessments do not consistently test the forms of applied performance that early-career administrative work requires.

The central contribution of the study is to show that competency ambiguity carries real practical consequences: training can appear successful while important performance gaps remain unaddressed. The policy lesson is not that the LAC requires wholesale redesign, but that it needs clearer competency articulation, stronger practice-based pedagogy, and assessment tools that capture how officers are expected to think and act in real administrative settings. Such reforms would make the course more coherent, more measurable, and more faithful to the realities of bureaucratic work in Bangladesh.

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Investigating the Influence of Leadership on the Sustainable Performance of SMEs in Emerging Economies: Evidence from Bangladesh

Md. Salah Uddin¹, Md Nuruzzaman²

Abstract

This study investigates how leadership influences the sustainable performance of small and medium-sized enterprises (SMEs) in Bangladesh, focusing on the economic, social, and environmental dimensions of sustainability. Grounded in Dynamic Capabilities Theory, which explains how leaders sense opportunities, seize resources, and reconfigure organizational routines under constrained conditions, this study employed a cross-sectional survey and analyzed data using PLS-SEM (SmartPLS 4.1.0.8). The instrument comprised 16 reflective indicators across four latent constructs (leadership; economic, social, and environmental sustainability). After screening, 180 owner/manager responses were retained for analysis; reliability and validity (α , CR, AVE), discriminant validity (HTMT, Fornell–Larcker), and collinearity (outer/inner VIF) were assessed prior to testing structural paths with 5,000-sample bootstrapping. Results demonstrate that leadership has a positive and significant effect on economic, social, and environmental sustainability. Among these, the strongest influence is observed on social sustainability, followed by economic and environmental dimensions. These findings underscore the critical role of leadership in shaping triple bottom line outcomes within SMEs operating under resource constraints. The study is limited by its cross-sectional design and reliance on single-respondent survey data, which may constrain causal inferences. The findings provide actionable insights for SME managers and policymakers in emerging economies by demonstrating how effective leadership can drive sustainability practices, enhance resilience, and align SMEs with national development priorities and global sustainability goals. Rather than proposing a new theoretical model, this study extends the leadership–sustainability nexus into the underexplored context of SMEs in Bangladesh, contributing contextual empirical evidence and practical guidance for fostering sustainable growth in emerging economies.

Keywords: Leadership, Small and Medium-sized Enterprises (SMEs), Sustainable Performance, Emerging Economies

¹Email: salahuddinajnu@gmail.com; ²Email: mds@bcsadminacademy.gov.bd

1. Introduction

Small and medium-sized enterprises (SMEs) play a foundational role in global economies, accounting for about 90% of businesses and contributing over 50% of employment worldwide (World Bank, 2024). In Bangladesh, SMEs contribute roughly 25% of GDP and comprise approximately 7.9 million SMEs and micro-enterprises (ICAB, 2022), collectively employing around 24.5 million people, with men comprising the majority of the workforce (ICAB, 2022; Hossen & Uddin, 2024). These enterprises provide livelihoods for millions and remain central to employment generation outside agriculture, particularly in manufacturing and service sectors (Nakra, N., & Kashyap, V. 2025). Yet Bangladeshi SMEs typically operate with limited access to formal credit, weak institutional support, and limited managerial capacity, which makes firm-level leadership, rather than external institutional mechanism, the primary driver of strategic decision-making (Hossen & Uddin, 2024; LightCastle Partners, 2020). At the same time, growing pressures from economic uncertainty, climate change, and rising societal expectations mean that SMEs can no longer rely on short-term profitability alone (Hossen & Uddin, 2024); they must instead adopt a more comprehensive approach to sustainability that integrates economic resilience, social responsibility, and environmental stewardship (Pett, T. et al., 2025).

Leadership plays a decisive role in guiding organizational strategy, particularly in resource-constrained contexts where managerial discretion often substitutes for institutional support (Zaharuddin, Z. et al., 2024). In SMEs specifically, leaders exert a disproportionate influence on organizational direction and performance, since decision-making is less formalized and rests with a small number of owner-managers (Nakra, N., & Kashyap, V. 2025). This influence extends to sustainability adoption: leaders decide whether sustainable practices are embedded into the core of business operations or sidelined as peripheral activities (Pett, T. et al., 2025). Understanding this role remains important even though sustainability research has expanded considerably in recent years, because the way leadership matters differs markedly between large, professionally managed corporations and small, owner-led firms.

Despite this expanding discourse, the empirical literature on leadership and sustainable performance has developed mainly along two lines. One stream examines large, publicly listed firms in developed economies, where formal governance structures and abundant resources shape how leadership

translates into sustainability outcomes (Khaw et al., 2022). A second, smaller stream considers SMEs, but usually outside emerging-economy settings, or examines leadership's link to a single sustainability dimension, most often financial performance, rather than the full triple bottom line (Zhao, L. et al., 2023; Elkington, J., & Rowlands, I. H., 1999). What remains insufficiently examined is how leadership simultaneously shapes economic, social, and environmental outcomes within SMEs operating under the institutional voids, resource scarcity, and climate exposure characteristic of emerging economies. Bangladesh illustrates this gap clearly: it is among the most climate-vulnerable countries globally, depends heavily on SMEs for employment and inclusive growth, and offers an institutional environment markedly different from those in which most leadership–sustainability research has been conducted, yet empirical evidence from this setting remains scarce. Leadership–sustainability linkages in SMEs in emerging economies, and in Bangladesh specifically, therefore remain underexplored both conceptually and empirically.

The main objective of this study is to investigate the influence of leadership on the sustainable performance of SMEs in Bangladesh. The specific objectives of this study are outlined below:

- I. To assess how leadership affects the economic sustainability of SMEs
 - II. To evaluate the role of leadership in promoting social sustainability of SMEs
 - III. To examine the impact of leadership on environmental sustainability of SMEs.
- By doing so, this study contributes contextual evidence to the strategic management literature and offers practical insights for managers and policymakers. It is also consistent with SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production) by showing how leadership supports the economic, social, and environmental sustainability of SMEs in Bangladesh.

The remainder of this paper is organized as follows. The next section reviews the extant literature on leadership and sustainable performance, highlighting theoretical frameworks and empirical evidence. Section 3 outlines the methodology employed, followed by Section 4, which presents the results and the discussion. Section 5 concludes with key insights, contributions, limitations of the study, and avenues for future research.

2. Literature Review and Theoretical Underpinnings

This section reviews the literature on leadership and sustainable performance,

compares findings across contexts, and identifies where the SME and emerging-economy literature remains incomplete, before introducing the theoretical framework and hypotheses that guide this study.

Leadership is widely recognized as a critical determinant of organizational outcomes, shaping the strategies, values, and practices that influence firm performance (Khaw et al., 2022; Uddin, 2024). Within SMEs, leadership assumes an even more central role because flatter structures, personalized decision-making, and limited access to external resources leave fewer buffers between leaders' choices and firm outcomes (Pett, T. et al., 2025). Scholars have increasingly examined how leadership fosters sustainability, conceptualized as the integration of economic, social, and environmental concerns into business operations (Elkington, J., & Rowlands, I. H., 1999). However, as the following review shows, this literature has developed unevenly across the three sustainability dimensions and across firm types.

Economic sustainability refers to the ability of firms to generate consistent profitability, maintain financial resilience, and ensure long-term survival (Iqbal, Q. et al., 2020). Leadership has been linked to economic sustainability through strategic vision, financial decision-making, and the mobilization of limited resources (Burawat, P. 2019). Specifically, transformational leaders motivate employees to pursue efficiency and innovation, thereby enhancing competitiveness (Zaharuddin, Z. et al., 2024). In the context of SMEs, leadership can compensate for the absence of sophisticated governance mechanisms by making agile decisions that secure financial performance in volatile markets (Fatoki, O. 2021). Furthermore, empirical studies have shown that strong leadership positively influences SME profitability, growth, and market adaptation (Burawat, P. 2019). Taken together, these studies converge on a positive economic role for leadership, although most draw on large-firm or single-country samples, leaving open how consistently this relationship holds among SMEs operating under the financial constraints typical of emerging economies such as Bangladesh. By examining these relationships, we draw our first hypothesis.

H1: Leadership has a positive impact on the economically sustainable performance of SMEs.

Social sustainability emphasizes employee well-being, community development, and ethical stakeholder engagement (Nor-Aishah, H. et al., 2020). In this regard, leadership influences social sustainability through the establishment of values, organizational culture, and practices that prioritize fairness, inclusivity, and responsibility (Iqbal, Q., & Ahmad, N. H. 2021).

Moreover, studies show that leaders who demonstrate ethical and participative styles tend to foster higher employee satisfaction, lower turnover, and stronger stakeholder trust (Burawat, P. 2019). Additionally, in SMEs, where close-knit relationships with employees and communities are common, leadership is particularly decisive in shaping social outcomes (Pett, T. et al., 2025). For example, socially oriented leaders can enhance SMEs' reputation, attract talent, and secure legitimacy within local markets (Khaw et al., 2022). While these studies consistently report a positive leadership-social sustainability link, most were conducted in large organizations or in single-country settings outside South Asia, leaving the strength of this relationship in Bangladeshi SMEs largely untested. Stemming from this literature, we develop our second hypothesis.

H2: Leadership has a positive impact on the socially sustainable performance of SMEs.

Environmental sustainability relates to reducing ecological footprints, adopting eco-innovations, and ensuring resource efficiency (Fatoki, O. 2021). Studies demonstrate that leadership contributes to environmental outcomes by promoting green values, fostering innovation, and allocating resources toward environmentally friendly practices (Iqbal, Q., & Ahmad, N. H. 2021). For instance, transformational and visionary leaders are particularly effective in embedding environmental considerations into business models (Zhao, L. et al., 2023). Furthermore, evidence from emerging economies suggests that leadership directly drives SME engagement in waste reduction, energy efficiency, and compliance with environmental standards (Nakra, N., & Kashyap, V. 2025). Even so, evidence on this relationship remains thinner than for the economic and social dimensions, and much of it originates from contexts with stronger environmental regulation than Bangladesh, raising the question of whether leadership exerts the same influence where formal environmental enforcement is weak. Accordingly, we draw our third hypothesis.

H3: Leadership has a positive impact on the environmentally sustainable performance of SMEs.

Across these three streams, the literature consistently points to a positive relationship between leadership and sustainability, yet three limitations stand out. First, most studies examine large or publicly listed firms, where governance structures and resource slack differ substantially from SME conditions (Khaw et al., 2022). Second, although an increasing number of studies have examined leadership and sustainability in SMEs (Burawat, P. 2019; Nor-Aishah, H. et al., 2020; Fatoki, O. 2021), most evidence comes

from contexts outside Bangladesh, leaving Bangladeshi SMEs largely underrepresented despite the country's climate vulnerability and strong dependence on SMEs for employment. Third, few studies examine the three sustainability dimensions simultaneously within a single model, making it difficult to compare their relative importance or to determine whether leadership matters more for some dimensions than others. These unresolved issues motivate the present study's focus on SMEs in Bangladesh and its simultaneous treatment of economic, social, and environmental sustainability within one framework.

This study is grounded in Dynamic Capabilities Theory (DCT), which holds that firms achieve competitive advantage not merely through resource possession but through their ability to sense opportunities, seize them, and reconfigure resources and routines in response to changing conditions (Teece, 1997). DCT is particularly relevant here because SMEs in emerging economies rarely have the formal structures or dedicated departments needed to manage sustainability; instead, these capabilities are concentrated in the leader, who identifies emerging challenges, mobilizes scarce resources, and adapts organizational routines to respond effectively, often compensating for the absence of formal governance mechanisms commonly found in larger firms (Nor-Aishah et al., 2020; Hassan et al., 2021). This also helps explain why leadership's influence may differ across the three sustainability dimensions: sensing and seizing economic opportunities draws on capabilities that leaders exercise routinely, whereas improving environmental sustainability often requires additional resources, technology, and regulatory support that lie partly outside the leader's direct control.

Based on this literature and theoretical grounding, we propose the following conceptual framework (Figure 1).

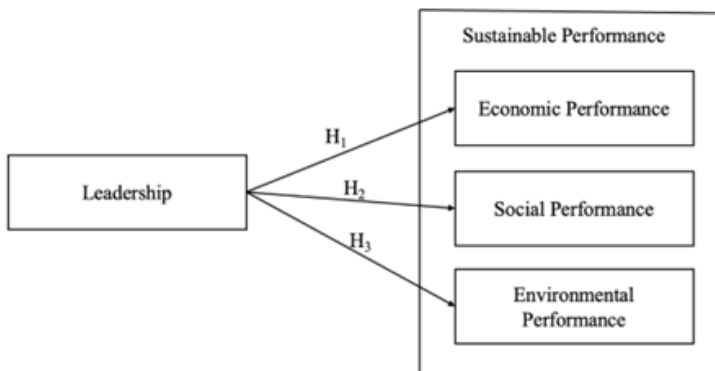


Figure 1. Conceptual Framework

Figure 1 illustrates the proposed conceptual framework, which positions leadership as a key determinant of sustainable performance in SMEs.

3. Methodology

This study adopted a quantitative, cross-sectional survey design. The research objectives required measuring the strength and direction of the relationships between leadership and multiple sustainability outcomes across a broad sample of SMEs at a single point in time. The study did not seek to examine changes within firms over time. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed as the analytical technique. PLS-SEM was chosen over covariance-based SEM because it is prediction-oriented, performs well with a moderate sample size, and is well suited to models with multiple reflective constructs, while also tolerating non-normal data more readily than covariance-based alternatives (Hair Jr et al. 2021). These properties make PLS-SEM appropriate for testing the theory-driven hypotheses proposed in this study. SmartPLS 4.1.0.8 was used for estimation because it offers an accessible, well-validated platform for bootstrapping, discriminant validity assessment, and predictive evaluation, all of which this study required.

Data were collected from SME owners and senior managers, who are directly involved in strategic decision-making and thus best positioned to evaluate leadership practices and sustainability outcomes. This respondent choice reflects the flatter structure of SMEs, where owners and senior managers, typically decide whether and how sustainability practices are pursued. Using purposive sampling across diverse sectors, a total of 200 valid responses were obtained. However, after collecting responses, 20 questionnaires were excluded from data analyses as they were partially filled or deemed misrepresented. So, data from 180 questionnaire surveys were analysed, which exceeded the recommended sample size based on both the 10-times rule and statistical power analysis (Hair Jr et al. 2021; Kock, N. 2018).

The measurement model comprised four reflective latent constructs: leadership, economic sustainability, social sustainability, and environmental sustainability. These constructs are measured using proxies from existing scholarship (Dey, P. K. et al., 2022), selected because they had already been validated in SME and sustainability research. All items used a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

To assess construct reliability and validity, we examined Cronbach's alpha,

composite reliability (CR), and average variance extracted (AVE), with recommended thresholds of $\alpha \geq 0.70$, $CR \geq 0.70$, and $AVE \geq 0.50$ (Fornell & Larcker, 1981). Discriminant validity was evaluated using both the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT), following Henseler, Ringle, and Sarstedt (2015). Collinearity at the indicator level was assessed using outer VIF values, while construct-level collinearity was checked using inner VIF values, with cut-offs set at 5.

The structural model was assessed using a bootstrapping procedure with 5,000 resamples to test the significance of hypothesized paths (Hair, J. F. et al., 2012). The model’s predictive power was examined through the coefficient of determination (R^2), where values of 0.25, 0.50, and 0.75 are interpreted as weak, moderate, and substantial, respectively (Chin, 1998). Additionally, we reported effect sizes (f^2) to assess the relative contribution of exogenous constructs, and predictive relevance (Q^2) using the blindfolding procedure, where $Q^2 > 0$ indicates predictive validity (Hair, J. F. et al., 2012). Model fit was further examined using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI) (Ullman, J. B., & Bentler, P. M. 2012). This multi-stage evaluation ensured that both the measurement and structural models met the requirements for reliability, validity, and predictive accuracy, thereby enabling robust testing of the proposed hypotheses.

4. Results

In the measurement model, we employed several robustness tests to ensure the reliability and validity of the constructs. The reliability and convergent validity of the constructs were assessed using Cronbach’s alpha, composite reliability, and average variance extracted (AVE) (Table 1).

Table 1. Construct Reliability and Validity

	Cronbach’s alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
ECS	0.937	0.943	0.952	0.799
ENS	0.793	0.830	0.877	0.705
OL	0.849	0.858	0.898	0.688
SS	0.833	0.842	0.888	0.666

As shown in Table 1, Cronbach’s alpha values ranged from 0.793 (ENS) to 0.937 (ECS), all above the recommended threshold of 0.70 (Nunnally & Bernstein, 1994). Similarly, composite reliability values (rho_c) were between 0.877 and 0.952, exceeding the 0.70 benchmark (Hair et al., 2012), thereby confirming strong internal consistency. AVE values ranged from

0.666 (SS) to 0.799 (ECS), surpassing the minimum requirement of 0.50 (Fornell & Larcker, 1981), establishing convergent validity.

Discriminant validity was examined through the HTMT ratio, the Fornell–Larcker criterion, and cross-loadings. As reported in Table 2, all HTMT values were well below the conservative threshold of 0.85 (Henseler, Ringle, & Sarstedt, 2015), suggesting no discriminant validity concerns.

Table 2. HTMT Matrix

	ECSF	ENSF	OL	SSF
ECS				
ENS	0.504			
OL	0.376	0.307		
SS	0.220	0.293	0.502	

Table 3. Fornell-Larcker Criterion

	ECSF	ENSF	OL	SSF
ECS	0.894			
ENS	0.434	0.839		
OL	0.344	0.265	0.830	
SS	0.200	0.245	0.428	0.816

The Fornell–Larcker criterion (Table 3) further confirmed that the square roots of AVE (diagonal values) were greater than the inter-construct correlations, indicating that each construct shared more variance with its indicators than with other constructs. Together, these results provide robust evidence of discriminant validity.

Collinearity was assessed through outer and inner VIF values (Tables 4 and 5). Outer VIF values ranged from 1.557 to 5.919, with most values falling below the cut-off of 5, except for two economic sustainability indicators (EC3 = 5.002; EC4 = 5.919), which marginally exceeded the threshold. Since their loadings and theoretical relevance were strong, they were retained. We acknowledge this as a potential limitation.

Table 4. Outer Model List

	VIF
EC1	3.186
EC2	3.919
EC3	5.002
EC4	5.919
EC5	2.695
EN1	1.903

EN2	1.557
EN3	1.706
OL1	1.826
OL2	2.350
OL3	1.920
OL4	1.768
SP1	1.742
SP2	1.959
SP3	1.773
SP4	1.707

Inner VIF values (Table 5) were all 1.000, indicating no collinearity among predictor constructs in the structural model. This confirms that the hypothesized relationships can be interpreted without multicollinearity bias.

