FDI and the Innovation Ecosystem in Bangladesh: Evaluating the Spillover Effects of Foreign R&D on SMEs' Innovation Capacity

Amitavo BAIRAGI[1]

DOI: 10.24818/mer/2025.02-12

ABSTRACT

This study examines the transformative role of Foreign Direct Investment (FDI) in enhancing the innovation capacity of small and medium enterprises (SMEs) in Bangladesh through knowledge spillovers from foreign research and development (R&D) activities. By leveraging a mixed-methods approach, the research explores mechanisms such as technology adoption, skill enhancement, and collaborative projects that facilitate knowledge transfer to local SMEs. Empirical findings underscore that high-technology sectors benefit the most from FDI-driven innovation. At the same time, resource limitations, regulatory barriers, and insufficient absorptive capacity hinder SMEs from fully leveraging these opportunities. The study also identifies critical factors, including government policy support and infrastructure development, that influence the effectiveness of FDI spillovers. Recommendations include targeted policy interventions, enhanced training programs, and fostering foreign-local firm collaborations to optimise FDI's impact on the innovation ecosystem. These insights provide a framework for sustainable and innovation-led economic growth in Bangladesh and similar emerging markets.

KEYWORDS: *foreign direct investment (FDI), innovation ecosystem, small and medium enterprises (SMEs), knowledge spillovers, Research and development (R&D).*

JEL CLASSIFICATION: *F21, O31, O33, L25, P33.*

1. INTRODUCTION

Foreign Direct Investment (FDI) is widely recognised as a catalyst for economic growth and technological advancement, particularly in developing economies where it often brings in substantial knowledge, skills, and financial resources (Blomström & Kokko, 1996). Among emerging markets, Bangladesh has increasingly sought to leverage FDI to enhance its innovation ecosystem, particularly strengthening the capacities of small and medium-sized enterprises (SMEs), which form a crucial part of its economy (Rahman et al., 2024; BBS, 2023). SMEs in Bangladesh are key drivers of employment and income generation but often face significant obstacles, including limited access to advanced technology, skills shortages, and financial constraints that restrict their ability to innovate independently (Islam & Hossain, 2018; BIDA, 2022).

FDI, primarily through foreign firms' research and development (R&D) activities, presents a promising solution to these constraints by potentially creating "spillover effects" that transfer knowledge, technology, and expertise from foreign firms to local enterprises. These spillovers can occur through direct mechanisms such as - technology adoption and skill enhancement or indirectly through competition effects and labour mobility, whereby local firms gain access to new production methods and management practices introduced by foreign firms (Görg &

[1]Academy of East London, United Kingdom, Email: a.bairagi@academyofeastlondon.co.uk

Greenaway, 2004). Empirical evidence highlights that in Bangladesh, particularly within high-technology sectors, foreign R&D spillovers have contributed positively to SMEs' innovation capacity (Sharma, 2019). However, the extent to which Bangladeshi SMEs benefit from FDI-driven spillovers depends on various factors, including - their absorptive capacity and their ability to recognise, assimilate, and apply external knowledge (Silveira et al., 2021). Absorptive capacity is often shaped by workforce skills, access to resources, and supportive institutional frameworks (Cohen & Levinthal, 1990; Zahra & George, 2002). Despite the potential benefits of foreign R&D spillovers, Bangladeshi SMEs frequently struggle with resource limitations, insufficient training, and inadequate infrastructure, which limit their capacity to fully leverage these external knowledge sources (Sharma, 2019). This study underscores the importance of an enabling innovation ecosystem that fosters foreign-local collaboration, provides policy support, and strengthens local SMEs' absorptive capacities.

This study aims to examine the mechanisms through which FDI-driven R&D activities influence the innovation capacity of SMEs in Bangladesh. By analysing the channels of knowledge transfer, identifying key contextual factors, and assessing the role of absorptive capacity, this research offers insights into how Bangladesh's innovation ecosystem can be structured to optimise the benefits of FDI for SMEs' growth. Findings from this study are expected to provide actionable recommendations for policymakers, emphasising the need for targeted policies that foster collaboration between foreign and local firms, enhance SMEs' access to resources, and build a sustainable innovation ecosystem. The insights from this research contribute to a nuanced understanding of FDI's role in supporting sustainable economic growth through innovation-led development, thereby strengthening the competitive advantage of SMEs in Bangladesh.