Table 5. Inner Model List

	VIF
OL -> ECS	1.000
OL -> ENS	1.000
OL -> SS	1.000

The measurement model results indicate that the constructs used in this study exhibit strong reliability, convergent validity, and discriminant validity. These findings are consistent with prior leadership and sustainability studies that emphasize the need for robust measurement when analyzing multidimensional constructs such as economic, social, and environmental sustainability (Henseler, Ringle, & Sarstedt, 2015). The high levels of reliability and validity observed here suggest that subsequent hypothesis testing within the structural model is not compromised by measurement error. The discriminant validity results are particularly important in this context. Leadership, economic, social, and environmental sustainability are conceptually related constructs, and establishing their empirical distinctiveness strengthens the argument that leadership exerts differentiated effects across the triple bottom line rather than the constructs simply overlapping. The use of both HTMT and Fornell–Larcker criteria aligns with best practices in PLS-SEM reporting (Ringle, C. M. et al., 2020), providing robust support for discriminant validity and, by extension, for treating the three sustainability dimensions as separate outcomes worth modeling individually rather than as

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Although two indicators (EC3 and EC4) displayed slightly high VIF values, these were retained due to their theoretical importance in capturing economic sustainability. This is consistent with Hair et al. (2012), who note that VIF values between 5 and 10 are tolerable when justified by theoretical relevance. The absence of collinearity in the inner model further enhances confidence in the structural relationships to be tested. Overall, the measurement model is validated, allowing the study to proceed to the structural model analysis and hypothesis testing.

After validating the measurement model, the next step was to assess the structural model to test the proposed hypotheses. This involved examining the overall model fit as well as the significance and strength of the structural paths between leadership and the three dimensions of sustainable performance. The structural model is presented in Figure 2.

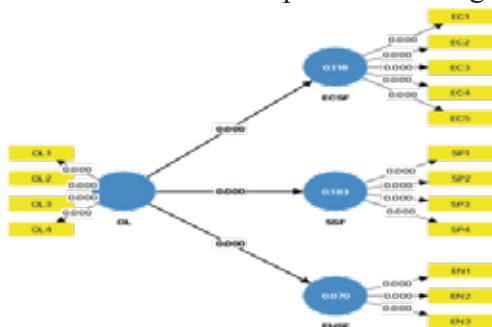


Figure 2. Structural Model

Figure 2 presents the estimated structural model, showing the path coefficients and R^2 values for each endogenous construct. The model depicts leadership as the single exogenous driver of all three sustainability dimensions, with the path to social sustainability appearing strongest, followed by economic and then environmental sustainability, mirroring the relative explanatory power reported below. This pattern suggests that leadership's influence is not uniform across the triple bottom line: it is systematically stronger where outcomes depend directly on the leader's day-to-day decisions and relationships, as with social sustainability, and weaker where outcomes depend on external enablers such as technology, financing, or regulation, as with environmental sustainability. This pattern is examined statistically below.

The overall model fit was evaluated using multiple indices (Table 6). The estimated SRMR was 0.107, slightly above the commonly recommended threshold of 0.08 (Mueller & Hancock, 2018), indicating a moderate model fit. The d_ULS (1.552) and d_G (0.264) values provide additional discrepancy measures between the empirical and model-implied correlation matrices, with lower values indicating better fit (Sarstedt, M., Ringle, C. M., & Hair, J. F. 2021). The estimated Chi-square value was 279.695, although this statistic is sensitive to sample size and is therefore interpreted cautiously in PLS-SEM. The Normed Fit Index ($NFI = 0.839$) indicates an acceptable level of model fit. Overall, although the global fit is moderate, PLS-SEM is primarily prediction-oriented. Consequently, greater emphasis is placed on measurement quality, structural relationships, and predictive validity than on global fit indices alone (Hair et al., 2012).

Table 6. Model Fit Summary

	Saturated model	Estimated model
SRMR	0.057	0.107
d_ULS	0.438	1.552
d_G	0.228	0.264
Chi-square	250.787	279.695
NFI	0.855	0.839

The structural paths were assessed using bootstrapping with 5,000 resamples. Table 7 reports the path coefficients, t-statistics, and significance levels.

Table 7. Path-coefficient

	Original sample (O)	Sample mean (M)	Std. deviation (STDEV)	T statistics ((O/STDEV))	P values
OL -> ECS	0.344	0.348	0.067	5.155	0.000
OL -> ENS	0.265	0.273	0.074	3.563	0.000
OL -> SS	0.428	0.435	0.059	7.290	0.000

The results indicate that organizational leadership (OL) has a positive and significant impact on all three sustainability dimensions. Specifically, leadership significantly influenced economic sustainability ($\beta = 0.344$, $t = 5.155$, $p < 0.001$), environmental sustainability ($\beta = 0.265$, $t = 3.563$, $p < 0.001$), and social sustainability ($\beta = 0.428$, $t = 7.290$, $p < 0.001$). Among the three dimensions, the strongest effect was observed on social sustainability, followed by economic and environmental sustainability.

The R^2 values of the endogenous constructs, displayed in Figure 2, show that leadership explained 11.8% of the variance in economic sustainability, 18.3% in social sustainability, and 7.0% in environmental sustainability. Following the guidelines of Chin (1998), these values indicate weak to moderate explanatory power. This is plausible because leadership is modeled as the sole exogenous construct. Economic, social, and environmental sustainability in SMEs are also influenced by factors such as access to finance, market conditions, government policy, and technology, which are not included in this direct-effects model. The R^2 values are therefore noteworthy rather than disappointing, as they suggest that leadership alone accounts for a meaningful share of variance in each dimension, particularly social sustainability. The findings provide empirical support for the hypothesized relationships between leadership and the triple bottom line of sustainability in SMEs, while also indicating room for future models that incorporate additional predictors. First, the positive impact of leadership on economic sustainability aligns with the resource-based and dynamic capabilities perspectives, which argue that leaders play a central role in mobilizing scarce resources and shaping strategies that foster financial resilience (Barney, J. B. 2001; Teece, 1997). This may reflect that economic outcomes, such as revenue growth and cost control, are the most immediate and closely monitored concerns for SME owner-managers, who typically make pricing, sourcing, and investment decisions personally rather than delegating them. This is particularly relevant in the context of Bangladeshi SMEs, many of which operate under financial constraints and institutional voids, where leadership-driven decision-making

can compensate for weak external support structures (Zhao, L. et al., 2023). Practically, this suggests that strengthening owner-managers' financial and strategic decision-making skills, through targeted training or advisory support, could support SME economic resilience.

Second, the significant relationship between leadership and social sustainability, the strongest of the three paths, highlights the importance of leaders in fostering employee well-being, fair labor practices, and community engagement (Hassan, H. et al., 2021), consistent with prior studies emphasizing that SMEs, due to their close social embeddedness, are more likely to translate leadership orientations into socially responsible practices (Nor-Aishah, H. et al., 2020). Social sustainability may show the strongest effect because it depends primarily on interpersonal behavior, such as how leaders treat employees and engage with the surrounding community, actions that fall largely within a leader's control and require little external investment or technology. The relatively higher effect size also suggests that Bangladeshi SME leaders prioritize social concerns, possibly strengthen legitimacy and reputation in their immediate communities, where reputational capital is closely tied to survival. This points to social sustainability as a comparatively low-cost entry point for resource-constrained SMEs beginning a broader sustainability journey.

Third, although leadership also significantly influenced environmental sustainability, the explained variance was the lowest of the three dimensions. This finding mirrors earlier work noting that environmental sustainability initiatives in SMEs, particularly in emerging economies, are often limited by financial and technological barriers (Iqbal, Q. et al., 2020). Unlike economic and social outcomes, environmental improvements, such as adopting cleaner technologies, managing waste, or improving energy efficiency, typically require upfront capital, technical know-how, and external infrastructure that individual leaders cannot supply through decision-making alone (Sajjad, A., Eweje, G., & Raziq, M. M. 2024). Leaders may recognize the importance of environmental practices but face genuine implementation constraints in the absence of external incentives or regulatory enforcement (Zaharuddin, Z. et al., 2024). This result underscores the need for policy support, such as green financing schemes or industry partnerships, to complement leadership efforts and strengthen SME leaders' capacity to pursue environmental goals.

Overall, leadership emerges as an important driver of SME sustainability, although its influence varies across dimensions. These findings are consistent

with prior studies in emerging-economy SMEs reporting positive but uneven effects across sustainability dimensions (Nor-Aishah et al., 2020; Hassan et al., 2021). the wider gap between the social and environmental effects observed here, however, may reflect Bangladesh's comparatively weaker environmental regulatory environment relative to other emerging economies studied previously (Iqbal et al., 2020). For SME owner-managers, the findings highlight leadership development as a practical tool for advancing sustainability; for policymakers, they suggest that leadership should be complemented by financial, technical, and regulatory support to strengthen environmental outcomes (Kurucz, E. C. et al., 2017). Taken together, the findings suggest that leadership alone is insufficient to achieve balanced sustainability outcomes in resource-constrained SMEs, particularly for environmental sustainability, without complementary institutional and policy support.

5. Conclusion

This study set out to examine the influence of leadership on the sustainable performance of SMEs in Bangladesh, focusing on the economic, social, and environmental dimensions of sustainability. Using PLS-SEM, it tested and confirmed all three hypotheses, demonstrating that leadership contributes significantly to SME sustainability across all dimensions, albeit with varying effect strengths: social sustainability emerged as the most strongly influenced dimension, followed by economic and environmental sustainability.

This study contributes to the literature in several ways. Theoretically, it extends leadership theory and the dynamic capabilities perspective to the relatively underexplored context in an emerging economy, offering contextual empirical evidence rather than a new theoretical model. By empirically examining leadership's distinct effects on the triple bottom line within a direct-effects framework, it enriches existing understanding of how leadership shapes sustainability outcomes under resource-constrained conditions. Practically, the findings offer guidance to SME leaders in Bangladesh, highlighting the value of sustainability-oriented leadership practices for enhancing competitiveness, legitimacy, and resilience. At the policy level, the study underscores the need for targeted support mechanisms, particularly for environmental initiatives, where leadership influence alone is insufficient without complementary financial and regulatory support.

Nevertheless, this study has limitations. First, its cross-sectional design limits

the ability to infer causal relationships between leadership and sustainability performance. It is equally plausible that firms already performing well on sustainability attract or retain more capable leaders, so causal direction cannot be established with certainty. Second, data were collected solely from SME leaders, which may introduce common method bias despite the statistical remedies applied, and may also reflect some self-serving bias in how leaders assess their own influence on sustainability outcomes. Third, the focus on SMEs in Bangladesh may constrain the generalizability of the findings to other emerging or developed economies with different institutional and regulatory environments.

Future research could address these limitations by adopting longitudinal designs to capture the dynamic nature of leadership and sustainability practices over time and to clarify the direction of causality. Incorporating multiple stakeholders, such as employees, customers, and community representatives, would provide a more holistic view of sustainability outcomes and reduce reliance on single-respondent data. Moreover, comparative studies across countries or regions could reveal how institutional contexts shape the leadership–sustainability nexus. Finally, future work could integrate additional organizational factors, such as innovation capacity, governance structures, and digital transformation, that may interact with leadership to influence SME sustainability, and could examine whether the direct effects identified here operate through intervening mechanisms.

Overall, this study reaffirms leadership as an important driver of sustainable performance in SMEs, particularly in resource-constrained contexts such as Bangladesh. At the same time, leadership alone cannot overcome structural and institutional barriers, particularly in advancing environmental sustainability. Strengthening leadership capacity, alongside policy and institutional support, therefore appears essential if SMEs are to more fully realize their contribution to national and global sustainability goals.

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Pesticide Use Knowledge among Vegetable Growers in Bangladesh: Implications for Sustainable Agriculture, Farmer Health, and Environmental Integrity

Md. Nazmul Hassan Tulon¹, Md. Jahan Boksh Moral²,
Ummey Kulsum³, Zihad Ahmed⁴, Md. Mizanoor Rahman⁵

Abstract

In Bangladesh, pesticides are frequently used in vegetable production to control pests and diseases with little consideration of their impact on the environment and human health, and their use remains largely uncontrolled despite the existence of several pesticide control rules and regulations. Against this backdrop, the study examined traditional practices, knowledge, behavior, and propensity for pesticide usage, as well as the impact of these chemicals on farmers' health and the environment. Data were collected through a questionnaire survey, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs) in the study villages. The health impact was illustrated through graphical presentations generated using the Statistical Package for the Social Sciences (SPSS), while a likelihood ratio test was used to examine links between health problems and factors such as pesticide use frequency, training level, education, and protective coverings. Results indicate that 60% of farmers apply pesticides, insecticides, and fungicides daily or weekly without necessary protective measures, and 68% rely on personal experience and fellow farmers' advice rather than Bangladesh guidelines. Harvesting often occurs within 2-5 days of pesticide application, especially for vegetables like long beans and eggplant, leading to health issues including gastric problems, headaches, nausea, skin problems, and diarrhea. Over-pesticide use also adversely affects the environment, depleting soil fertility and contaminating water. Addressing these challenges requires strengthening farmer training and awareness programs, including community-based initiatives such as Uthan Boithok, and promoting organic and sustainable farming practices that encourage the safe use of pesticides while safeguarding both farmer health and the environment.

Keywords: Pesticide use, Health hazard, PPE, Environmental contamination, Vegetable production

¹E-mail: nazmultulon@gmail.com; ²E-mail: jahan-ges@ru.ac.bd; ³E-mail: ummeykulsum@ru.ac.bd;
⁴E-mail: zihad6004@ru.ac.bd; ⁵E-mail: mizangeo@ru.ac.bd

1. Introduction

The issue of environmental degradation has become pertinent in recent years (Ali et al., 2024), with agriculture playing a substantial role in this process. From the beginning of the sixth decade of the last century, the world agricultural system started to be modernized, and chemical inputs increased manyfold (Rahman et al., 2021). Pesticides are pivotal in global agriculture, significantly boosting crop yields and protecting against pest-induced losses (Damalas and Eleftherohorinos, 2011); approximately 40% of potential crop losses are averted annually through the application of around 5 billion kg of insecticides worldwide (Oerke, 2006). Despite this crucial role, the persistent nature and high toxicity of pesticides raise concerns for human health and the environment, and also lead to increased production costs and unintended consequences as pests develop resistance over time (Carvalho, 2006; Gavrilescu et al., 2015). The World Health Organization (WHO) has highlighted the long-term health risks associated with pesticide exposure, including cancer, neurological disorders, reproductive impairments, and respiratory and skin problems (WHO, 1990). Sharma et al. (2010) and Zhang et al. (2015) note that pesticides play a vital role in meeting the ever-increasing global food demand by boosting productivity, but that their widespread use poses challenges to sustainable agriculture by contaminating essential resources such as air, water, and food. Developing nations, particularly farmers in rural regions, bear the brunt of pesticide-related illnesses and fatalities, accounting for 99% of such cases annually (Miller 2004; Zhang et al. 2011). According to estimates from WHO (2009), at least 300,000 individuals die each year from pesticide poisoning, with low- and middle-income nations accounting for 99% of these deaths, VVand the World Bank estimated that 355,000 people died in 2008. However, according to FAO (2005), which cited new data from Sri Lanka, pesticide poisoning may cause as many as 300,000 annual deaths in the Asia-Pacific region alone (Gyawali, 2018). Moreover, estimates from the UN Environmental Program and the World Health Organization indicate that three million farm workers in poor nations suffer severe pesticide poisoning each year, with over 18,000 losing their lives (Miller, 2004). Numerous pesticides have been shown or are believed to be endocrine-disrupting chemicals, substances that interfere with the endocrine system's normal function and may cause illness or abnormalities in both the organism and its progeny (McKinlay et al., 2008); breast cancer risks, for instance, is greater among women living in areas where

agricultural pesticide use has been rising (Reynolds et al., 2005). Pesticides and other organic contaminants also have wide-ranging, often interconnected ecological effects on ecosystems as well as individual organisms; Swedish research, for example, identified pesticide use as one of the main factors influencing biodiversity loss. According to WWF, the rise in sickness, malformations, and tumors among commercial fish species in heavily contaminated regions of the North Sea and UK coastal waters since the 1970s is consistent with consequences linked to pesticide exposure (FAO, 1996). Pesticide-induced groundwater contamination is likewise a global issue: the USGS reports that at least 143 distinct pesticides and 21 transformation products, representing all major chemical classes, have been detected in groundwater (Kole and Bagchi, 1995, cited in Aktar et al., 2009). Due to improper application and handling by untrained farm workers, most pesticides use in poor nations such as Nepal is linked to negative impacts on human health and the environment (Naidoo et al., 2010). Research from Vietnam suggests that approximately 80% of pesticides used in Vietnamese agriculture are applied improperly, which raises production costs, reduces bioefficacy, and increases the environmental hazard load (Nguyen, 2014). Bangladesh, a densely populated nation heavily reliant on agriculture, illustrates the complex interplay between pesticides, agricultural practices, and their consequences. With limited land resources, Bangladesh depends heavily on pesticides, and agriculture contributes significantly to the GDP (13.3% in 2018-2019) (BBS, 2020a). Bangladesh is now the third-largest vegetable producer in the world, with an anticipated 19.7 million metric tonnes (MT) produced in 2020–2021 (BBS, 2022). Vegetables, essential components of a healthy diet, are particularly susceptible to pests, necessitating intensive pest management; a myriad of vegetable species are cultivated on approximately 470,414 hectares of land in Bangladesh, with an annual growth rate of 2.8% (BBS, 2010). Government initiatives, such as providing free pesticides before 1974 and substantial subsidies thereafter, have contributed to the intensified use of pesticides among vegetable growers (Amin and Bashu, 2004); although use began in 1951, it remained low until the 1960s. Some 242 trade names of pesticides and 84 active compounds in different formulations have since been registered for crop and vegetable protection in the country (Ara et al., 2014), indicating a massive increase in use. Pesticide consumption in Bangladesh is reported to have surged from 758 metric tons in 1960 to 48,690 metric tons in 2008, reflecting growing

dependence on these chemical interventions (Islam et al., 2016; Miah et al., 2014). However, the excessive use of pesticides, including prohibited ones, raises concerns about their impact on both human health and the environment (IRIN, 2010). Reports from Bangladesh have documented extremely high concentrations of organophosphate and carbamate pesticides in soil and water (Chowdhury et al., 2012; Shammi et al., 2014), and the widespread use of organophosphate insecticides has led to a disturbing finding that 900 farmers out of every 100,000 suffer from pesticide poisoning (Dasgupta and Meisner, 2005). A lack of proper awareness, insufficient self-protection measures among farmers, and excessive pesticide application all contribute to these alarming statistics (Goldner et al., 2010). The World Bank's findings highlight the common issue of excessive pesticide use among vegetable cultivators in Bangladesh, particularly those involved in bean and eggplant farming (Dasgupta and Meisner, 2005). Moreover, highly toxic pesticides, both permitted and prohibited, are frequently employed by Bangladeshi farmers, contributing to significant health and environmental impacts (Meisner, 2004; Robinson et al., 2007; Shammi et al., 2020). More than 47% of Bangladeshi farmers growing Boro (winter rice), potatoes, beans, eggplant, cabbage, sugarcane, and mangoes have also been found to overuse pesticides. This overuse is a potentially dangerous issue for both the environment and farmers' health, since only 4% of farmers have received official training in pesticide use or management, and more than 87% freely acknowledge taking little to no precautions while applying pesticides (Dasgupta, 2007). Although data from around the world indicate several connections between agricultural practices and products and environmental health concerns, public policy initiatives have frequently targeted agriculture and health separately (Sarkar et al., 2012). Even though the importance of occupational health and safety has grown in recent years (Cecchini et al., 2018). This overuse of pesticides, coupled with a lack of knowledge and protective behavior among vegetable farmers, creates a substantial impact on both health and the environment that remains largely undocumented in Bangladesh. Against this backdrop, this study tried to assess pesticide usage in vegetable farming, including practices, health risks, and farmer perceptions of pesticides' environmental impact, and develops targeted recommendations for safer pesticide use and environmental protection.

2. Materials and methods

Both primary and secondary data were used in this investigation. Primary data

were gathered through a questionnaire survey, focus group discussions, and Key-informant discussions in two agrarian villages—one in Godagari Upazila, Rajshahi district, and the other in Manirapur Upazila, Jashore district purposively chosen for their intensive vegetable-growing characteristics (Fig.1). These villages are known for producing a wide range of vegetables, including okra (*Abelmoschus esculentus*), cauliflower (*Brassica oleracea* var *botrytis*), eggplant (*Solanum melongena*), tomato (*Lycopersicon esculentum*), bitter gourd (*Momordica charantia*), pumpkin (*Cucurbita pepo*), cucumber (*Cucumis sativus*), white spot arum (*Amorphophallus*), radish (*Raphanus sativus*), chili (*Capsicum annuum* L.), cabbage (*Brassica oleracea* var. *capitata*), long beans (*Vigna unguiculata*), papaya (*Carica papaya*), and others.

A total of 191 respondents, purposefully chosen from among active vegetable growers, pesticide dealers, and retailers, were used for the questionnaire survey and FGDs, while agricultural officers, local leaders, and school teachers served as key informants. Various statistical tools, including descriptive and analytical statistics, were then used to process and interpret the data. Descriptive statistics were used to display the frequency distribution and percentages of the variables, while analytical statistics such as likelihood ratio tests demonstrated the relationship between distinctive characteristics of vegetable growers — including gender, education, training, precautions taken, and health risks. Finally, the impact of pesticide contamination on the environment was examined using a binary logistic regression model, since this technique predicts a dichotomous outcome, such as whether perceived environmental quality is changing (yes/no), and is appropriate where linear regression would violate its error assumptions and yield out-of-range probabilities (Hosmer et al., 2013; Peng et al., 2002).

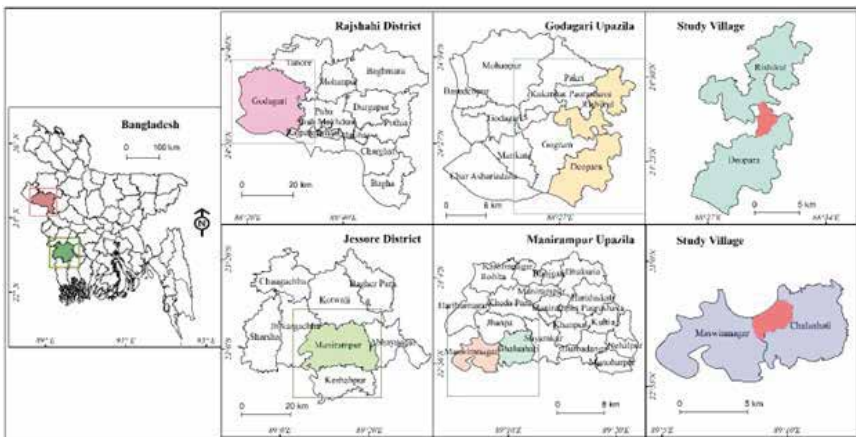


Fig 1. Study area map

3. Results and discussions

In most situations, the relationship between pesticide use and its effects on the environment and human health depends on the demographics of the farmers, primarily their age, sex, and educational attainment (Shammi et al., 2020; Nguyen, 2017). In light of this perspective, the following is a visual representation of the examination of farmers' demographic patterns:

3.1 Demographic profile and experiences of the vegetable growers

The demographic details of the vegetable growers who participated in the study's interviews are shown in Figure 2. The information sheds light on the participants' age groupings, education levels, gender distribution, and pesticide use experiences.

3.1.1 Gender Similar trends were seen in the research area, where males predominate in agricultural practices. Only 2.09 percent of respondents were female, while 97.91 percent of respondents were male.

3.1.2 Age The interviewed growers were distributed across various age groups. Ages 30 to 40 made up the largest age group (37.20%), followed by those over 40 (28.80%).

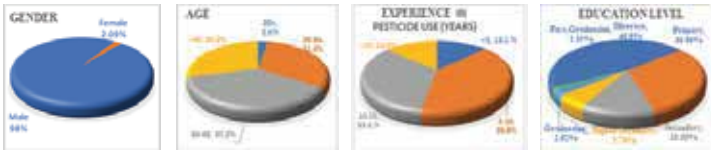


Fig 2. Demographic Characteristics of the interviewed vegetable growers

3.1.3 Experience in Pesticide Use The participants' duration of pesticide use experience varied. 39.80% of the largest group had five to ten years of experience. However, a startling number of people (13.6%) have worked with pesticides for more than 15 years. Additionally, 33.5% have 10–25 years of pesticide application experience.

3.1.4 Education Level The vegetable growers' levels of education also differed. A sizable portion of farmers are illiterate (46.60%), followed by those with lesser levels of education (30.89%), primarily primary education. Numerous studies have found that farmers' perceptions of the health risks associated with chemical pesticide use are influenced by factors such as age, agricultural experience, education level, farm size, yield, average income, and membership in agricultural organizations (Liu et al., 2021; Bakhsh et al., 2017). Ghalavandi et al. (2018) stressed the importance of proper knowledge and education for handling pesticides safely at every stage, including

purchase, storage, composition, spraying, and correct waste disposal. Janmaimool and Watanabe (2014) similarly validated the impact of prior experience, attitude, mental norm, perceived ability to regulate risk, and sociodemographic characteristics (age, gender, education, socioeconomic level, and membership in organizations) on health-risk perception, while Ahmadipour and Nakhei (2024) showed a significant relationship between education and pesticide-related health risks.

3.2 Tradition of pesticide use and knowledge of the vegetable growers

Agrochemicals, such as pesticides and chemical fertilizers, are prevalent in agriculture, especially among intensive and small farm holders like those in Bangladesh, a densely populated nation whose society is highly dependent on the agricultural economy (BBS 2016; BBS 2020b; WB 2016a). Farmers' answers to questions on their knowledge and pesticide usage behaviors are shown in Table 1. About 48% of farmers use pesticides only when required to control pests, while 34% and 18% use pesticides daily and weekly, respectively; frequency also varies by vegetable variety, with farmers who grow eggplant and long beans heavily responsible for the frequent use of pesticides, often applying an excessive dose in the belief that increased application leads to increased output. Similar results were reported in previous World Bank research showing that pesticide abuse is common among Bangladeshi vegetable growers, particularly those who raise eggplant and beans (Dasgupta and Meisner 2005). The most commonly used pesticide input (42.93%) was insecticides; rodenticides (3.14%) were less common than fungicides (31.41%) and herbicides (22.51%), and over 85% of farmers use both fungicides and insecticides, with overdosing remaining common. Farmers' decisions about pesticide use are influenced by a number of factors; 40.31% relied mostly on recommendations from other farmers, and 28.80% on their own experience, while proposals from pesticide retailers (16.75%) were also important, and labeling guidelines (8.38%) and recommendations from agricultural authorities (5.76%) had a smaller impact, with very few farmers following agriculture officers' suggestions. According to similar results from an earlier study (Chowdhury et al. 2013a), most Bangladeshi farmers base their pesticide selections on their own experience and the recommendations of pesticide merchants rather than official guidance. Farmers also had varying preferences regarding when to apply pesticides: application before an attack (24.60%) and after the severe stage of an attack (1.04%) were less common than application at the primary stage of attack

(31.93%) or when needed (42.41%) — though even this more appropriate practice remain underused. Most respondents (94.90%) preferred spraying, with only 5.09% choosing granular approaches, and 30.37% of farmers sprayed pesticides on an empty stomach, while 69.63% did so on a full stomach, suggesting that many farmers continue to disregard the correct way to apply pesticides. The interval between final spraying and harvesting is similarly important: most respondents reported intervals of 2–5 days (38.21%) and 5–10 days (28.78%), with smaller shares reporting intervals of less than 2 days (20.41%) or more than 10 days (12.56%) — a pattern likely linked to the 84.19% of farmers who lack adequate training on pesticide use and its effects on human health. By comparison, a previous study of small-scale commercial vegetable growers in Vietnam found that 54.8% of vegetables had a preharvest interval of 8 to 15 days, while 31.4% had fewer than 7 days (Nguyen et al. 2017).

Table 1. Pesticide use tradition among vegetable growers

Variables	Response (%)	Variables	Response (%)
Pesticide usage frequency		Pesticide usage types	
Daily	34.03	Insecticides	42.93
Weekly	18.33	Fungicides	31.41
Used when needed	47.64	Herbicides	22.51
		Rodenticides	3.15
Pesticide application based on		When should pesticides be applied?	
Personal experience	28.80	Before Attacking	24.60
Agricultural officer's suggestion	5.76	Primary Stage of Attacking	31.93
Labeling instruction	8.38	Following the Severe Stage of Attacking	1.06
Fellow farmer's suggestion	40.31	When needed	42.41
Pesticide retailer's suggestions	16.75		
Prefer method of pesticide applications		Pesticide application with	
Granular	5.09	Empty stomach	30.37
Spray	94.91	Full Stomach	69.63
Interval Between Spraying and Harvesting		Training received?	
<2	20.41	Yes	15.81
2-5	38.21	no	84.19
5-10	28.78		
>10	12.56		

3.3 The behavior of vegetable growers during pesticide application

Although behavior is shaped by a complex array of factors that are far from well understood or consistent across situations, attitudes toward the environment influence behavior, which in turn is shaped by information and knowledge. Table 2 shows vegetable growers' behavior regarding pesticide application: the majority (76.97%) do not take safety measures during

pesticide application, while those who do use partial cover with towels on the face (37.41%), masks (22.45%), or full shirts (40.14%). Yang et al. (2014) note that protective measures taken before, during, or after pesticide application are thought to effectively reduce farmers' risk, yet 71% of farmers in a comparable survey did not use sufficient protective clothing, with the majority of those who did relying on a complete shirt and a towel over the face (Nguyen et al. 2017). A study of the Moghan Plain region of Iran likewise found that roughly half of farmers used little personal protective equipment, with a long-sleeved shirt the most common item work, and personal protective equipment use rising alongside farmers' negative opinions of pesticides (Bondori et al., 2018). After pesticide use, farmers took a range of precautions, including changing dress (23.04%), washing hands with water only (38.22%), washing hands with mud and water (11.51%), washing hands with soap (19.89%), taking a shower (5.25%), and doing nothing (2.09%). A major concern, however, was the handling of used pesticide bottles and packets and the disposal of remaining pesticides: research results indicate that a majority of growers (76.96%) leave pesticide bottles and packets in the field after use, while 13.08% burn them and 9.96% preserve them for further use; regarding disposal of the remaining pesticide, 53.49% of respondents spray it continuously until finished, 30.01% unload it on the ground, and 16.50% keep it for the next spray. Similar findings were made in an earlier study conducted in Oman, where applicators' (workers from South Asia, including Bangladesh) practices for handling partially used pesticides were shown to be problematic, with 81.1% storing them in other areas of the house and 14.9% storing them in their bedrooms, and personal protective equipment (PPE) such as nose masks and eye protection was hardly ever employed when applying pesticides (Esechie and Ibitayo, 2011).

Table 2. Pesticide use behavior among vegetable growers

Variables	Total responses (%)	Variables	Total responses (%)
Taking safety measures during spray?	23.03	Types of safety cover taken	37.41
Yes	76.97	Towel on face with a few cloths	22.45
No		Mask with normal cloth	40.14
		Full shirt only	
Preventive precautions conducted immediately following pesticide use	23.04	Pesticide bottle and packet after use	
Change dress	38.22	Burned	13.08
Wash hands with only water	11.51	Left in the field	76.96
Wash hands with mud and water	19.89	Preserve for further use	9.96
Wash hands with soap	5.25		
Take shower	2.09		
Do nothing			

Disposal technique of the remained pesticides			
Unloaded on the ground	30.01		
Kept for the next spray	16.50		
Until finished, spray continuously	53.49		

3.4 Trends of pesticide use among vegetable growers

Pesticides are essential to sustaining high output in vegetable growing, protecting crops from pests and diseases (Khatun et al., 2023; Mahugija et al., 2017; Tudi et al., 2021). To cultivate traditional and new rice types, potatoes, spices, vegetables, and cotton, farmers frequently use pesticides in place of fertilizers (Rahman, 2013), and with limited land available to feed a large population,. Bangladesh depends heavily on intensive application of chemical inputs to boost crop yield. Fig. 3 illustrates trends in different types of pesticide usage in Bangladesh from 2000 to 2018, categorized into Rodenticides, Herbicides, Fungicides, Insecticides, and Total Use. Total pesticide use rose rapidly from 15632.24 MT to a high of 48690.19 MT in 2008, before declining to 37,187.28 in 2018 — still well above the 2000 level. Insecticides use grew sharply from 13,430.71 MT in 2000 to 30,115.18 MT in 2008, peaking alongside total use, but then declined consistently after 2008, reaching 14,838.29 MT in 2018, while fungicide use grew steadily from 1,220.06 MT in 2000 to 16,087.97 MT in 2018, indicating the growing importance of fungal disease control in agriculture; rodenticides remained negligible, highlighting a limited focus on rodent control. Vegetable growers were also asked during the survey about their perception of the pesticide use trend: 76% of farmers (Fig.4) said that pesticide use in vegetable farming had increased significantly over the years, while 19% said it was decreasing. A similar result has been reported in numerous studies.: Islam et al. (2015, cited in Begum et al. 2025) note an alarming rise in pesticide use in Bangladesh, driven by a significant increase in vegetable output, with over 37,000 MT applied in 2022 compared to 19,000 MT in 2000.



Fig. 3. Total pesticide consumption from 2000 to 2018 in Bangladesh (Mt)



Fig 4. Farmer's perception on pesticide use propensity in vegetable farming

Source: Bangladesh Crop Protection Association

Similarly, the data in Fig.5 show that pesticide use has increased for all vegetables over the past five years, in both concentration per 10 liters of water and total volume per acre. Vegetables like eggplant, long bean, and yard-long bean now use double the previous amount and even for crops like bitter gourd and chilis, where acreage use remained low, concentration levels have risen. This trend highlights a notable intensification of pesticide application in the study area.

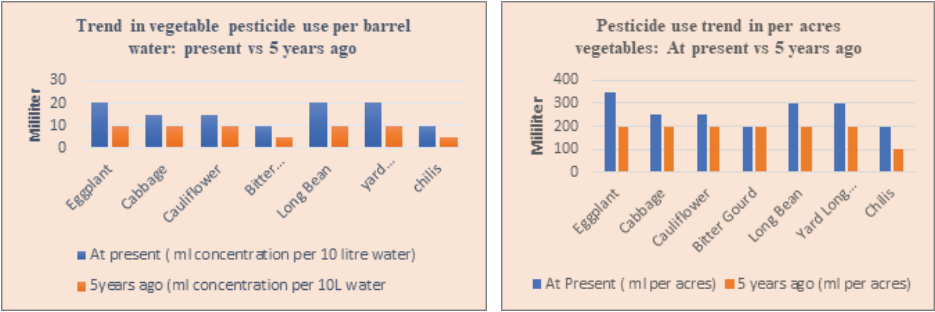


Fig 5: Trend of pesticide usage in the vegetables of the study area.

Moreover, Table 3 presents information on various pesticides used by farmers in the study area, including their common names, active ingredients, WHO hazard classifications, and application targets. Most insecticides, like Alco 550 EC and Heron 5 EC, are moderately hazardous (Class II), while some, like Goldazim 500 SC and Amistar 250 SC, are classified as low hazard (Class U); abamectin-based pesticides are marked with UK guidelines, indicating special handling instructions, and a few entries, like Upperclen and Amistar, lack WHO classifications. The table also includes the herbicide Roundup 480 SC, targeting weeds, with a Class III (slightly hazardous) rating. Though the table presents commonly used pesticides and their hazard classifications, field observations during the survey also revealed the use of banned pesticides like Ultima 40 WG and Diazinon 14G. The presence of these restricted or prohibited chemicals raises serious concerns about a lack of awareness, weak regulatory enforcement, and unsafe farming practices in the study area — concerns reinforced by other studies finding that a significant number of pesticides used in Bangladesh appear on lists of banned or restricted substances (such as dichlorvos, dicotophos, disulfoton, ethyl parathion, methyl parathion, mercury compounds, monocotophos, phosphamidon) under international agreements such as the Stockholm

Convention, the Basel Convention, and the Rotterdam Convention (Chowdhury et al., 2018; Meisner, 2004; Begum et al., 2025).

Table 3: Different types of pesticides used by farmers of the study area

Common name	Active ingredients	WHO class	Application
Alco 550 EC	Chlorpyrifos 50% and cypermethrin 5%	ii	Maggots, sap-sucking, and soil-dwelling pests
Goldazim 500 SC	Carbendazim 50%	U	Red rust, Sigatoka, powdery mildew
Heron 5 EC	Lufenuron	ii	Jab insects, bed bugs, brown insect
Toximite 1.8 EC	Abamectin	UK	Spiders
Salvation 32.5 SC	Abamectin	UK	Late blight
Upperclm 5 SG	Emamectin benzoate		Insects, aphids, and fruit borers
Amistar 250 SC	Azoxystrobin	U	Vegetable, rice, cotton, and tree nut diseases, including leaf spots, blights, and powdery mildew.
Roundup 480 SC	Glyphosate	iii	Weeds

3.5 Health Impacts of Pesticide Use on Farmers: Symptoms, Treatment, and Contributing Factors

Farmers in the study area experienced a variety of health issues during or after using pesticides. Gastric issues were the most commonly reported health problem among farmers, with 39.3% of respondents experiencing it, while headaches and nausea were also relatively common, affecting 19.9% and 14.7% of farmers, respectively; skin problems, diarrhea, and poisoning were reported to a lesser extent but remain noteworthy at 8.4%, 9.9%, and 7.8%, respectively. Similarly, a survey in Oman noted that skin irritation (70.3%), burning (39.2%), headache (33.8%), vomiting (29.7%), and salivation (21.6%) were health symptoms related to pesticide exposure (Esechie and Ibitayo 2011). These health problems appear to be compounded by farmers' tobacco use while spraying: a significant proportion of farmers (36.1%) reported using tobacco during pesticide spraying,, most commonly by smoking with other forms of tobacco use accounting for the remainder. However, a major concern is that most farmers (65.4%) did not visit a health facility when experiencing pesticide-related health problems, and self-treatment was the most common approach, used by 54.5% of farmers, while village doctors and community clinics were used to a lesser extent, at 18.3% and 12.0%, respectively (Table 4).