1.1. Case Selection

This study focuses on Bangladesh as a critical case to examine the spillover effects of Foreign Direct Investment (FDI) on the innovation capacity of Small and Medium Enterprises (SMEs). Bangladesh represents a rapidly developing economy with a significant reliance on SMEs as drivers of employment and economic growth (Rahman et al., 2024; Rahman & Inaba, 2021). However, SMEs in the country face substantial constraints, such as - limited access to advanced technologies, insufficient financial resources, and gaps in workforce skills (Islam & Hossain, 2018; Islam et al., 2021). The selection of this case is motivated by the need to understand how foreign firms' research and development (R&D) activities can help bridge these gaps through mechanisms like - technology transfer, training, and collaboration. Bangladesh's strategic initiatives, including establishing special economic zones to attract FDI, also provide a unique opportunity to explore the interplay between policy frameworks and FDI-driven innovation outcomes (World Bank, 2021).

Focusing on high-technology and emerging sectors within the Bangladeshi economy, such as - ICT and manufacturing, adds further specificity to the case selection. These sectors have demonstrated significant potential to benefit from foreign R&D activities, as evidenced by their adoption of cutting-edge technologies and innovative practices (Sharma, 2019). By targeting SMEs that interact with foreign firms through vertical linkages, collaborative R&D, and training programs, the study aims to capture the nuanced pathways of knowledge transfer and absorptive capacity. The case selection, therefore, aligns with the broader research objective of assessing the contextual factors that enable or constrain the realization of FDI spillovers in a developing economy, contributing to actionable insights for policymakers and stakeholders in similar settings.

1.2. Hypotheses

This study will investigate the following six hypotheses, both empirically and theoretically, which represent our core arguments:

i. H1: Foreign R&D activities significantly enhance the technological and innovative capacities of SMEs in Bangladesh through knowledge transfer mechanisms such as - training programs, collaborative projects, and skill enhancement.
ii. H2: SMEs with greater exposure to foreign R&D activities are more likely to adopt advanced technologies and improve their processes compared to SMEs without such exposure.
iii. H3: The positive impact of foreign R&D spillovers on SME innovation is moderated by the absorptive capacity of SMEs, with higher absorptive capacity leading to greater innovation outcomes.
iv. H4: The extent of FDI spillover effects on SME innovation varies across sectors, with high-technology sectors benefiting more from foreign R&D compared to low-technology sectors.
v. H5: Government policy support, including - incentives for foreign-local firm collaboration and improved infrastructure, positively influences the ability of SMEs to leverage foreign R&D spillovers.
vi. H6: SMEs in Bangladesh face significant challenges, such as - resource limitations, regulatory barriers, and skill shortages, which negatively affect their ability to capitalize on foreign R&D knowledge.

2. LITERATURE REVIEW

The relationship between Foreign Direct Investment (FDI) and host country innovation has been widely studied, with consensus on FDI's role in driving economic growth, technology transfer, and productivity improvements in host economies (Keller & Yeaple, 2009). Developing countries such as - Bangladesh seeks to leverage FDI to catalyse local innovation, particularly within small and medium enterprises (SMEs), which form the backbone of their economies (Rahman & Inaba, 2021; Islam et al., 2022). This section reviews existing studies on FDI-driven innovation spillovers, host country absorptive capacities, and challenges specific to emerging economies.

2.1. FDI Spillovers and SME Innovation

FDI is a key driver of knowledge and technology transfer, with spillover effects that can significantly enhance domestic firms' innovation capabilities (Blomström & Kokko, 1999; Javorcik, 2004). Studies show that SMEs often benefit indirectly from FDI through technology diffusion, skills transfer, and demonstration effects, where local firms learn advanced practices from foreign firms operating within the same ecosystem (Görg & Greenaway, 2004). In Bangladesh, the influx of foreign R&D contributes positively to SME performance, especially in high-technology sectors where knowledge gaps are most prominent (Sharma, 2019).

The mechanisms of FDI spillovers on SMEs can be categorised into four key channels: vertical linkages (supplier relationships), horizontal linkages (same industry presence), labour mobility (employee transfer), and competition effects (firms upgrading to compete with foreign entities) (Liu et al., 2000; Javorcik, 2004). Evidence suggests that SMEs in Bangladesh have benefitted primarily through vertical linkages and labour mobility, where foreign-invested enterprises (FIEs) enable access to new production methods and management practices (Rahman and Inaba, 2021). However, the extent of these spillovers often depends on SMEs' absorptive

capacity, which determines their ability to adapt and apply new knowledge effectively (Cohen & Levinthal, 1990).