Table 4: Farmers’ health issues and their treatment techniques

Variables	Total responses	Variables	Total responses
Farmers experienced health problems	39.3	Visit the health complex	34.6
Gastric	19.9	Yes	34.6
Headache	14.7	No	65.4
Nausea	8.4		
Skin problem	9.9		
Diarrhea	7.8		
Poisoning			
Addiction during spray		Pesticide-related health issues treatment method	
Smoking	36.1	Self-treatment	54.5
Remain of tobacco	13.6	Village doctor	18.3
Betel leaf	4.2	Community clinic	12.0
No addiction	46.1	Napa, omeprazole	6.3
		Health complex	8.9

Table 5 shows the results of a likelihood ratio test examining the relationship between farmers’ characteristics and the occurrence of health problems due to pesticide use, evaluating how factors like gender, age, education, training, protective measures, and frequency of pesticide use are statistically associated with pesticide-related health issues. The results also reveal that education level, training, protective measures, and frequency of pesticide use have a significant association with farmers' health problems during or after pesticide application. Education showed a strong influence at the $p<0.01$ level, indicating that better education may reduce health risks, while training and use of protective measures were highly significant ($p<0.001$), suggesting their critical role in minimizing health issues. Frequency of pesticide use also showed a strong association with health outcomes ($p<0.001$), highlighting the danger of repeated exposure. Gender was only marginally significant ($p=0.036$), and age was not significantly associated ($p=0.083$). These findings align with Nguyen et al. (2017), who also identified education, protective equipment, and pesticide frequency as major influencing factors.

Table 5: Relationship Between Farmers’ Characteristics and Health Problems from Pesticide Use

Farmer's characteristics	Likelihood ratio test		
	Value	df	P value
Gender	11.935	5	.036
Age	23.051	15	.083
Education level	40.03	18	.01
Training	35.406	5	<0.001
Types of Protective Measures	29.96	10	0.001
Frequency of pesticide use	35.19	10	<0.001

Significant association at $p < 0.01$ and $p < 0.001$ levels respectively

3.6 Farmers' perception of the impact of pesticides on vegetable farming and the environment

Table 6 summarizes vegetable growers' perceptions of the environmental impacts of pesticide use, while Table 7 presents the results of a binary logistic regression model identifying which of these perceptions significantly influence the belief that overall environmental quality is declining. Most farmers reported experiencing soil fertility loss (68.1%), water contamination (67.0%), pest resistance (63.9%), and pest incidence (62.8%) due to pesticide use, consistent with earlier research showing that pesticides increase vegetable production but that their overuse creates a serious problem for agriculture and the environment (Kapka-Skrzypczak et al. 2011; Shorma et al. 2014). However, the regression analysis revealed that only air contamination, perceived by 41.8% of respondents, was positively and significantly associated with the perception of environmental degradation ($B = 0.853$, $p = 0.009$). In contrast, perceptions of water contamination ($B = -1.036$, $p = 0.003$), reduced soil fertility ($B = -0.762$, $p = 0.027$), and developing pest resistance ($B = -0.922$, $p = 0.006$) showed significant but negative associations, suggesting an inverse or complex relationship, while pest incidence, although commonly reported, was not statistically significant ($p = 0.663$). The overall model was statistically significant ($-2LL = 231.26$, Nagelkerke $R^2 = 0.213$), indicating modest explanatory power. These findings suggest that while farmers widely recognize several environmental impacts from pesticide use, they conceptually separate specific agricultural issues from broader environmental degradation, likely reflecting overlapping or interrelated perceptions. This highlights the importance of targeted awareness and education to align farmers' understanding of specific pesticide effects with overall environmental outcomes, and underscores the need to address water, soil, and air quality impacts in pesticide management. Similar

arguments have been made in previous research: according to Swedish research, pesticide use is one of the most important factors affecting biodiversity, and according to WWF, since the 1970s, the North Sea and the coastal waters of the United Kingdom have experienced an increase in sickness, malformations, and tumors in commercial fish species, consistent with consequences known to be caused by chemical exposure (FAO 1996). Glotfelty and Schomburg (1989) also note that every application of pesticides results in some drift, even when using ground-based equipment, so that air, water, and soil — the most vital components of the ecosystem— can all be contaminated by pesticides, altering the quality of the ecosystem.

Table 6: Perception of the vegetable growers on the environmental impacts of pesticide use

Variables	Frequency	Yes (%)	Mean	SD
Increasing insect incidence?	120	62.8	.63	.48
Increasing insect resistance?	122	63.9	.64	.48
Decreasing soil fertility?	130	68.1	.68	.46
Is air contamination increasing?	79	41.4	.59	.49
Is water contamination increasing?	128	67.0	.67	.47

Table 7: Result of the Binary Logistic Regression

Do You Think Environmental Quality is Changing Due to Pesticide Contamination? (Dependent variable)

Variables in the equation

Explanatory variables	B	S.E.	Wald	df	Sig.
Increasing pest incidence	.147	.339	.189	1	.663
Water pollution	-1.036	.348	8.893	1	.003
Air contamination	.853	.328	6.764	1	.009
Reducing soil fertility	-.762	.344	4.890	1	.027
Developing pest resistance	-.922	.339	7.418	1	.006
Constant	.949	.391	5.890	1	.015

-2 log likelihood=231.26, Nagelkerke R Square=.213, level of significance=0.0

3.7 Measures to improve farmers' safety behavior and pesticide-related

environmental issues

In Bangladesh, where agriculture plays a pivotal role in the livelihoods of a densely populated society, addressing the prevalent use of pesticides and fertilizers is of paramount importance (BBS 2016; BBS 2020b; WB 2016a). Recognizing that farmers are key stakeholders in mitigating environmental pollution and safeguarding their own health as well as that of their families, it is imperative to address their perceptions of pesticide-related risks. To enhance knowledge and promote safer pesticide practices in rural areas, the following recommendations are suggested:

3.7.1 Education and Training: Implement targeted educational programs for farmers and retailers on pesticide use, handling, and safety. Collaborate with agricultural extension services to provide regular training sessions that emphasize the proper application of pesticides and the associated risks. These programs should also underscore the importance of adhering to safe pre-harvest intervals.

3.7.2 Awareness Campaigns: Launch public awareness campaigns in rural communities to inform farmers about the potential negative impacts of pesticides on human health and the environment. Use a variety of media channels, including radio, television, and community meetings, to disseminate information about safe pesticide practices and their benefits.

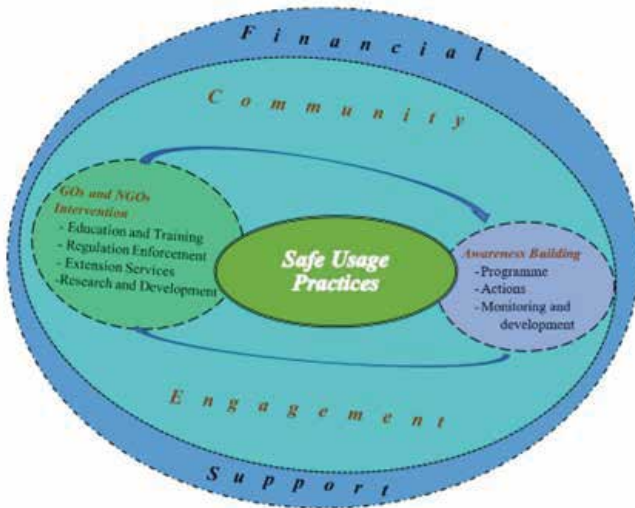


Fig 6: Safe Usage Practices Framework

3.7.3 Safe Usage Practices: Emphasize the adoption of safe pesticide usage practices, including the use of protective clothing, equipment, and recommended dosages. Promote the implementation of Integrated Pest Management (IPM) techniques, which reduce reliance on chemical pesticides (Fig 6).

3.7.4 Regulation and Enforcement: Strengthen the enforcement of existing pesticide regulations, such as the Pesticides (Amendment) Act, 2009, in Bangladesh. Develop more stringent legislation where necessary to address gaps and ambiguities in pesticide control. Increase penalties for non-compliance and ensure that regulatory agencies have adequate resources for monitoring and enforcement.

3.7.5 Extension Services: Strengthen and upgrade agricultural extension services to offer continued assistance to farmers with timely information, training, and technical advice. The DAE carries out programs such as Integrated Pest Management (IPM) and the Farmer Field Schools (FFS), which educate farmers in the field on the appropriate use of safe pesticides and the sustainable production of field crops, as well as help promote environment-friendly practices more broadly. These services need to be extended to strengthen their education on sustainable, environmentally friendly farming techniques, including organic farming, crop rotation, and biopesticides.

3.7.6 Financial Support: Seek funding from both government and non-government sources to support farmer training programs and the implementation of safe pesticide practices. Encourage the private sector to invest in research and development of safer, more eco-friendly pesticides.

3.7.7 NGO and Donor Interventions: Collaborate with non-governmental organizations (NGOs) and donor-funded initiatives like UTHAN BOITHOK (yard meeting) and Integrated Pest Management (IPM) to further promote responsible pesticide use. These organizations can play a significant role in providing resources, expertise, and advocacy for sustainable agriculture.

3.7.8 Research and Development: Invest in research and development efforts to identify and promote low-toxicity, eco-friendly alternatives to highly and moderately toxic pesticides. Encourage local universities and research institutions to engage in research that benefits both farmers and the environment.

3.7.9 Monitoring and Reporting: Establish a robust monitoring and reporting system for pesticide residues in agricultural produce. This will help to ensure compliance with safety standards and enable timely corrective actions when contamination is detected.

3.7.10 Community Engagement: Engage local communities and farmers in

discussions and decision-making processes related to pesticide use and environmental protection. Encourage community-driven initiatives to reduce pesticide risks and promote sustainable farming practices.

4. Conclusion

The study reveals that pesticides are the predominant method used for pest management in Bangladeshi vegetable farming, yet they are widely viewed as hazardous, posing risks to the environment, crop quality, and consumer health. Alarmingly, the findings show that farmers are significantly exposed to these risks while also jeopardizing the broader ecosystem. Pesticide contamination of the environment and its adverse health effects on farmers are pressing concerns that stem from a lack of training, excessive reliance on pesticides, limited awareness of pesticide risks, low literacy rates, and insufficient knowledge of personal protective equipment. Addressing these issues demands the promotion of personal protective equipment (PPE), comprehensive training in pesticide application, and a concerted effort to improve education. Correcting pesticide handling practices, tightening monitoring of banned pesticides, and developing extensive training programs are all pivotal to raising farmers' awareness of the risks pesticides pose to their health and the environment. Effective regulation of pesticide use, promotion of non-chemical or organic pest control methods, and streamlining the process for banning harmful pesticides are indispensable steps toward sustainable vegetable farming. Realizing a future of sustainable agriculture in Bangladesh will require directing financial support toward alternative practices such as organic vegetable farming and the adoption of integrated pest management (IPM) strategies. The government must play a central role in providing pesticide application training and must also work with NGOs to help ensure farmers' safety. Given the health and environmental consequences of chemical pesticides, a paradigm shift in agriculture is urgently needed — one centered on substantially reducing chemical pesticides use, to the benefit of public health, the ecosystem, and the wider economy. This study contributes to the existing literature by offering a comprehensive assessment of pesticide use practices, farmers' knowledge and awareness, associated health and environmental impacts, and the socio-economic determinants of pesticide dependence in Bangladeshi vegetable farming. Future research should focus on evaluating the long-term health and environmental impacts of pesticide exposure, as well as assessing the effectiveness and adoption of integrated pest management (IPM) and other sustainable pest control alternatives among farmers.

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Silenced Grievances: Waste Workers' Knowledge, Perceptions, and Experiences Regarding Occupational safety and Health Hazards in LG's of Bangladesh

Dr. Shafiqul Islam¹, Mr. Mohammad Rabiul Islam²

Abstract

Occupational safety and health hazards are a significant public health concern worldwide, especially in low- and middle-income countries. In Bangladesh, twelve city corporations produce vast amounts of solid waste, and thousands of waste workers are employed by these corporations to collect, transport, and dispose of it. These workers suffer from various diseases and are often neglected and maltreated despite performing risky jobs. However, the literature on occupational health hazards relevant to solid waste collection in the local government of Bangladesh, particularly on waste workers' livelihoods, working environment, and health risks, is limited. This article explores the nature of the violence waste workers face, along with the societal expectations and perspectives that perpetuate it. Data were gathered from Cumilla City Corporation in Bangladesh through in-depth interviews, focus group discussions with waste workers, key-informant interviews with various stakeholders, and observations of waste collection and disposal points. Thematic analysis shows that waste workers experience violence in the occupational setting, encompassing physical and psychological abuse, persistent pressure, constraints on personal liberty, denial of treatment, exploitation, discrimination, social exclusion, undermined social recognition, and wage withholding. Fear of job loss prevented them from filing complaints. Supervisors described the waste workers as 'illiterate', 'low class', 'insubordinate', 'uncooperative', and 'reluctant to work', thereby rationalising their conduct as acceptable. Other stakeholders largely dismissed these issues. The study highlights the need for actionable measures to prevent workplace violence and address emerging occupational health concerns in Bangladesh's waste management sector.

Keywords: Public Health, Occupational Safety, Health Hazards, Waste Workers, Waste Management, City Corporation, Bangladesh

¹E-mail: shafiq.bcs@gmail.com; ²E-mail: rabiuldhaka19@gmail.com

1. Introduction

Occupational health hazards are remarkably increasing in the waste management sector of local cities, and local governments are facing challenges in achieving public health-related SDG goals (Kavouras, Vardopoulos, Mitoula, Zorpas, & Kaldis, 2022). The goals include good health and well-being, decent work and economic growth, reduced inequalities, and sustainable cities and communities (Reis, Oliveira, Braga, Silva, & Silva, 2020; WHO, 2021). Solid waste handling in the municipal area is a growing work-related health hazard (Yang et al., 2001). The collection and transportation of solid waste require heavy physical activities such as collecting waste from drains, roads, and bins, and the loading and unloading of garbage trucks (Ray, Mukherjee, Roychowdhury, & Lahiri, 2004). While performing their jobs, waste workers are generally exposed to many health risks- injuries, respiratory diseases, musculoskeletal, gastrointestinal, and infectious diseases (Abd El-Wahab et al., 2014). They also suffer from several pathogens (bacteria, fungi, viruses, parasites, and cysts), various toxic substances, vehicle exhaust fumes, noise, extreme temperature, and ultraviolet radiation (Lavoie & Dunkerley, 2002). Consequently, solid waste workers are the victims of the high rate of occupational health hazards (Madl et al., 2008).

Occupational safety and health hazards remain a significant public health concern worldwide, especially in low- and middle-income countries. Although city conservancy department in Bangladesh's twelve city corporations strive to dispose of the vast amounts of solid waste they generate, a significant portion remains unaddressed, owing to weak governance and a shortage of fund and logistical support (Ahsan et al., 2014; Bhuiyan, 2010). Thousands of waste workers are employed by these city corporations to collect, transport, and dispose of the waste (Hasan & Chowdhury, 2006), often working day and night without adequate occupational health and safety measures (Ahsan et al., 2014). Although the Bangladesh Labour Act, 2006 was intended to ensure workers' health, hygiene, and occupational safety, local government officials have not implemented it properly (MoLE, 2021). As a result, these workers suffer from various diseases and remain neglected and maltreated despite performing risky jobs for low salaries (Phosrikham, Laohasiriwong, Luenam, & Soeung, 2020; Ramitha, Ankitha, Alankrutha, & Anitha, 2021). Bangladesh's Perspective Plan 2021-41 has also emphasised reducing

work-related health risks by strengthening the capacity of local governments (GED, 2020).

In the cities of Bangladesh, the working environment of waste workers needs to be improved (Kabir, Farhana, Akter, Jesmin, & Ali, 2015). Waste workers in Dhaka city are exposed, while they work, to vast amounts of dust, contaminated organic matter, airborne particulates, bacteria, noise, and ergonomic stress (Anwar, Mehmood, Nasim, Khurshid, & Khurshid, 2013), and often lack adequate knowledge and understanding of public health-related safety measures (Hassan, Ahmed, Rahman, & Biswas, 2008). A similar scenario prevails in other cities, such as Cumilla City Corporation, which was constituted in 2011 by amalgamating two municipalities. The city consists of 27 wards, covers an area of 53 sq km, and has a population of 0.80 million producing 200 tons of waste per day; thousands of waste workers in the city corporation's conservancy department work to manage this waste (Majumder & Karim, 2012).

Several researchers have studied the occupational health hazards faced by waste cleaners globally. Studies in Latin America have evaluated the range of diseases and risks faced by waste workers and documented environmental, social, and health impacts related to solid waste management, including an assessment of Mexican municipalities that identified correlations between the development and implementation of health-hazard policies (Cervantes et al., 2021), while other work has examined the health situations and occupational hazards affecting waste workers in Brazil (Zolnikov, da Silva, Tuesta, Marques, & Cruvinel, 2018). Further studies have examined the nature of activities and knowledge of work-related health risks and practices among waste collectors in Ghana (Asibey, Amponsah, & Yeboah, 2019), used a cross-sectional design to show how the working environment affects waste workers' quality of life in a German City (Velasco Garrido, Bittner, Harth, & Preisser, 2015), identified respiratory and skin-related diseases among waste collectors in India (Priyanka & Kamble, 2017), and examined the safety factors, hazards, and vulnerabilities street sweepers face during waste collection in low- and middle-income countries (Gutberlet & Uddin, 2017). However, the literature on occupational health hazards relevant to solid waste collection in Bangladesh, particularly regarding waste workers' livelihood, working environment, and health risks, remains limited. Uddin, Gutberlet, Ramezani, and Nasiruddin (2020) explored the everyday life of informal waste pickers in Dhaka city; Akter, Hawlader, and Hoque (2019) examined

awareness among waste pickers at Matuail Sanitary Landfill in Dhaka city; Sharior et al. (2023) assessed the organisational capacity, shortcomings, and challenges in local governance of waste management during COVID-19 in Dhaka City; and Fattah, Amin, Nasrin, and Sultana (2018) identified governance constraints in waste management and the livelihoods of waste cleaners in Dhaka City. These studies, however, focus only on Dhaka city, and research on occupational health hazards among solid waste workers in other cities, or from the lens of public health and occupational health risks, remains minimal; no study has yet examined occupational health and safety in Cumilla City Corporation's solid waste management. Comprehensive research exploring the livelihoods, work environment experiences, and physical and mental health of waste workers in Cumilla City Corporation is therefore necessary. This study aims to develop an in-depth understanding of city waste collectors' knowledge and perceptions concerning occupational safety and related health hazards in the cities of Bangladesh, especially Cumilla City Corporation.

2. Objectives and Research Question

The aim of this research is to explore the waste worker's livelihood, work environment experience, and the physical and mental health phenomena of the waste workers of local government of Bangladesh

Research Question:

What are the waste worker's practices, experiences, knowledge and perceptions regarding occupational safety and health hazards in their livelihood and working environment in Cumilla City Corporation?

3. Methodology

Research Design

The researcher used qualitative research techniques. Qualitative research helps deeper insight into a specific problem and the findings provide recommendations based on common emerging themes (Benaquisto & Given, 2008; Creswell, 2014). The researcher utilised a transformative and constructive philosophical worldview in this research (Neuman & Robson, 2012).

Study Setting

The study was conducted in Cumilla City Corporation, one of the 12 city

corporation of Bangladesh. Cumilla City Corporation constituted in 2011 amalgamating two municipalities. The city consists of 27 wards, has an area of 53 sq km and a population of 0.80 million who produce 200 tons of waste per day, and thousands waste workers of city corporation conservancy are working for waste management (Majumder & Karim, 2012).

Data Collection (including sample distribution)

The qualitative study employed in-depth interviews (IDIs) of fifteen workers (n=20) and Key Informant Interviews (KIIs) with fourteen officials (n=14) of a City Corporation, NGO, doctors and the officials of the local government ministry. One focus group discussions (FGDs) with 36 waste workers. Table 1 presents the socio-demographic profile of the waste workers.

Table 1: Socio-demographic profile of the waste workers

	IDIs (n=20)	FGDs (n=36)
Age (Years)		
18-24	8	10
25-32	6	11
33-40	2	6
40+	4	9
Marital Status		
Married	10	20
Separated/divorced	2	6
Unmarried	8	10
Education		
None/illiterate	14	16
1-5year	4	10
6-10yrs	1	8
10+	1	2

The research team visited Cumilla City Corporation and observed the waste workers' livelihoods, working environment, and working life, investigating conditions by observing the waste collection points, transport, dumping areas, disposal process, and the logistics and clothing used by waste workers. Eight workplace observations, each lasting 6–10 hours, were carried out to examine the cleaners' lived experiences of health issues during work. Through direct observation, the study assessed working conditions, job tasks, rest intervals, the behaviour of officials and supervisors, and the health risks associated with working in drains and on roads. The researcher made detailed observational notes at the worksite, captured photographs, and later coded these observational notes. The value of observation lies in its capacity to document authentic behaviour and practices in a natural context. Data collection took place from December 2023 to September 2024; the extended period was mainly due to challenges in gaining access to workplaces and conducting interviews with waste workers.

The researcher obtained permission from the city corporation to visit the sites and speak with officials and workers. The research employed a purposive sampling technique to select waste workers, officials, doctors, and other key stakeholders. Before data collection, the research team informed the authorities—the Mayor and CEO of the City Corporation—and then conducted interviews with senior officials of the corporation's conservancy department, who provided a list of waste workers and their contact details. While visiting the sites, the team also met other relevant stakeholders where it felt this was warranted.

Based on the literature, an unstructured questionnaire was prepared for the interviews and continuously updated as the interviews progressed. Unstructured interview guides were used to facilitate conversation with participants, and the discussions centred on the nature of occupational tasks in the City Corporation's waste management, workers' experiences, the factor influencing supervisors' and officials' behaviour, and both workers' and officials' perceptions of the workplace. All interview guides were pilot-tested on five people with comparable, homogeneous demographic profiles, who were not part of the study participants, to improve their suitability and refine interview procedures for the local context. Interviews were conducted in Bengali, the local language, and then transcribed. Each interview helped the research team develop better-articulated questions to explore the themes emerging from the field.

In-depth interviews (IDIs) and focus group discussions (FGDs) with waste

workers were carried out at their workplaces, homes, or other settings the participants deemed convenient. Discussions took place at the residences of both male and female workers, in accordance with their stated preferences, as participants preferred to stay away from their workplace to speak freely about their experiences of work, life, and health; the researcher likewise sought to avoid the formal setting of the waste area. FGDs were therefore conducted in a room voluntarily offered by the city corporation, while KIIs were conducted in private rooms near the working area, with appointments scheduled by telephone for each participant. The researcher facilitated the FGDs, and each interview and FGD lasted approximately 45–60 minutes and was audio-recorded with participants' consent. Light refreshments, including snacks and water, were provided to all participants.

Data Analysis

The researcher converted all interview recordings into written transcripts and verified them against the audio data to ensure accuracy and consistency prior to coding. Two university graduates assisted with transcription, and the researcher reviewed a subset of the transcripts to ensure consistency. The data were analysed using an inductive thematic method (Schreier, Stamann, Janssen, Dahl, & Whittal, 2019; Yin, 2011). To undertake the thematic analysis, the descriptive data were repeatedly reviewed to ensure thorough familiarisation, enabling the development of an initial coding framework. The analytic process combined deductively derived codes informed by the research questions with inductively generated codes emerging from the data. The inductive component involved an open-coding procedure in which discrete segments of data were systematically labelled, followed by the aggregation of these initial codes into higher-order categories, which were then further refined and organised into overarching themes capturing the salient patterns within the dataset. The researcher also used Nvivo software to develop systematic, specific themes from the qualitative data gathered through interviews, FGDs, and observations. Finally, the themes were illustrated through case narratives.

4. Results

Socio-demographic profile and nature of the job

The findings indicate that a large proportion were below the age of 25. Most participants were married and had dependent children. In terms of educational attainment, the majority had no formal schooling or had education limited

to primary level (up to grade five). Most worked as helpers and drain cleaners or road cleaners, while some were employed as waste downloader and uploader in truck. All had migrated from rural villages outside the city or living in the slums of the city. Those who have children have to leave their children behind to work in the waste management sector of the city corporation and support their family income.

The findings are categorized based on the types of violence reported in the workplace. The most commonly reported forms of violence in this study included verbal abuse, restrictions on various rights, and work-related constraints that impacted how these backward people were treated in the workplace. This analysis of experiences with violence focuses on two key aspects: first, identifying the various types of violence occurring in the waste management industry in the municipalities of Bangladesh and their impact on people's health and safety. Second, it explores the perspectives of different stakeholders on the factors contributing to these acts of violence.

Verbal and Physical abuse

All participating waste workers indicated that they were routinely subjected to verbal mistreatment by their supervisors, including being shouted at, demeaned, subjected to disparaging remarks, and addressed in an abrasive manner within the workplace. Verbal aggression, particularly shouting, was identified as the predominant form of abuse, with respondents perceiving their supervisors as exhibiting a notable absence of empathy. Participants also recounted experiences in which supervisors subjected them to public humiliation, explaining that they were frequently 'spoken to as though we are less than human' and 'treated badly, like servants'.

One waste worker shared,

"If we make even a small mistake during work, the line supervisors shout at us. We keep quiet because if we say anything, we might lose our jobs. We are not even allowed to talk among ourselves while working."

A number of workers described incidents of physical mistreatment in the workplace, although such occurrences were reported less often than verbal abuse. The most frequently mentioned forms of physical aggression included slapping, pinching, pushing, and throwing waste materials at workers' faces. One participant stated,

"Today, I reached the work area thirty minutes late, and my supervisor became angry. He pushed me, shouted at me, and even lifted his hand as if he would slap me. Luckily, another supervisor stepped in and took him away."

Another worker explained the underlying reasons for such behavior, “If we cannot meet the target or if we make a mistake, they hit us. One day, my supervisor threw dust and garbage at me because I made a mistake while cleaning the drain. If we try to say anything, they get angry and slap us.”

Exploitation

Most of the waste workers reported that they often are subjected to physical and verbal abuse not only in workplace, but also in living area- slums. They face exploitation, such as low wages, long working hours, unsafe working condition. As they live in slum area, many regular facilities and recognition enjoyed by the regular citizens, are not enjoyed by them.

Discrimination

Waste workers living in slum area are often stereotyped as uneducated, criminal, unclean, and leading social marginalization. They face barriers in accessing basic services such as health care, education, and sanitation due to systemic neglect by various institutions. They also lack access to clean water, and electricity. They are excluded from the urban planning and development. They are often excluded from the political process and decision-making, which hinders their ability to advocate for their rights and needs.

One respondent mentioned,

“if our kids go to school, other families do not allow their children to mix with our kids. When we go to the common tubewell to bring clean water other families tease us with bullying”

Behaviour Restrictions

Insufficient breaks and opportunity to communicate outside

Observations at the waste collection and processing revealed that workers do their job under intense heat from the lights, in dirt and dusts. They collect the stinky wastes with their hands, clean the drains by getting down into the drains. They do not have the appropriate safe clothing and no safety measures are taken. They work hard but are not granted adequate short breaks to drink water and food, as supervisors deem it unproductive. They are permitted only a one-hour lunch break during a 10 to 12-hour workday. Waste workers reported that their supervisors believe frequent water consumption would lead to more bathroom breaks, potentially hindering their ability to meet cleaning and collection of waste targets. One worker said

“we do not get necessary safety clothing and products and do not get long break to have lunch or snacks in the work time. Because it hampers our waste collection targets”

The waste workers reported that feeling isolated from the outside world during working hours, as they are prohibited from bringing their cell phones to work. Upon entering the work site or in the garbage truck, their bags are searched by a supervisors to confiscate any phones. This restriction poses significant challenges, especially when their family members are unwell at home. However, if supervisors discover their phones, the workers face verbal and physical abuse.

“Entering the site or getting into the garbage truck, we feel like stepping into another world. During working hours, we are unable to communicate with our family by phone, and if we secretly bring a phone, it gets confiscated.”

Constant Pressure

The Daily production targets

The city roads and drains are divided. They have to clean assigned roads and drains. At the same time, loading and unloading of 10 tons garbage trucks must be completed. Loading unloading of garbage truck is set for us five rounds per day. So it becomes a huge pressure. Workers described the targets as ‘not humanly manageable’ and ‘impossible to achieve.’ They reported that when they are unable to meet the required hourly quotas, which occurs on most days. They are subjected to scolding, shaming in front of others, and reductions in their wages.

Threat of Job loss

All the workers stated that they frequently face the insecurity of being removed from jobs. This potential job loss would leave them in a state of extreme economic vulnerability, prompting them to consistently seek compromises with their supervisors. They mentioned the existence of a complaint box in the city corporation office for reporting physical or verbal abuse, but they refrained from using it due to fear of retaliation, as they believe it could provoke more dangerous and vengeful behavior from their supervisors and conservancy officers. To avoid conflict, the workers reported that they choose to remain silent and avoid arguing with their seniors, especially when the seniors shows their anger. An employee said,

“We perform job under the sky, and when our seniors hit us, either bodily and psychologically, it’s visible to everyone. If we submit a grievence in the suggestion box, it’s not kept confidential. Later, the seniors find out and retaliate, often causing people to lose their jobs. Some of our colleagues filed complaints against the supervisors, and as a result, they were forced to leave.”

Inaccessibility of necessary medication

The workers reported experiencing injuries, various cuts in legs and hands, sore in leg and hands, gastric issues, headaches, body aches, fever and cold. The most frequent injuries include finger and leg injuries from cleaning drains and waste collections. They also mentioned that the medicines and doctors often not available for the cleaners and waste workers.

Wrongfully accusing workers

The respondent also mentioned that when they visit doctors of city corporation, medicines are provided. However, if they visit several times, they claim that they are having medicine with false claims. In addition to that sometimes the spades and other equipment of waste collection are lost, then the workers are rebuked by the supervisors accusing stealing of the equipment. One worker shared,

"When we get injured by a machine or cleaning equipments, we don't receive any medicine. Most of the time, when we visit the doctors or pharmacy of city corporation, we are not welcomed by them. They always accuse us of collecting the medicine on false cause, but we never do that. Why would we collect medicine if not sick? It's not food that we would eat when we're hungry. Moreover, it makes us feel so sad, insulted, and helpless when we're blamed for stealing the cleaning equipment."

Occupational health repercussions and violence

All the workers shared that after returning home from work, they often felt sadness and cried due to physical and verbal abuse from their supervisors. They also mentioned experiencing difficulties with sleep and appetite. Despite feeling 'agitated,' 'angry,' and 'upset,' they chose to remain silent, believing they were expected to endure the abuse without expressing their emotions. Additionally, the workers noted that the supervisors never offered apologies, but they believed that receiving an apology would help alleviate some of their sufferings.

In connection to this, an employee demonstrated his body sores. These were aggravated by a feeling of identity crisis in terms of power in society,

"The main purpose I work in the waste sector is to financial support. However, the supervisors here constantly yell at us. Despite working hard and deserving respectful treatment, we are met with bad behaviour. They take advantage of the fact that we can't do much to stand up to them, which leaves us feeling upset all the time."

Another worker stated that

“The behaviour of supervisors make us sick. We expect that they will encourage us, will behave well and appreciate our efforts. Their rude behaviour make us upset and threatened.”

Employer's Perspective

At the garbage collection and dustbin points visited, all supervisors were male. Each of them expressed the belief that waster workers are often ‘disobedient,’ ‘non-cooperative,’ and ‘unwilling to work’. They claimed that employees are often late in the work, when come, engage in gossip, spend time in the street talking the friends and family members, and are easily distracted by conversations with co-workers. Additionally, they stated that controlling the workers requires shouting at them. A supervisor said,

“These workers lack formal education and come from lower socioeconomic backgrounds. It may not be effective to always address them kindly, as they might not respond to gentle communication. Sometimes, raising your voice may be necessary, as kindness alone might lead to greater disobedience.”

Another conservancy supervisor explained,

“Waste workers often face high-pressure working conditions. It is believed that controlling the workers is necessary to maintain productivity. Without strict supervision and raising voices, they may become distracted, which could lead to delays in meeting targets of cleaning roads, drains and garbage points.”

The supervisors denied the occurrence of physical violence against waste workers, acknowledging only verbal abuse. One supervisor remarked, "waste workers were physically abused 10 years ago, but now such incidents are rare. The working environment has improved, and we no longer physically harm them."

However, the supervisors expressed negative perceptions of the waste workers, accusing them of dishonesty and theft. They claimed that workers frequently lied about their health to obtain sick leave and stole items like equipment. A conservancy officer stated,

"They always ask for sick leave even when they are not sick. They lie to us, and we do not trust them."

Views of Government Officials

Four individual interviews (IDIs) and a focus group discussion (FGD) were conducted with government officials to gather further insight into working conditions in the waste sector. These discussions highlighted that greater

priority is placed on structural safety upgrades than on individual security. From the officials' perspective, the occupational work environment has been changing positively since the city corporation was established in 2011, and waste workers are now equipped with safety clothing and equipment. However, waste workers are often reluctant to wear this safety clothing. One respondent explained,

“the city corporation increased its budget for buying the vehicles, safety cloths and equipment for the waste workers. If they do not use them properly, how can we improve?”

Nevertheless, none addressed violence against waste workers seriously. They did, however, acknowledge instances of verbal abuse, attributing this to the large number of workers doing their job in the streets and drainage systems. According to their explanation, officers and supervisors often resort to shouting as a way to maintain discipline. One city corporation official remarked,

“We occasionally are informed about incidents of bodily abuse in the workplace. While our supervisors report such cases to the city corporation high officials, we have not received any official complaints of violence against waste workers. However what happens, this could be because they often work under pressure to maintain discipline within the sites of wastes.

5. Discussion

This study examined waste workers' experiences of workplace violence and the perspectives of other stakeholders in the waste management industry, particularly the city corporation in Bangladesh. The findings indicate that violence against waste workers in the workplace is prevalent in this context. Participants described instances of bodily abuse, including slapping, hitting, and pushing, as well as psychological abuse such as bullying. Besides these, reported mistreatment included wage reductions and continuous threats of job dismissal. Additionally, waste workers expressed reluctance to voice their complaints due to fear of retaliation, such as job termination or retribution from supervisors, and conveyed a sense of powerlessness in addressing or improving their work culture.

The study highlights that the maltreatment of waste workers, in both the society and the working area, has a substantial effect on their physical and mental well-being. Although waste workers find violence unacceptable, stakeholders did not view it as a health and safety concern. This study also

highlighted an important finding: when different organisations considered the importance of occupational health, city corporations focused more on developing infrastructure, such as building more roads, footpaths, and drains. Additionally, the pressure from cleaning targets set with fewer waste workers contributed to a toxic working environment, and city corporation officials acknowledged that when supervisors are unable to handle this stress, they may direct their frustration towards waste workers. As a result, workplace violence appears to be regarded, for waste workers, as an acceptable and effective means of meeting unrealistic daily cleaning and waste-collection targets. The Universal Declaration of Human Rights states that every worker is entitled to a workplace free from violence and discrimination, and Bangladesh has ratified several key international agreements, including the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR). It is the country's responsibility to guarantee a workplace free from violence for all workers, in all sectors.

This research addressed the need for a comprehensive qualitative exploratory study of the practices, experiences, and perceptions of waste workers in Bangladesh, particularly in Cumilla City Corporation. It also provided insight into factors relevant to waste workers', the governance of waste management, and the health-related implications for the city, and identified the waste workers' social and economic crisis alongside their physical and mental health implications. Recent literature from other settings has suggested similar findings: waste collectors face multi-faceted health risks (Hossain et al, 2025) and go through safety challenges (Rahman et al., 2026); waste workers are a non-privileged marginalised group (Miller, J.,2025); and untreated injuries and chronic illnesses among waste workers in Islamabad are common (Sabir and Sharif, 2026).

While this research makes a significant contribution to the literature on occupational health and violence, certain limitations should be acknowledged. The study was conducted in a single city corporation in Bangladesh and may not fully represent the overall picture of violence in the waste management industry across the country. Given the sensitive nature of the topic, discussions with different key stakeholders (such as workers, supervisors, city corporation officials, and local government divisions) may have led to underreporting of such experiences due to social desirability bias. However, the researcher brings both sociological research expertise and

practitioner knowledge to this field.

Research Implications and Recommendations:

The findings of this study suggest several essential measures for addressing this issue in Bangladesh, and offer policy recommendations to reduce workplace health hazards, improve waste workers' lives, and strengthen the capacity of local government—the City Corporation. First, it is crucial for government officials, city corporation employees, and waste worker representatives to acknowledge the problem; denying its existence will not lead to a solution.

Second, this study highlights the challenges posed by a centrally controlled system, particularly in setting daily waste-collection volume targets. Such a system creates downward pressure on supervisors, which in turn pressures workers to meet unrealistic cleaning targets. To alleviate this pressure, city corporations, government officials, and public representatives need to collaborate in creating a more flexible and reasonable cleaning and waste-collection system. While awareness campaigns are ongoing, governments need to adopt more rigorous policies and facilities to safeguard workers' rights.

Third, within the Bangladeshi context, state authorities, nationally oriented rights advocacy bodies, and employers are advised to draw on these findings in developing appropriate strategies.

Fourth, tackling the issue of abuse against waste workers must be prioritised by the relevant authorities, city corporation officials, public representatives, and national rights-based organisations, in order to shift the attitudes and behaviours of supervisors. Designing and implementing behaviour-change interventions targeting key stakeholders, especially supervisors, is essential to improving the situation.

6. Conclusion:

This article examines the occurrence of violent acts in the workplace within Bangladesh's waste management industry, revealing that waste workers face various forms of violence resulting in both physical and psychological harm. The research explored the humiliation and suffering endured by waste workers in their workplaces. The study has (1) demonstrated evidence of such acts of violence and their impact on health, (2) examined the perspectives of various stakeholders contributing to this occupational health culture, and (3) proposed appropriate actions to address the issue. It suggests strategies for tackling violence against waste workers in Bangladesh's waste management sector, across city corporations and municipalities.