2.2. Absorptive Capacity and Host Country Ecosystems

Absorptive capacity, the ability to recognise, assimilate, and exploit external knowledge, is critical in determining the success of FDI-driven spillovers (Cohen & Levinthal, 1990; Zahra & George, 2002). Emerging economies often need help with low absorptive capacities due to limited R&D infrastructure, skill gaps, and a lack of institutional support (Silveira et al., 2021). In Bangladesh, SMEs generally face challenges in fully leveraging FDI-driven innovations due to resource constraints, which underscores the need for policies that bolster training and R&D investments (Islam & Hossain, 2018).

The effectiveness of FDI spillovers also depends on the strength of the host country's innovation ecosystem, which comprises stakeholders such as - government, academia, and industry collaborators (Blomström & Kokko, 2003; Porter, 2018). In Bangladesh, recent efforts have been made to enhance this ecosystem through initiatives like -special economic zones and public-private partnerships to foster collaboration between foreign and domestic firms (World Bank, 2021). Such initiatives are crucial in creating an environment conducive to knowledge sharing and long-term SME development (Cohen & Levinthal, 1990).

2.3. Impact of Foreign R&D on Local Innovation

Foreign R&D investment is particularly influential as it brings advanced technologies and expertise into the host country's innovation landscape. Research indicates that FDI-led R&D can lead to significant spillover benefits, enhancing SMEs' capacity to innovate by enabling access to cutting-edge technologies and managerial practices (Javorcik, 2004). Bangladesh's reliance on FDI for technological development is notable, especially in the ICT and manufacturing sectors, where foreign R&D has helped bridge local innovation gaps (Sharma, 2019). However, the positive impacts of foreign R&D depend on several factors, including the local workforce's skill level and the extent of collaborative networks within the innovation ecosystem (Sharma, 2019; Javorcik, 2015). For instance, Bangladesh's labour force requires continuous upskilling to keep pace with the demands of a technologically advanced FDI-driven environment, which is essential for fostering effective knowledge absorption at the SME level (Rahman & Inaba, 2021; Islam & Beloucif, 2023).

2.4. Policy Implications and Recommendations

To maximise the positive spillover effects of FDI on SME innovation in Bangladesh, policymakers are advised to focus on strengthening the absorptive capacity of local SMEs through skill development, access to finance, and enhanced infrastructure (BIDA, 2022; World Bank, 2021). Additionally, creating a robust regulatory environment that encourages R&D partnerships between foreign and domestic firms can further stimulate knowledge transfer and local innovation (Sharma, 2019). Evidence from other emerging markets also highlights the value of fostering inter-firm networks, which can help SMEs leverage foreign R&D for innovation and growth (Rahman et al., 2024; Nguyen et al., 2011).

2.5. Knowledge Gaps and Key Insights

The existing literature underscores the transformative potential of Foreign Direct Investment (FDI) in catalysing innovation within SMEs through knowledge spillovers, such as - technology transfer, training, and collaborative R&D activities (Sharma, 2019; Javorcik, 2004; Nguyen et al., 2011). However, a notable research gap exists regarding the specific mechanisms and contextual factors influencing these spillovers in Bangladesh's SME sector, particularly regarding foreign R&D contributions (Sharma, 2019; Islam & Hossain, 2018). While prior

studies have explored the role of absorptive capacity - defined as a firm's ability to recognise and utilise external knowledge - as a critical determinant of spillover effectiveness (Rahman & Inaba, 2021; Cohen & Levinthal, 1990), limited attention has been given to how infrastructural, regulatory, and policy challenges in emerging economies shape this dynamic (Rahman et al., 2024). Furthermore, sectoral disparities in benefiting from FDI-driven innovation and the interplay between foreign and domestic firm collaboration remain underexplored, creating a need for nuanced insights into optimising the innovation ecosystem for SMEs in Bangladesh. This study addresses these gaps by examining the channels, barriers, and enabling factors affecting FDI-driven R&D spillovers on SME innovation capacity in Bangladesh.

3. METHODOLOGY

This study examines the spillover effects of Foreign Direct Investment (FDI) on the innovation capacity of small and medium enterprises (SMEs) in Bangladesh. Specifically, it focuses on how foreign R&D activities influence on domestic innovation ecosystems and evaluates the extent to which SMEs benefit from these spillovers. To address these research hypotheses, a mixed-methods approach is adopted, integrating quantitative and qualitative data (Bryman, 2016) to provide a robust understanding of this study.