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Islamic Perspectives on Entrepreneurship in the Industry 4.0 and Artificial Intelligence Era

Md. Amirul Islam¹, Dr. Mohammad Omar Faruq², Mohammad Fateul Abedeem³

Abstract

This study re-establishes the theoretical foundations of Islamic entrepreneurship through Quranic and Hadith guidance, while examining barriers faced by Muslim society in the era of the Fourth Industrial Revolution (4IR), driven by Artificial Intelligence (AI). Content analysis of Quranic verses and six major Hadith compilations identified five themes from each source, together forming a comprehensive ethical framework for Islamic entrepreneurship. Data from 100 Muslim participants—including scholars, da'wah followers, pir-murids, religious officers, and general Muslims—were analyzed using statistical frequency and thematic analysis. Findings revealed five principal barriers: religious misconceptions (76.8% perceived entrepreneurship as risky), lack of institutional and financial support (70% cited difficulty accessing Sharia-compliant investment), skills deficit (63% lacked business and digital skills), socio-cultural barriers (69% viewed employment as safer), and technological unpreparedness (63% lacked digital skills, 49% resisted integrating Islamic economics with entrepreneurship).

The study proposes a three-tier framework: (1) Quranic-Hadith foundations, (2) skills development and education reform, and (3) institutional and policy support. Recommendations are offered for religious institutions, Islamic banks, educators, policymakers, and the technology sector. Limitations include the Bangladesh-only sample and convenience sampling. Future research should explore comparative studies, AI-integrated models, and female Islamic entrepreneurship. Islamic entrepreneurship is framed as worship, social responsibility, and spiritual pursuit, capable of ensuring prosperity and success in the hereafter when aligned with 4IR technologies.

Keywords: Islamic entrepreneurship, Muslim society, Fourth industrial revolution, Religious misconceptions, Education reform.

¹E-mail: t70698@nu.ac.bd ; ²E-mail: omardu@ais.jnu.ac.bd; ³E-mail: fuad11169@gmail.com

1. Introduction

Human life is shaped mainly by spiritual, physical, and sexual needs, and there are various ways of satisfying them. One driving force that plays a key role in meeting these needs, however, is finance, which sustains the mosques, temples, pagodas, synagogues, theaters, parks, libraries, and foundations where people go to satisfy their spiritual needs — maintaining a spiritual environment in these institutions is itself inseparable from financial management. Meeting the remaining two needs is likewise tied to monetary affairs. These monetary affairs, which originate in business entrepreneurship, are thus the root cause of fulfilling all human needs (Rusmini, 2022; Timuroglu et al., 2017).

Business entrepreneurship refers to a self-motivated process in which an individual or group, through innovation, risk-taking, and opportunity creation, builds a system of production, distribution, or service that creates economic value and fulfills the needs of society. In Islamic terms, it falls within the general scope of ‘tijarat’ (trade) and ‘qasb’ (earning), where the entrepreneur seeks not only profit but also the pleasure of Allah, social responsibility, and moral integrity (Hoque et al., 2014; Linge & Ahmad, 2021). In light of this definition, it is worth noting that despite Muslims being held up as the perfect example (uswah) for mankind, a considerable gap remains between actual practice and the pathway of business entrepreneurship prescribed by the Holy Quran and Hadith. From an Islamic perspective, however, business entrepreneurship is not a mere worldly occupation but a moral act imbedded in worship, provided it is conducted with righteous intent, Sharia-compliant methods, and social justice. History bears this out: the Prophets and messengers of Islam were, in most cases, themselves business entrepreneurs in their respective eras. Hazrat Adam (AS), for example, was an agricultural entrepreneur who laid the foundations of human civilization through cultivating land and producing crops; Hazrat Nuh (AS) was a marine engineer and the father of shipbuilding, uniting engineering and labor in a way unique for his time; Hazrat Hud (AS) led a commercial caravan; Hazrat Ibrahim (AS) was an animal husbandry and commercial entrepreneur; Hazrat Shuaib (AS), honest in weights, measures, and transactions, remains a symbol of business integrity; Hazrat Yusuf (AS), an economic planner and grain store manager, who embodied the management of Egypt's wealth; Hazrat Dawud (AS) was an armor maker and blacksmith; Hazrat Sulayman (AS) was a pioneer in international trade and seafaring; and

Hazrat Muhammad (SAW) was himself a business, recognized as the finest entrepreneur in Arabia through his management of Khadija's (RA) business (Ripin & Yusof, 2018; Latifah et al., 2023; Faizal et al., 2013).

Following these prophets and messengers, the early adherents of Islam set an unmatched example as business entrepreneurs. Hazrat Abu Bakr (RA) was a cloth merchant and the first caliph of the Islamic state; Hazrat Umar (RA), a businessman and skilled financial administrator, established the Baitul Mal and laid the foundation for the Islamic financial system; Hazrat Uthman (RA), owner of a vast merchant empire, transformed the trade of Medina and financially strengthened the Islamic state through his commercial knowledge and wealth; Hazrat Abdur Rahman Ibn Awf (RA), a wealthy businessman and pioneer of Islamic economics, established markets in Medina and modeled interest-free transactions; Hazrat Zubair Ibn Awam (RA) traded in weapons and equipment; Hazrat Talha Ibn Ubaidullah (RA) traded in cloth and dates; Hazrat Saad Ibn Abi Waqqas (RA) traded in weapons and military equipment; and, above all, Hazrat Khadija (RA) was Arabia's greatest female entrepreneur, managing international caravan trade and becoming the first to recognize the Prophet's (PBUH) mission (Nurfatwa et al., 2025; Cevherli, 2022).

Not only the early followers of Islam but also the scholars and jurists of later generations were renowned as business entrepreneurs. Imam Abu Hanifa (RA) was a successful entrepreneur in the textile trade who wrote on the complex issues of business transactions in Islamic jurisprudence; Imam Malik (RA) was involved in the book trade and was known throughout the markets of Medina for his business integrity; Imam Shafi'i (RA) traded in textiles and books; Imam Ahmad ibn Hanbal (RA) was involved in the manuscript and book trade, as were Imam Bukhari (RA) and Imam Tirmidhi (RA); and Imam Ghazali (RA) offered a comprehensive discussion of business ethics in his 'Ihya Ulumuddin', which played a leading role in establishing the moral foundation of Islamic entrepreneurship (Islahi, 2021; Suherli et al., 2023).

These historical examples make clear that the tradition of Islamic entrepreneurship flowed successively from the Prophets, through the Companions and Tabi'in, to later scholars. Yet present-day Muslim society is steadily deviating from this rich tradition, even as the Quran and Hadith continue to offer clear instruction for business entrepreneurship. This gap raises the study's central question — why and how did it rise, and how can Islamic

entrepreneurship be revived in this era of the Fourth Industrial revolution (AI, blockchain, big data)? Finding answers to these questions is the main purpose of this research.

1.1. Background of the research

Islamic economic philosophy, guided by the Holy Quran and Hadith, establishes the business entrepreneur on the principles of honesty, justice, freedom from interest, and risk sharing. Surah Al-Baqarah (2:275-280) of the Quran prohibits interest, and Surah Al-Mutaffifin (83:1-6) censures business fraud; in the Hadith, the Prophet (peace be upon him) affirmed that the truthful businessman to be the companion of the Prophets, the Siddiqs, and the martyrs (Sunan Tirmidhi, 1209). Historically, the Prophets, Companions, and later scholars were the genuine pioneers of this principle. However, present-day Muslim society has gradually deviated from this tradition — turning, in the name of conventional worship, away from the halal financial transactions prescribed by the Quran and Hadith; engaging in sectarianism rather than skilled and intellectual economic activity; and in the name of religious education, learning only the theoretical aspects of religion in madrasas (Muhammad et al., 2017; Abubakar et al., 2025). In addition, because clerics often emphasizes hereafter-focused education over worldly education and professional skills, a skill-averse attitude has developed in Muslim society one that conflicts with the Quranic instruction to “travel in the land and seek the bounty of Allah” (Surah Al-Jumu’ah, 62:10).

At present, the world is standing at the threshold of the Fourth Industrial Revolution (4IR), where artificial intelligence (AI), blockchain, big data, and automation have created unparalleled opportunities and ethical challenges for the economy. In this context, revitalizing Islamic entrepreneurship through a combination of Quranic and Hadith guidance, mosque-based human resource development reforms, and modern technology is a timely research topic that can pave the way for employment, economic prosperity, and sustainable development in Muslim society.

1.2. Significance of the research

The significance of this study is a multifaceted and far-reaching. From a theoretical perspective, it develops a comprehensive framework combining the business guidance of the Quran and Hadith, the historical entrepreneurial models of the Prophets and Companions, and the technologies of the Fourth Industrial Revolution — artificial intelligence, blockchain, and big data — opening new horizons for Islamic entrepreneurship research. From a

religious and moral perspective, it demonstrates that Islamic entrepreneurship is a part of worship and that reforming of the mosque-madrassa-based education system is essential to reducing the customary skill-averse attitude in Muslim society. From an economic perspective, it contributes to job creation, poverty reduction, and sustainable development through an interest-free digital entrepreneurship model. Above all, the research prepares Muslim society to compete globally in the era of the Fourth Industrial Revolution and offers practical guidance for policymakers formulating Islamic entrepreneurship development policies (Rouf et Al., 2024; Saridudin et al., 2024).

1.3. Purposes of the research

The objectives of this research — which aims to analyze the obstacles to reviving Islamic entrepreneurial culture in present-day Muslim society within the technological context of the Fourth Industrial Revolution — are as follows:

1.3.1. To identify and classify the guidelines related to business entrepreneurship from the verses of the Holy Quran and the narrations of the six major hadith books (Bukhari, Muslim, Abu Dawud, Tirmidhi, Nasa'i, Ibn Majah).

1.3.2. To investigate the challenges—financial, institutional, cultural, religious and technological—that hinder Muslims from becoming business entrepreneurs in the current socio-economic context of the Fourth Industrial Revolution based on artificial intelligence.

2. Literature Review

The integration of artificial intelligence (AI) technologies with Islamic perspectives on entrepreneurship and the Fourth Industrial Revolution (Industry 4.0) is an emerging and increasingly important area of research. A significant number of studies on the ethical foundations of Islamic entrepreneurship have been published in recent decades, emphasizing principles such as taqwa (fear of God), halal-haram compliance, honesty, fairness, and social responsibility (Oukil, 2011; Ramadani et al., 2015; Mustapa & Arishin, 2023). Oukil (2011) presents an Islamic perspective on technology-based entrepreneurship but does not link it to Fourth Industrial Revolution technologies. Ramadani et al. (2015) extensively discussed the concepts, principles, and perspectives of Islamic entrepreneurship, contributing significantly to its theoretical foundation (Ramadani et al., 2016). Mustapa &

Arishin (2023) analyzed Islamic entrepreneurship ethics in the context of *ijtihad* and innovation, While Ukil et al. (2024) identified determinants of Islamic entrepreneurial intention across two country samples, highlighting its behavioral dimensions. Islam et al. (2021) examined the role of spiritual leadership in Bangladesh's SME sector during crises, helping to establish the link between Islamic leadership and entrepreneurship.

While these studies make important contributions to the theoretical and behavioral foundations of Islamic entrepreneurship, share have a significant weakness: none engages with the technological advances of the Fourth Industrial Revolution —such as the Internet of Things (IoT), blockchain, and automation — or the practical applications of artificial intelligence (machine learning, big data analytics). In other words, they remain bound to the framework of classical Islamic economics and largely ignore contemporary technological realities.

Other researchers have examined the role of Islamic ethics in the digital economy without linking it to entrepreneurship. Ishaq and Mohammad (2023) discuss the potential of AI in Islamic economics and highlight ethical considerations but do not explore the broader technological framework of the Fourth Industrial Revolution or its practical application to entrepreneurship. Yohana et al. (2025) mapped Islamic entrepreneurship through a combination of religious values and business ethics, helping to clarify its ethical framework, but likewise made no connection to the Fourth Industrial Revolution or AI.

Based on this critical analysis the following research gaps can be identified: First, no research has integrated the Islamic entrepreneurship perspective with the AI technologies of the Fourth Industrial Revolution. Various studies have discussed the ethics of Islamic entrepreneurship separately (Oukil, 2011; Ramadani et al., 2015; Mustapa & Arishin, 2023; Ukil et al., 2024; Yohanna et al., 2025), and AI or the Fourth Industrial Revolution separately (Ishak & Mohamed, 2023), but none has integrated the two fields.

Second, no integrated study to date has identified and categorized instructions on business entrepreneurship from Qur'anic verses and the six major Hadith books while linking them to the AI-based context of the Fourth Industrial Revolution. Previous studies (Ramadani et al., 2016; Islam et al., 2021) have confined Quranic-Hadith guidance to traditional economics, or analyzed AI technology separately from Islamic ethics (Ishak & Mohamed, 2023).

Third, the financial, institutional, cultural, religious, and technological challenges to entrepreneurship development in contemporary Muslim societies — especially in the AI-based context of the Fourth Industrial Revolution — have not been investigated through an integrated framework. Ukil et al. (2024) identified determinants of Islamic entrepreneurial intention but did not analyze them in an AI-based context.

Fourth, the skills orientation of mosque-madrasah-based education, and its limited role in fostering entrepreneurship, has been almost entirely neglected in previous studies — an important gap given its significance for reviving Islamic entrepreneurship.

This study, titled "Islamic Perspectives on Entrepreneurship in the Industry 4.0 and Artificial Intelligence Era," therefore proposes an integrated framework by identifying and classifying the guidance of the Qur'an and Hadith and investigating the challenges that hinder Muslim entrepreneurship in the AI-based context of the Fourth Industrial Revolution, which is a combination missing from prior research. This is a timely undertaking: as the world moves rapidly toward the Fourth Industrial Revolution, reviving Islamic entrepreneurship is essential if Muslim societies are to remain competitive globally.

3. Research Methodology

In line with the research objectives and questions, this study adopted a mixed-methods approach combining qualitative and quantitative data, which makes the research richer and more robust by drawing on both numerical data and in-depth descriptive analysis to answer the research questions (Creswell & Creswell, 2009). A purely qualitative approach was used to meet the first objective (identifying and classifying the Quranic-Hadith instructions), while both qualitative and quantitative data were collected and analyzed to meet the second objective (investigating current challenges).

3.1. Data Collection and Analysis Method

3.1.1. Data Collection and Analysis for the First Objective

Documentary analysis was used to fulfill the first objective — "to identify and classify the guidelines related to business entrepreneurship from the verses of the Holy Quran and the narrations of the six major Hadith books."

3.1.1.1. Source of data:

- Verses of the Holy Quran (especially Surah Al-Baqarah,

Al-Mutaffifin, An-Nisa, Al-Jumu'ah, Al-Ma'idah etc.)

- Six major hadith books: Sahih Bukhari, Sahih Muslim, Sunan Abu Dawud, Sunan Tirmidhi, Sunan An-Nasa'i and Sunan Ibn Majah

3.1.1.2.Data collection method:

The verses and hadiths related to business entrepreneurship were identified and collected from chapters of the above books such as 'Kitabul Buyu' (Sale and Purchase), 'Kitabul Musaqt' (Agriculture), 'Kitabul Ijarah' (Lease), and 'Kitabus Sulh' (Contracts) etc.

3.1.1.3.Data analysis method:

The collected data were analyzed using the content analysis method. First, the verses and hadiths were read and their main meanings and instructions identified. They were then divided into several categories according to their content and nature: (a) business honesty and justice, (b) prohibition of interest and fraud, (c) risk sharing and business partnerships, (d) workplace behavior and seeking Allah's favor, and (e) consumer rights and social responsibility. This classification fulfilled the first objective of the research and provided a theoretical basis analyzing the second.

3.1.2. Data collection and analysis for the second objective

An interview-based survey method was used to fulfill the second objective — "to investigate the financial, institutional, cultural, religious, and technological challenges that hinder Muslims from becoming business entrepreneurs in the current AI-based socio-economic context of the Fourth Industrial Revolution."

3.1.2.1.Study population and sample:

The study population comprises Muslims of different classes and professions in Bangladesh. From , this population 100 Muslims (<https://docs.google.com/forms/d/e/1FAIpQLSenzdmm1TIpWbISkx-OitdRCQvAtnXBk-HKNQmzD35YCluiV7Q/viewform?usp=header>) were selected as a sample using the convenience sampling method. The sample included—

S.N	Participants' identity	Number of the participants from each class
01	Mosque-Madrasa scholars	20
02	Dawah and Tabligh brothers	20
03	Priests and their followers	20
04	Religious Education Cadre Officers	20
05	General Muslim population	20
In total		100

This diverse sample made the research richer and more comprehensive, allowing it to reflect a variety of religious, cultural, financial, and technological perspectives.

3.1.2.2. Data Collection Tools and Methods:

A semi-structured questionnaire combining open and closed questions was prepared for data collection, based on five main dimensions (financial, institutional, cultural, religious, and technological). The researcher conducted a face-to-face interviews with each respondent, allowing for spontaneous opinions and in-depth experiences to emerge; each interview lasted 20-30 minutes, with the respondent's comfort given the utmost priority.

3.1.2.3. Data Analysis Methodology:

The collected data was analyzed using Mixed Analysis—

- Quantitative analysis: Responses to the closed questions were coded and analyzed using statistical frequency analysis, which helped determine the prevalence and priority of the challenges.
- Qualitative analysis: Responses to the open questions were analyzed using thematic analysis. Recurring issues, patterns, and important themes were identified from respondents' statements and categorized under the five key dimensions.

3.1.3. Data Reliability and Ethics

3.1.3.1. Reliability and Validity:

To ensure the study's reliability, the questionnaire was initially pilot-tested on 10 participants and amended as necessary. To increase the credibility of the qualitative data, a triangulation method was followed — that is, data on the same topic were collected from different sources (scholars, preachers, pirs, and members of the general public) and checked for consistency.

3.1.3.2. Ethical Considerations:

Ethical standards were maintained at every stage of the study. Each respondent was informed of the study's purpose, and informed consent was obtained; respondent's names and identities were kept confidential, and they were assured that the information they provided would be used for academic purposes only. The respondent's freedom and confidentiality were treated as paramount.

3.1.3.3. Methodological Limitations

The research methodology has some limitations. First, the sample is

limited to Bangladesh and does not represent the global Muslim community. Second, although the sample shows variation, the use of convenience sampling means it is not fully random. Third, some respondents may have felt hesitant to share their opinions freely for religious or cultural reasons, which may have affected the spontaneity of the data. The researcher is aware of these limitations and has taken them into account in the data analysis.

4. Data Analysis and Findings

This chapter presents the analysis and results of the data collected for on the study’s two objectives using mixed methods. Documentary and content analysis were used to fulfill the first objective (identifying and classifying Quranic-Hadith instructions), while survey data from 100 participants are presented through statistical frequency analysis and thematic analysis to fulfill the second objective (investigating current challenges). Each stage of the analysis follows the procedures outlined in the methodology.

4.1. Results of the first objective: Guidance on business entrepreneurship in the Quran and Hadith

4.1.1. Guidance in the Holy Quran

The numerous verses related to business entrepreneurship in various Surahs of the Holy Quran have been classified into five main themes through content analysis

Table 1: Themes related to business entrepreneurship in the Quran

S.N	Theme	Representative Verses	Key Instructions
01	Basic principles of transactions	Surah An-Nisa (4:29); Surah Al-Baqarah (2:275)	Mutual consent, legality of trade, prohibition of interest
02	Prohibition of interest (riba)	Surah Al-Baqarah (2:278-280)	Strict prohibition of interest, compassion for the borrower
03	Honesty and Justice	Surah Al-Mutaffifin (83:1-6); Surah Hud (11:85)	Honesty in weights and measures, prohibition of cheating
04	Effort and Initiative	Surah Al-Jumu'ah (62:10); Surah Al-Muzzammil (73:20)	Economic activities after worship, seeking the grace of Allah
05	Social Responsibility	Surah Al-Hashr (59:7); Surah At-Tawbah (9:60)	Equitable distribution of wealth, Zakat and social welfare

Analytical explanation: The Quranic instructions provide a comprehensive ethical framework for Islamic entrepreneurship — one that, on the one hand, allows business freedom and profit-making, while, on the other, renders that profit lawful and blessed through honesty, justice, and social responsibility. In

particular, the instruction in Surah Al-Jumu'ah (62:10) shows that entrepreneurship complements rather than opposes worship, offering an antidote to the religious distortions prevalent in contemporary Muslim society.

4.1.2. Hadith Guidance

From the content analysis of the six major hadith texts, guidance on business entrepreneurship has been categorized into five themes:

Table 2: Hadith Themes on Business Entrepreneurship

S.N	Theme	Representative Hadith	Key Instructions
01	The dignity of a businessman Sunan	Tirmidhi (1209); Sahih Bukhari (2079)	The truthful businessman is the companion of the prophets and martyrs; there is a blessing in honesty
02	Honesty in transactions Sunan	Abu Dawud (3329); Sahih Muslim (1513)	Disclosure of errors, prohibition of fraud, frankness
03	Prohibition of interest Sahih	Muslim (1597); Sunan Ibn Majah (2276)	Curse on the usurer-the usurer-the writer-the witness
04	Risk and uncertainty (Gharar) are prohibited	Sahih Muslim (1513); Sunan Abu Dawud (3383)	Trading in unknown-uncertain products is prohibited
05	Enthusiasm for work effort	Sahih Bukhari (2078); Sunan Bayhaqi	Enthusiasm for being a self-reliant entrepreneur; an honest hardworking entrepreneur is the choice of Allah

Analytical explanation: The Hadith instructions give practical form to the guidance of the Quran. In particular, the declaration that "the truthful businessman is the companion of the Prophets and Martyrs" elevates the entrepreneur's status to the highest level, directly countering the view in contemporary Muslim society that business is merely a 'worldly' pursuit. The word 'barakat' in the Hadith of Bukhari links economic success with spiritual success, establishing the dual purpose — world and the hereafter — of the Islamic entrepreneur.

Conclusion: The instructions of the Quran and Hadith demonstrate that Islamic entrepreneurship is not merely an economic activity but a moral, social, and spiritual responsibility.

4.2. Results of the second objective: Analysis of current challenges (Quantitative Analysis)

To fulfill the second objective, data were collected from 100 participants through semi-structured questionnaires. The sample included Islamic scholars from mosques-madrasas, followers of dawat and tabligh, Islamic priests and their followers, and members of the Muslim public. The data were analyzed using statistical frequency analysis and thematic analysis.

4.2.1. Question 1: Religious and psychological challenges

Question 1: In your opinion, which of the following psychological disorders and misconceptions about practicing Islam among traditional-minded Muslims prevent them from becoming entrepreneurs?

Table 3: Frequency analysis of religious and psychological challenges (n=100)

Challenges	Respondent Rate	Frequency (individuals)
Being an entrepreneur is risky and uncertain	76.8%	73
Sustenance is determined by fate, so there is no need to take initiative	33.7%	32
Worldly success must be abandoned for success in the Hereafter	28.4%	27
Entrepreneurship is a matter of luck, not achievable through effort	17.9%	17
Business is a worldly job, the opposite of worship	14.7%	14

Analysis and explanation: A maximum of 76.8% of participants consider risk and uncertainty the main obstacle — the biggest psychological barrier on the path to Islamic entrepreneurship. Yet while ‘gharar’ (uncertainty) is prohibited in Islam, determined risk-taking and planned initiative (mukhtara) are praised in the biographies of the Prophets. A further 33.7% believe that sustenance is predetermined by fate, an idea that contradicts the instruction to ‘seek the bounty of Allah’ in Surah al-Jumu’ah (62:10), which encourages hard work, while 28.4% perceive a conflict between success in this world and the Hereafter, contradicting the Quranic injunction to ‘do good in this world and do not forget the Hereafter’ (Surah al-Qasas, 28:77). Only 14.7% consider business the opposite of worship — a positive sign that most respondents understand the Islamic perspective correctly.

Question 2: Challenges related to Islamic knowledge and economics

Question: "In your view, what challenges and misconceptions related to Islamic knowledge and economics prevent traditional Muslims from becoming entrepreneurs?"

Table 4: Frequency analysis of challenges related to Islamic knowledge and economics (n=100)

Challenges	Respondent Rate	Frequency (individuals)
Difficulty in accessing Sharia-compliant investment and financing platforms	70%	70
Lack of Sharia-based business knowledge	66%	66
Unwillingness to explore the relationship between Islamic economics and modern entrepreneurship	49%	49
Imagination of difficulty in verifying halal-haram	26%	26
Considering zakat and charity as the main means of economic development	10%	10

Analysis and explanation: A maximum of 70% identified the unavailability of Sharia-compliant investment platforms as the biggest institutional barrier to Islamic entrepreneurship — in many Muslim countries, Islamic banks are more interested in lending to large companies, leaving small and medium entrepreneurs behind. A further 66% admitted to a lack of Sharia-based business knowledge, pointing to weaknesses in madrasa-based education and the absence of entrepreneurship in the religious curriculum, while 49% expressed reluctance to explore the relationship between Islamic economics and modern entrepreneurship — a worrying finding, since integrating Islamic economics with modern technology is critical in the era of the Fourth Industrial Revolution. Only 10% consider Zakat-giving the primary means of economic development, a positive sign that most respondents are interested in the institutional economic model.

4.2.3. Question 3: Skill Shortage

Question: "In your opinion, what skills do you feel are lacking in order to be an entrepreneur?"

Table 5: Frequency analysis of skill shortages (n=100)

Skill gap	Respondent rate	Frequency (individuals)
Lack of business planning, financial knowledge and digital skills (hard skills)	63%	63
Lack of self-confidence, leadership and risk-taking skills (soft skills)	51%	51
No clear idea about the required skills	50%	50
Even if there are opportunities to learn skills, I do not use them	33%	33
Lack of self-development habits and self-motivated learning	28%	28

Analysis and explanation: A maximum of 63% admitted to a lack of hard skills (business planning, financial literacy, digital skills), which are crucial for entrepreneurship in the era of the Fourth Industrial Revolution, while 51%

reported a lack of soft skills (confidence, leadership, risk-taking ability) — skills developed through family and education, consistent with the results of Question 4. Half of respondents (50%) said they did not know what skills were needed, pointing to a failure of the education system in which entrepreneurship education is not part of the curriculum, while only 28% reported a lack of interest in self-development — a positive sign that most respondents are interested in acquiring skills but simply lack opportunity and guidance.

4.2.4. Question 4: Family, Social and Educational Environment Challenges

Question: "In your opinion, what aspects of the family, social and educational environment prevent traditional Muslims from becoming entrepreneurs?"

Table 6: Frequency analysis of family, social and educational challenges (n=100)

Challenges	Respondent rate	Frequency (individuals)
Family-Society-Educational Institutions Consider Job as Safe and Respectable	69%	69
Lack of Entrepreneurial Skills and Mindset Development in the Education System	59%	59
Lack of Enthusiasm in Building Confidence in the Family and Obstacles to Decision Making	51%	51
Negative View of Failed Entrepreneurs in Society	41%	41
Family-Society Reluctance to Take Risks and Considering Failure as Shameful	35%	35

Analysis and explanation: A maximum of 69% identified a job-centric attitude — a cultural barrier deeply rooted in Muslim society and one entirely at odds with the entrepreneurial spirit of the Companions. A further 59% identified a deficiency in the education system, consistent with Question 3, since the lack of entrepreneurship education creates a skill deficit, while 51% cited obstacles to family decision making, which creates psychological barriers, especially for young people, on the path to entrepreneurship. Finally, 41% identified a negative societal view of failed entrepreneurs, which further reinforces reluctance to take risks for fear of social humiliation in the event of failure.

4.2.5. Question 5: Practical Support and Institutional Challenges

Question: "In your opinion, what are the major challenges faced by traditional Muslim entrepreneurs in terms of practical support and institutional challenges?"

Table 7: Frequency analysis of practical support and institutional challenges (n=100)

Challenges	Respondent rate	Frequency (individuals)
Difficulty in raising initial investment or capital	64%	64
Lack of training and mentoring	60%	60
Islamic finance and Sharia-compliant investments are not readily available	52%	52
Lack of investment support from relatives or society	37%	37
Lack of inspiring examples of successful entrepreneurs based on religion	37%	37

Analysis and explanation: A maximum of 64% identified difficulty raising initial capital as an obstacle — a real, structural problem stemming largely from the lack of entrepreneur-friendly lending policies among Islamic banks and from high interest rates. A further 60% acknowledged a lack of training and mentoring, which is critical for skill development and mindset formation but practically nonexistent in Muslim society, while 52% considered Islamic finance not easily available, consistent with Question 2. Only 37% cited a lack of religiously grounded examples of successful entrepreneurs — a opposite sign, since examples from the Prophets and Companions do exist; what is lacking is their proper promotion and presentation.

4.3. Thematic Analysis (Qualitative Analysis)

Responses to the open-ended questions were analyzed using thematic analysis. Recurring issues, patterns, and important themes were identified from respondents' statements and categorized under five main dimensions, with verbatim quotes from participants included under each theme to preserve the academic rigor of the qualitative analysis.

4.3.1. Theme 1: Religious Distorted Concepts and Mental Barriers

Description: Many respondents consider entrepreneurship the opposite of worship, an obstacle to success in the hereafter, or an activity contrary to destiny. These views stem from a narrow reading of religious teaching prevalent in Muslim society and from an anti-entrepreneurial attitude more broadly.

Respondents' statements

"Our Alim Sahib said that doing business reduces the time for prayers and fasting, so it is better not to do business. Hearing this, my desire to become

an entrepreneur has decreased." — (Respondent, Imam, 55 years old)

"Pir Sahib said that if you fall behind in this world, the hereafter will be ruined. That is why we, the followers, are busier with worship and rituals than with jobs or business." — (Respondent, a priest's follower, 40 years old)

"My father says, sustenance is in the hands of Allah, what will happen if you try? So there is no need to take initiative." — (Respondent, madrasa student, 25 years old)

Analytical explanation: These statements show that religious leadership and family attitudes create the greatest psychological obstacles to entrepreneurship. Yet the instruction in Surah Al-Jumu'ah (62:10) to "when the prayer is finished, disperse in the land and seek the bounty of Allah" directly contradicts this view. Such distorted ideas have taken hold partly because the fact that the Prophets themselves were entrepreneurs is not properly conveyed in religious education.

4.3.2. Theme 2: Lack of Institutional and Financial Support

Description: Participants identified the unavailability of Shariah-compliant investment platforms, capital shortages, and a lack of entrepreneur-friendly policies among Islamic banks as the main barriers.

Respondents' statements

"Islamic banks lend to big businessmen, not small entrepreneurs. I went to three banks, but none helped." — (Respondent, an entrepreneur, 32 years old)

"I have heard of Shariah-compliant investment platforms, but I don't know how to go there, how to apply—anything." — (Respondent, BCS education cadre, 38 years old)

"My friend wanted to start a halal business, but he stopped because he couldn't get an interest-free loan." — (Respondent, religious person, 39 years old)

Analytical interpretation: These statements paint a realistic picture of the lack of institutional support. Islamic banks generally prioritize large institutions and corporate clients over small and medium entrepreneurs, and modern Islamic financing models such as Sharia-compliant crowdfunding or venture capital have not yet gained popularity in Muslim societies.

4.3.3. Theme 3: Skills and Education Deficits

Description: Most respondents admitted to a lack of hard skills (business planning, financial knowledge, digital skills) and soft skills (confidence, leadership, risk-taking ability); the near-total absence of entrepreneurship education in madrasas is particularly concerning.

Respondents' statements

“Our madrasas only teach Quran-Hadith and Fiqh. There is no education in business and commerce.” — (Respondent, a dawra student of madrasah, 23 years old)

“I don’t know how to do digital marketing or e-commerce. I have heard about doing business on Facebook, but I don’t understand how to start.” — (Respondent, female, 35 years old)

“I don’t have the confidence and leadership skills. I don’t have the courage to make big decisions because my family never encouraged me.” — (Respondent, young, 20 years old)

Analytical explanation: These statements highlight structural weaknesses in the education system. Entrepreneurship or business education is almost entirely absent from traditional madrasa education in Bangladesh, even as religious institutions in the West increasingly incorporate it into their curricula, and the resulting lack of digital skills is one reason Muslim entrepreneurs are falling behind in the era of the Fourth Industrial Revolution.

4.3.4. Theme 4: Social and Cultural Barriers

Description: In Muslim society, a job-centric attitude, a negative view of entrepreneurship, and the stigmatization of failure stand as major obstacles to developing an entrepreneurial culture.

Respondents’ statements

“My family wants me to work. If I do business, they say, ‘There is no respect in business, there is respect in jobs.’” — (Respondent, business graduate, 25 years old)

“My brother failed in business; everyone in society laughs at him, calls him a ‘failure’. That’s why I am afraid to do business.” — (Respondent, an ordinary man, 32 years old)

“When someone starts a new business in our village, everyone says, ‘He will fail, he will make a loss’—they don’t dare to take the initiative because of such negative attitudes.” — (Respondent, young entrepreneur, 20 years old)

Analytical explanation: These statements point to a problem deeply rooted in social attitudes. In the West, failed entrepreneurs are often respected under the ethos of “fail fast, learn fast” but in Muslim society failure is treated as a stigma. The excessive emphasis on employment within family and society further suppresses entrepreneurial spirit, even though the Companions were known more as business entrepreneurs than as job-seekers.

4.3.5. Theme 5: Technological Unpreparedness and Digital Divide

Description: In the era of the Fourth Industrial Revolution, a lack of digital

skills, unfamiliarity with digital platforms, and any absence of the concept of technological entrepreneurship emerged as a distinct theme.

Respondents' statements

"I have heard of AI or blockchain, but I don't know how to use them in business. These topics are not in our religious education." — (Respondent, a tabligh brother, 30 years old)

"To do business online, you need to know digital marketing, but I know how to use a phone, but I don't know how to use a business digital platform." — (Respondent, female, 35 years old)

"I have heard about opening an e-commerce site, but I have no idea how to start, how to sell products online." — (Respondent, a potential entrepreneur, 35 years old)

Analytical explanation: AI, e-commerce, and digital marketing skills are essential for entrepreneurs in the era of the Fourth Industrial Revolution, yet these are almost entirely absent from Muslim society, particularly within religious educational institutions. This digital divide is holding Muslim entrepreneurs back in global competition.

4.4. Summary of thematic analysis

Table 8: Summary of thematic analysis

Theme	Main Challenge	Key Learnings from Respondents' Statements	Quantitative Support
1. Religious misconceptions	considering entrepreneurship as the opposite of worship	anti-entrepreneurial attitude of religious leadership	76.8% consider risk as an obstacle
2. Lack of institutional support	capital crisis, non-responsiveness of Islamic banks	Small entrepreneurs are out of Islamic banks	Difficulty in accessing 70% of investments
3. Skill deficit	lack of hard and soft skills	absence of entrepreneurship education in madrasas	63% lack hard skills
4. Socio-cultural barriers	job-centric attitude, stigma of failure	negative view of entrepreneurs in society	69% consider their jobs secure
5. Technological unpreparedness	lack of digital skills, AI-ignorance	absence of digital entrepreneurship subject in religious education	63% lack of digital skills

4.5. Relationship between research objectives and results

Table 9: Relationship between research objectives and results

Objectives	Results	Level of achievement of the intended results
Objective 1: Identify and classify the instructions related to business entrepreneurship from the verses of the Quran and the six major hadith books.	Five themes emerged from the Quran (principles of transactions, prohibition of interest, honesty, hard work, social responsibility) and five from the Hadith (dignity of the businessman, honesty, prohibition of interest, prohibition of gharar, encouragement of hard work).	✓ Fully earned
Objective 2: To investigate the challenges (financial, institutional, cultural, religious, technological) that hinder Muslim entrepreneurship in the current AI- driven context of the Fourth Industrial Revolution.	Five challenge themes were identified through frequency and thematic analysis of data from 95-100 participants across 5 dimensions.	✓ Fully earned

4.6. Summary

4.6.1. Summary of Quantitative Results:

The top challenges identified were: (1) 76.8% perceived entrepreneurship as risky, (2) 70% reported difficulty accessing Shariah-complaint investments, (3) 69% held job-centric social attitudes, (4) 64% cited an initial capital shortage, and (5) 63% repoted a lack of hard skills.

4.6.2. Summary of Qualitative Results:

Five themes were identified: (1) religious misconceptions, (2) lack of institutional support, (3) skill shortages, (4) socio-cultural barriers, and (5) technological unpreparedness. Respondents' direct statements show that narrow religious education, negative attitudes within family and society, and the lack of entrepreneur-friendly policies among Islamic banks are the three main obstacles on the path to Muslim entrepreneurship.

4.7. Overall Conclusion:

The Quran and Hadith clearly provide guidance for business entrepreneurs on honesty, justice, freedom from interest, risk-sharing, and hard work, yet current Muslim society is failing to follow this guidance due to religious distortions, a lack of institutional support, skill shortages, socio-cultural barriers, and technological unpreparedness. This finding is fully consistent with the research gaps and problems identified in the introduction and background, and it forms the basis for the discussion and recommendations in the following chapters.

5. Discussion

This chapter offers an analytical and critical interpretation of the results presented in Chapter Four. The results are analyzed from theoretical, religious, practical, and policy perspectives, linking them back to the study's title, introduction, background, literature review, and objectives. It also highlights where the results are consistent or in tension with previous research, and examines their contribution to filling the identified research gap.

5.1. Discussion of the first objective: Quranic-Hadith guidance for business entrepreneurs

5.1.1. Relevance and contemporary application of Quranic guidance

The research findings identify five themes in the Quran: (1) basic principles of transactions, (2) prohibition of interest, (3) honesty and justice, (4) effort and initiative, and (5) social responsibility. Together, these themes provide a coherent ethical framework for Islamic entrepreneurship, distinguishing it from the Western entrepreneurial model, in which profit maximization is the primary goal (Chapra, 2000).

Special relevance: The instruction in Surah al-Jumu'ah (62:10) to “spread out in the land and seek the bounty of Allah” shows that Islamic entrepreneurship complements rather than contradicts worship — a direct antidote to the common misconception in contemporary Muslim society that business is an obstacle to worship. This verse directly counters the view held by the 14.7% of respondents identified in Section 4.2.1 who saw business as the opposite of worship, and can serve as Quranic guidance for them.