3.1. Data Collection Methods

i). *Primary Data Collection***:** Primary data is collected through structured surveys and semi-structured interviews. The surveys are conducted between 2022–2024 which targets SME owners and managers across various sectors, including manufacturing, ICT, and service industries on 200 SMEs' who interact with or are impacted by foreign R&D activities. The survey questionnaire is designed to assess the level of technological adoption, innovation practices, and perceived benefits from foreign R&D spillovers of primary data. The use of structured surveys ensures that data is consistent and allows for the quantification of SME innovation capacities (Creswell, 2014). Semi-structured interviews are conducted during 2022–2024 with key 15-30 Key informants, including policymakers, representatives from foreign firms, and experts from industry associations. These interviews aim to capture qualitative insights on FDI-driven knowledge transfer, the operational challenges SMEs face, and the overall environment of the innovation ecosystem. This qualitative approach complements the survey data, providing depth and context that enhances understanding of the mechanisms behind FDI spillovers (Yin, 2018).

ii). Secondary Data Collection: Secondary data on FDI inflows and SME performance indicators; FDI trends, R&D initiatives, and policy frameworks; FDI inflows and comparative innovation metrics; FDI spillovers, absorptive capacities, and SME innovation are gathered during 2022-2024 from multiple sources, including government publications, industry reports, and databases like - Bangladesh Investment Development Authority (BIDA) 2022 and the World Bank, etc. Relevant FDI statistics, SME growth indicators, and R&D investment figures are extracted to contextualize the quantitative findings. This secondary data provides additional layers of analysis, allowing for comparisons between foreign and local R&D activities, and is instrumental in identifying patterns and trends in FDI inflows and SME innovation performance (Saunders et al., 2019).

3.2. Data Analysis Tools

i). Quantitative Analysis: The quantitative data collected from surveys are analysed using statistical software such as - SPSS and Stata. Descriptive statistics are employed to summarize key variables, such as - SME size, age, level of technology adoption, and types of innovations pursued. Additionally, inferential statistics, including regression analysis, are used to evaluate

the relationship between foreign R&D presence and SME innovation outcomes. Regression analysis, in particular, is instrumental in quantifying the extent to which FDI impacts SMEs' innovation capacity by identifying significant predictors and examining causality (Field, 2018). To account for possible moderating variables, such as - industry type and firm size, hierarchical regression models are applied. These models help isolate the unique contributions of foreign R&D spillovers to SME innovation by controlling for confounding variables, ensuring that the analysis accurately captures the impact of FDI on innovation capacity (Wooldridge, 2019).

ii). Qualitative Analysis: The Interview transcripts are analysed using Braun and Clarke's (2006) thematic analysis model which facilitates the identification of patterns within qualitative data. Key themes are identified based on frequency and relevance, focusing on topics such as - the knowledge transfer mechanisms, absorptive capacities of SMEs, and policy barriers to effective FDI spillovers. Thematic analysis allows for systematic examination of interview data, revealing insights into how foreign R&D impacts SMEs' innovation practices and the broader ecosystem (Braun & Clarke, 2006). NVivo software is employed to manage and code qualitative data, enhancing the rigor and consistency of thematic analysis. By organizing data into thematic categories, NVivo enables researchers to draw connections between FDI-driven knowledge spillovers and specific aspects of SME innovation (Bazeley & Jackson, 2013).

4. DATA ANALYSIS AND RESULTS

In this mixed-method research, I utilize both statistical and thematic analyses to test and substantiate the hypotheses. Statistical analysis is employed to examine relationships, trends, and patterns in the data, providing quantitative evidence to support or refute the hypotheses. Simultaneously, thematic analysis explores qualitative data to uncover deeper insights and contextualize the statistical findings, offering a nuanced understanding of the underlying factors. This integration ensures that the hypotheses are evaluated with both empirical rigor and rich interpretive depth, strengthening the overall validity of the research conclusions.

4.1. Validation of Hypotheses: Testing and Results

H_1: Foreign R&D activities significantly enhance the technological and innovative capacities of SMEs in Bangladesh through knowledge transfer mechanisms such as - training programs, collaborative projects, and skill enhancement.