5.1.2. Practical Significance of Hadith Guidance

The five Hadith themes — (1) the dignity of the merchant, (2) honesty in transactions, (3) prohibition of interest, (4) prohibition of risk and uncertainty (gharar), and (5) encouragement of effort — provide practical guidance for the Islamic entrepreneur. In particular, the declaration that “the truthful merchant is the companion of the Prophets, the Siddiqs, and the martyrs” (Sunan Tirmidhi, 1209) elevates the entrepreneur's status to the highest level, offering a powerful counter to the anti-entrepreneurial attitude in contemporary Muslim society.

Consistent with the literature review: These results are consistent with the studies of Ramadani et al. (2015) and Husna, & Rahman (2024), who identified the Quran-Hadith as the foundation of Islamic entrepreneurship. But previous research was largely limited to a descriptive presentation of these guidelines, whereas this study categorizes them and connects them to current challenges—which is the novelty of the research.

5.2. Discussion of the second objective: Analysis of current challenges

5.2.1. Religious misconceptions and mental barriers (Theme 1)

As a result, 76.8% of the respondents considered entrepreneurship risky and uncertain. This is very worrying, because the basic principles of Islamic entrepreneurship are planned risk-taking (*mukhtara*) and trust in Allah (*tawakkul*). The companions, such as Abdur Rahman Ibn Auf (RA) who established a market in Medina at great risk, are recognized in history.

- Theoretical relevance: 33.7% The idea that "Sustenance is determined by fate, so there is no need to take initiative" — this is a distorted interpretation of Islamic fate. Allah says in the Quran: "Man will have only what he strives for" (Surah An-Najm, 53:39). This verse proves that even though sustenance is determined by fate, effort and initiative are essential. Therefore, it is important to correctly interpret these verses and highlight the importance of entrepreneurship in mosque-madrasa-based education.
- Consistency with literature review: Malaysian Sulaiman et al's (2023) study also identified risk aversion and religious distortions among Muslim entrepreneurs. However, this study specifically identified the role of religious leadership (scholars, pirs), which was neglected in previous studies.

5.2.2. Lack of Institutional and Financial Support (Theme 2)

70% of respondents identified difficulties in accessing Sharia-compliant investment platforms. This is a structural problem—Islamic banks generally prioritize large institutions and corporate clients, while neglecting small and medium entrepreneurs (Rahman, 2024). Yet the fundamental principle of Islamic economics is the equitable distribution of wealth and the development of small entrepreneurs (Surah Al-Hashr, 59:7).

- Practical Proposal: These results demonstrate the need for Islamic banks and financial institutions to develop entrepreneur-friendly products (e.g. micro-Mudaraba, crowd funding, venture capital), which would meet the needs of 70% of respondents to Question 2.

5.2.3. Skills Shortage (Theme 3)

A further 63% of respondents acknowledged a lack of hard skills (business planning, financial literacy, digital skills). This is especially significant given that digital skills are essential for entrepreneurship in the era of the Fourth Industrial Revolution (Xu et al., 2018).

- Key problem: Half of respondents (50%) did not know what skills were needed, pointing to a failure of the education system: entrepreneurship education is almost entirely absent from traditional madrasa education in

Bangladesh, even though the Companions themselves acquired business skills. As one madrasa student put it, “In our madrasas, we only teach Quran-Hadith and Fiqh; there is no education in business and commerce”— a statement that highlights this structural weakness.

- Consistency with the literature review: Alvadina et.al.’s (2023) study in Indonesia likewise identified the absence of entrepreneurship subjects in madrasa-based education. This study, however, specifically identifies the skills-oriented policies of religious institutions, which is a novel contribution.

5.2.4. Socio-cultural barriers (Theme 4)

A further 69% of respondents identified a job-oriented social attitude, a cultural barrier deeply rooted in Muslim society — despite the fact that most Companions and Tabi’in were themselves entrepreneurs, including Abu Bakr (RA) as a cloth merchant, Uthman (RA) as a merchant emperor, and Abdur Rahman ibn Auf (RA) as the owner of a business empire.

- Critical analysis: A further 41% mentioned society’s negative view of failed entrepreneurs. In the West, failed entrepreneurs are often respected under the ethos of "sail fast, learn fast," but in Muslim society failure is seen as a stigma. Changing this attitude requires raising awareness among religious leadership and society more broadly about the importance of entrepreneurship (Ohman et Al., 2025).

5.2.5. Technological Unpreparedness and Digital Divide (Theme 5)

The ignorance and unpreparedness of Muslim entrepreneurs regarding Fourth Industrial Revolution technologies — AI, blockchain, big data — emerged in this study as a distinct theme, with 63% admitting to a lack of digital skills, consistent with previous studies (Xu et al., 2018)

- Critical observation: Notably 49% expressed reluctance to explore the relationship between Islamic economics and modern entrepreneurship — a psychological barrier arguably more serious than technological unpreparedness itself, since entrepreneurs can only learn new technologies if they are willing to do so. This reluctance stems from the narrowness of religious education and a “forsaking worldly knowledge” attitude that contradicts the Quranic injunction to “travel in the land and seek the bounty of Allah” (Surah Al-Jumu’ah, 62:10).

5.3. Summary

This chapter has offered an analytical and critical interpretation of the data analysis results. The guidance of the Quran and Hadith provides a comprehen-

sive moral framework for Islamic entrepreneurship, one that directly counters the religiously distorted ideas prevalent in current Muslim society. The current challenges — religious misconceptions, lack of institutional support, skill shortages, socio-cultural barriers, and technological inadequacies — are, in turn, fully consistent with the identified research gap and form the basis for the framework proposed in the next chapter.

6. Recommendations and Integrated Framework

This chapter proposes an integrated entrepreneurship framework based on the data analysis in Chapter four and the discussion in Chapter five, combining the guidance of the Quran and Hadith, historical entrepreneurial models, and the technologies of the Fourth Industrial Revolution. It also offers practical recommendations for Muslim societies, religious institutions, Islamic banks, policymakers, and educational institutions, drawing on the conclusions of the research results and discussion. Each recommendation is linked to the guidance of the Quran and Hadith, the research findings, and the contemporary context.

6.1. Integrated Framework of Islamic Entrepreneurship

Based on the research findings and discussions, a three-pillar integrated framework is proposed, which will serve as a guiding model for the revival of Islamic entrepreneurship.

6.1.1. Pillar 1: Theoretical Foundation

Elements:

- **Quranic Guidance:** Principles of Transaction, Prohibition of Interest, Honesty and Justice, Effort, Social Responsibility (Surah An-Nisa 4:29; Surah Al-Baqarah 2:275-280; Surah Al-Mutaffifin 83:1-6; Surah Al-Jumu'ah 62:10; Surah Al-Hashr 59:7)
- **Hadith Guidance:** The Dignity of the Merchant, Honesty in Transactions, Prohibition of Interest, Prohibition of Risk and Uncertainty, Encouragement of Effort (Sunan Tirmidhi 1209; Sahih Bukhari 2079; Sahih Muslim 1597; Sahih Bukhari 2078)
- **Historical Models:** Entrepreneurial Biographies of the Prophets and Companions (Adam, Noah, Abraham, Shu'aib, Yusuf, Muhammad SAW; Abu Bakr, Uthman, Abdur Rahman Ibn Auf, Khadija (RA))

Purpose: This pillar provides the moral, spiritual and legal foundation of Islamic entrepreneurship, which makes entrepreneurs aware of the guidance of the Quran and Hadith and encourages them to consider entrepreneurship as an act of worship.

6.1.2. Pillar 2: Skill Development and Education

Elements:

- Hard skill development: Business planning, financial management, digital skills (e-commerce, digital marketing, AI application), Sharia-compliant transaction knowledge
 - Soft skill development: Confidence, leadership, risk-taking, decision-making, communication skills, problem-solving
 - Religious education reform: Inclusion of entrepreneurship subjects in madrasa and mosque-based education; Teaching practical application of business verses and hadiths of the Quran and Hadith
- Objective: This pillar addresses the 63% hard skill and 51% soft skill deficit identified in the research results and eliminates the skill-bias in religious education.

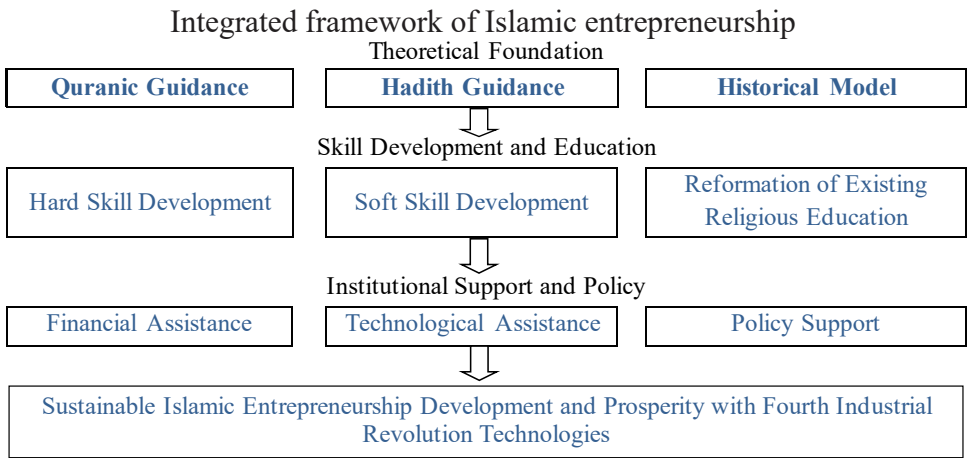
6.1.3. Pillar 3: Institutional Support and Policy

Elements

- Financial support: Islamic micro-finance, interest-free loans, Mudaraba and Musharaka-based venture capital, crowdfunding platforms
- Technical support: Digital platforms, e-commerce training, blockchain-based transparent transactions, AI-powered market analytics
- Human resource development: Entrepreneurial mentorship, training centers, shaping entrepreneurial-friendly attitudes of religious leadership, promoting examples of successful entrepreneurs
- Policy support: Government entrepreneurship development policies, entrepreneur-friendly products of Islamic banks, tax benefits and incentives

Objective: This pillar addresses 70% of the investment access difficulties, 64% of the capital shortage and 69% of the lack of institutional support identified in the research results.

6.1.4. Visual Representation of Integrated Structure



6.2. Practical Recommendations Based on the research findings and discussions, the following recommendations are provided for various stakeholders:

6.2.1. Recommendations for Religious Institutions and Leadership

A. Reform of Mosque-Madrasa-Based Education

The research results showed that 66% of respondents admitted to a lack of Sharia-based business knowledge, and qualitative analysis identified a near-total absence of entrepreneurial education in madrasas. The following recommendations are therefore made:

- Include business entrepreneurship and economics in the madrasa curriculum, where practical application of business guidance from the Quran and Hadith will be taught.
- Include discussions on the importance of entrepreneurship, the business biographies of the companions, and interest-free economics in mosque-based Friday sermons.
- Launch entrepreneurship training programs for religious leaders (Alim, Pir, Mufti) so that they can promote an entrepreneurial-friendly religious outlook in society.

B. Antidote to religious misconceptions

The study found that 76.8% of respondents considered risk an obstacle and 33.7% believed sustenance to be determined by fate. The following recommendations are therefore made:

- Promoting the correct interpretation of Surah Al-Jumu'ah (62:10) and Surah An-Najm (53:39) of the Quran, which prove that effort and initiative are essential conditions for obtaining sustenance.
- Creating and distributing books, leaflets, and digital content on the entrepreneurial biographies of the Prophets and Companions, so as to prove that entrepreneurship is complementary to worship.
- Promoting the Hadith declaration that "the truthful businessman is the companion of the Prophets and Martyrs" (Sunan Tirmidhi, 1209) as an antidote to the idea that "business is the opposite of worship."

6.2.2. Recommendations for Islamic banks and financial institutions

The study found that 70% of respondents identified difficulty in accessing Sharia-compliant investments and 64% identified an initial capital shortage. The following recommendations are therefore made:

A. Creating entrepreneur-friendly Islamic financing products

- Launching micro-Mudaraba and Musharaka-based loan programs for small entrepreneurs, where profit-sharing models will be followed instead of interest.
- Creating crowdfunding and peer-to-peer (P2P) Islamic financing platforms, where small entrepreneurs can raise investment from the community.
- Relaxing collateral requirements for entrepreneurial loans and introducing alternative collateral mechanisms (e.g. personal guarantees, group guarantees).

B. Digital Islamic Finance for Tech Entrepreneurs

- Launching blockchain-based smart contracts, which will ensure transparent and interest-free transactions and monitor whether all stages of the transaction are Sharia-compliant.
- Creating an Islamic Fintech app, which will provide entrepreneurs with easy Sharia-compliant investments, Zakat calculations, and interest-free transactions.

6.2.3. Recommendations for Educational Institutions

The study found that 63% of respondents lacked hard skills and 50% had no clear idea what skills were needed. The following recommendations are therefore made:

A. Inclusion of Entrepreneurship Education Curriculum

- Including Islamic Entrepreneurship and Economics as compulsory or optional courses in the business education departments of universities and colleges.
- Including Business Fiqh, Islamic Economics and Entrepreneurship in Madrasas and religious educational institutions, so that religious students can also become entrepreneurs.
- Organizing business games, competitions, fairs to build an entrepreneurial mindset at the school level.

B. Skill Development Training

- Hard Skill Training: Launching practical training courses on business planning, financial accounting, digital marketing, e-commerce, AI and data analysis.
- Soft Skill Training: Organizing workshops and seminars on confidence, leadership, risk-taking, decision-making, communication skills.
- Internship and Mentorship: Launching internship and mentorship

programs for students with successful Muslim entrepreneurs.

6.2.4. Recommendations for Family and Society

The study found that 69% of respondents held job-oriented attitudes and 41% held negative attitudes toward failed entrepreneurs. The following recommendations are therefore made:

A. Creating an entrepreneur-friendly social attitude

- Encouraging children to develop an entrepreneurial mindset in the family, building the courage to take risks, and teaching them to accept failure as a lesson.
- Promoting stories of successful Muslim entrepreneurs in the society, especially the entrepreneurial biographies of the companions and prophets, so that a positive attitude towards entrepreneurs is created in the society.
- Creating a sympathetic and encouraging attitude of the society towards failed entrepreneurs—so that entrepreneurs are encouraged to try again instead of not taking initiatives due to fear of failure.

6.2.5. Recommendations for Policymakers and Government

The study found that 64% respondents cited capital crisis, 60% a lack of training, and 52% the unavailability of Islamic finance. Therefore, the following recommendations are made:

A. National Entrepreneurship Development Policy

- Formulate an Islamic Entrepreneurship Development Policy, which will provide interest-free entrepreneurship loans, tax benefits, training programs, and technical assistance.
- Establish an Islamic Entrepreneurship Fund, which will provide commission-free or profit-sharing capital for entrepreneurs.
- Provide government support and subsidies for the creation of halal e-commerce platforms.

B. Digital Infrastructure for Technological Entrepreneurship

- Establish digital skills development training centers, especially for rural and madrasa-based students, so that they can become proficient in AI, e-commerce, and digital marketing.
- Establish Islamic Fintech Incubators and Accelerators, which will provide technical, financial, and consulting support to entrepreneurs.

6.2.6. Recommendations to seize the opportunities of technology and the fourth industrial revolution

The research found that 49% of respondents were unwilling to explore the relationship between Islamic economics and entrepreneurship, and 63% lacked digital skills. The following recommendations are therefore made:

A. Islamic application of AI and digital technology

- Creating AI-powered market analysis tools that will help entrepreneurs identify market opportunities in a Sharia-compliant manner.
- Introducing a blockchain-based transparent transaction system that will ensure transparency and interest-freeness at all stages of the transaction and eliminate fraud and uncertainty (Gara).
- Creating a digital Mudaraba platform where entrepreneurs and investors can engage in Sharia-compliant partnerships online.

B. Digital promotion of Islamic entrepreneurship

- Creating and promoting digital content (e-books, podcasts, videos, webinars) on Islamic entrepreneurship, which will make entrepreneurs aware of the combination of Quran-Hadith guidance and modern technology.
- Promoting interviews, case studies and inspirational stories of successful Islamic entrepreneurs on digital platforms, which will create an entrepreneurial-friendly attitude in society.

6.3. Future Research Directions

Based on the study's limitations and results, the following topics are proposed for future research:

- i. Comparative research across Muslim countries: This study was limited to Bangladesh. In the future, comparative research can be conducted with Malaysia, Indonesia, and Middle Eastern countries, which will help understand the context of global Muslim entrepreneurship.
- ii. Practical research combining AI and Islamic entrepreneurship: Although this study proposes a theoretical framework, detailed research is needed on how to create a practical model combining AI, blockchain, and Islamic entrepreneurship.
- iii. Impact assessment of mosque-madrasa-based entrepreneurship training: This study identified the absence of entrepreneurship education in madrasas. Its impact can be assessed by introducing madrasa-based entrepreneurship training in the future.
- iv. Impact of entrepreneurship-friendly products of Islamic banks: Long-term research is needed to determine the impact if Islamic banks introduce entrepreneurship-friendly products.

- v. Challenges of female Islamic entrepreneurs: This study did not analyze the specific challenges of female entrepreneurs separately. In the future, research can be conducted on the obstacles and possibilities of female Islamic entrepreneurs.

6.4. Limitations of the Study

The following limitations should be taken into account in interpreting the study's findings and recommendations:

- i. Sample limitations: The study sample was limited to Bangladesh only and convenience sampling method was used, which is not completely random. As a result, the results are not representative of the entire Muslim world.
- ii. Data limitations: For the second objective, data was collected from 100 participants, which may not be sufficient to represent a larger population. Future research with larger samples may provide more reliable results.
- iii. Time limitations: The study was conducted over a specific period of time, but the challenges of Muslim entrepreneurs may change over time. Long-term research will help understand this change.
- iv. Technological limitations: The discussion of the Fourth Industrial Revolution technologies (AI, Blockchain) in the study was limited to the theoretical level; it was not possible to test the practical application of these technologies.

6.5. Conclusion

This study proposes an integrated framework for reviving Islamic entrepreneurship by combining the guidance of the Quran and Hadith, historical entrepreneurial models, and the technologies of the Fourth Industrial Revolution. The results show that current Muslim society lags behind on the path to Islamic entrepreneurship due to religious distortions, a lack of institutional support, skill shortages, socio-cultural barriers, and technological unpreparedness. The Quran and Hadith, however, offer clear instruction on honesty, justice, freedom from interest, risk-sharing, and hard work — instruction that provides a strong moral and spiritual foundation for Muslim entrepreneurs.

The proposed integrated framework rests on three pillars: (1) theoretical foundation (Quran and Hadith and historical models), (2) skill development and education (hard and soft skills, religious education reform), and (3) institutional support and policies (financial, technical, human resources, and

policy support). Implementing this framework will require the concerted efforts of religious institutions, Islamic banks, educational institutions, families, society, policymakers, and the technology sector.

Above all, this study demonstrates that Islamic entrepreneurship is not merely an economic activity but a form of worship, a social responsibility, and a spiritual pursuit. If the technologies of the Fourth Industrial Revolution are integrated with Islamic ethics, Muslim society will be able to offer a just, sustainable, and blessed entrepreneurial model to the global economy — one that ensures worldly prosperity while also paving the way to success in the hereafter.

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