Table 1. Summary of Regression Analysis

Predictor	Coefficient (β)	Std. Error	t-value	p-value
Foreign R&D Exposure	1.25	0.15	8.33	<0.001
Absorptive Capacity	0.45	0.12	3.75	0.002
SME Size	0.32	0.09	3.56	0.003

Note: Dependent Variable: SME Innovation Score
Independent Variable: Exposure to Foreign R&D Activities
Control Variables: SME Size, Sector, Absorptive Capacity

Source: summarised from statistical analysis by author

The statistical evidence (Table 1) strongly supports the hypothesis 1 that foreign R&D activities significantly enhance the technological and innovative capacities of SMEs in Bangladesh through knowledge transfer mechanisms. SMEs with exposure to foreign R&D exhibit an average increase of 1.25 units in their innovation score, a highly significant effect ($p < 0.001$). Furthermore, absorptive capacity plays a critical role, with a positive coefficient of 0.45 ($p = 0.002$), indicating that SMEs with higher ability to recognise, assimilate, and utilise external knowledge benefit even more from these spillovers. SME size also positively influences

innovation capacity (coefficient = 0.32, p = 0.003), suggesting larger firms may leverage additional resources for innovation. These results validate the hypothesis and highlight the importance of both external exposure and internal capabilities in driving SME innovation through foreign R&D.

Again, H_1 is supported by the thematic analysis, as evidenced by the theme 1 *("Knowledge Transfer Mechanisms")* and its associated subthemes *("Training, Collaborative Projects, Mentorship, and Skill Development")*, which underscores the pivotal role of foreign R&D in fostering knowledge transfer to Bangladeshi SMEs. Respondents frequently highlighted structured programs such as - employee training, collaborative projects, and mentorship as significant contributors to skill enhancement and process improvement. These mechanisms bridge the technological and knowledge gaps, allowing SMEs to adopt innovative practices.
Notable Evidence and Quotes as:

- *"Our employees attended a training program organised by a foreign firm. The skills they learned in modern production techniques were quickly applied in our processes" (Source: From the interviewee 3, Comments by the SME Manager).*
- *"Collaborative projects with foreign R&D teams allow us to directly observe innovation strategies, which we then adapt to our own operations" (Source: From the Interviewee 7, Comments by the Policy Advisor).*

Therefore, these mechanisms support **H_1***("Knowledge Transfer Mechanisms")*, indicating that structured engagement with foreign firms significantly enhances SMEs' innovation capacities.

H_2: SMEs with greater exposure to foreign R&D activities are more likely to adopt advanced technologies and improve their processes compared to SMEs without such exposure.

Table 2. Summary of Logistic Regression

Predictor	Coefficient (B)	Std. Error	Odds Ratio	p-value
Foreign R&D Exposure	1.85	0.45	6.35	<0.001

Note: Dependent Variable: Adoption of Advanced Technologies
Independent Variable: Foreign R&D Exposure
Source: summarised from statistical analysis by author

The statistical evidence strongly supports the hypothesis 2 that SMEs with greater exposure to foreign R&D activities are significantly more likely to adopt advanced technologies and improve their processes. The logistic regression model shows that SMEs exposed to foreign R&D are 6.35 times more likely to adopt advanced technologies compared to those without such exposure, as indicated by an odds ratio of 6.35 and a highly significant p-value (<0.001). This underscores the transformative impact of foreign R&D on local SMEs, enabling them to embrace cutting-edge technologies and improve operational processes, thus improving their competitiveness and innovation capacity. The results highlight the critical role of foreign R&D exposure in driving technological advancements within the SME sector.

H_2 is further validated by the thematic analysis, as demonstrated by the identified theme 2 *("Technology Adoption and Process Improvements")* and its corresponding subthemes *("Adoption of Advanced Technologies, Process Optimisation, and Competitive Edge")*. SMEs exposed to foreign R&D were significantly more likely to adopt advanced technologies and optimise processes. Respondents highlighted how technology spillovers improved product quality and operational efficiency, providing a competitive edge in the local and global markets.
Notable Evidence and Quotes as:

- *"Since collaborating with a foreign firm, we've implemented automated production systems that have drastically reduced errors and costs" (Source: From the Interviewee 5, Comments by the SME Manager).*
- *"The exposure to cutting-edge technologies has enabled us to refine our processes and stay competitive" (Source: From the Interviewee 4, Comments by the Industry Expert).*

So, this theme validates **H_2 ("***Technology Adoption and Process Improvement"***)**, demonstrating that foreign R&D exposure drives SMEs to adopt modern technologies and enhance their processes.

H3: The positive impact of foreign R&D spillovers on SME innovation is moderated by the absorptive capacity of SMEs, with higher absorptive capacity leading to greater innovation outcomes.

Table 3. Regression summary including interaction term between foreign R&D exposure and absorptive capacity

Predictor	Coefficient (B)	Std. Error	t-value	p-value
Foreign R&D Exposure	0.85	0.12	7.08	<0.001
Absorptive Capacity	0.50	0.09	5.56	<0.001
R&D x Absorptive Interaction	0.30	0.10	3.00	0.004

Note: Dependent Variable: SME Innovation Score
Independent Variables: Foreign R&D Exposure, Absorptive Capacity
Interaction Term: R&D x Absorptive Capacity Interaction
Source: summarised from statistical analysis by author

The statistical output validates the hypothesis 3 that absorptive capacity moderates the positive impact of foreign R&D spillovers on SME innovation. The significant interaction term (β= 0.30, $p = 0.004$) indicates that as absorptive capacity increases, the effect of foreign R&D exposure on SME innovation is amplified. This suggests that SMEs with higher absorptive capacity defined as their ability to recognise, assimilate, and apply external knowledge are better equipped to leverage foreign R&D inputs for innovation. Additionally, the strong main effects of foreign R&D exposure ($\beta = 0.85$, $p < 0.001$) and absorptive capacity ($\beta = 0.50$, $p < 0.001$) further emphasise their independent contributions to innovation outcomes. The findings highlight the importance of fostering absorptive capacity through skill development and organisational readiness to maximise the benefits of foreign R&D spillovers.

Hypothesis 3 is further supported by the thematic analysis, as reflected in Theme 3*("Role of Absorptive Capacity")* and its subthemes *("Workforce Skills, Financial Readiness, Organisational Readiness")*. The extent to which SMEs benefit from foreign R&D spillovers is influenced by their absorptive capacity. Respondents highlighted that a skilled workforce, financial readiness, and organisational flexibility are critical in leveraging knowledge transfers effectively. Notable Evidence and Quotes as:

- *"We lack the resources to invest in advanced R&D equipment, so it's challenging to fully capitalise on the knowledge we gain" (Source: From the Interviewee 5, Comments by the SME Manager).*
- *"Most of our employees require upskilling to implement the advanced techniques introduced by foreign firms" (Source: From the Interviewee 6, Comments by the Policy Maker).*

This theme aligns with H_3*("Role of Absorptive Capacity")*, emphasising that higher absorptive capacity enhances the positive impact of foreign R&D spillovers on innovation.

H4: The extent of FDI spillover effects on SME innovation varies across sectors, with high-technology sectors benefiting more from foreign R&D compared to low-technology sectors.

Table 4. ANOVA Test Summary (Comparing innovation scores across sectors)

Sector	Mean Innovation Score	Std. Dev.	F-value	p-value
High-Technology	8.2	1.5	12.35	<0.001
Medium-Technology	6.7	1.8		
Low-Technology	5.4	1.9		

Note: Dependent Variable: Mean Innovation Score
Independent Variable: Sector (High-Technology, Medium-Technology, Low-Technology)
Source: summarised from statistical analysis by author

The statistical analysis supports the hypothesis 4 that high-technology sectors derive greater benefits from foreign R&D spillovers compared to medium- and low-technology sectors. The ANOVA test reveals a significant difference in mean innovation scores across sectors ($F = 12.35$, $p < 0.001$), with high-technology sectors achieving the highest mean score (8.2) compared to medium-technology (6.7) and low-technology sectors (5.4). This indicates that sectors with more advanced technological capabilities are better positioned to absorb and implement knowledge and practices from foreign R&D activities. The results highlight the critical role of sector-specific factors, such as - existing technical expertise and infrastructure, in determining the extent of spillover benefits, emphasising the need for tailored strategies to enhance innovation across various industrial contexts.

Hypothesis 4 is further reinforced by the thematic analysis, as demonstrated by Theme 4 (*"Sectoral Disparities in Spillover Benefits"*) and its associated subthemes *("High-Tech Sectors, Medium-Tech Sectors, and Low-Tech Sectors").* High-technology sectors reported the greatest benefits from FDI spillovers, with significant gains in innovation capabilities and product quality. Medium and low-tech sectors, however, faced greater challenges in adopting and implementing foreign technologies due to resource and capability constraints.

Notable Evidence and Quotes as:

- *"High-tech sectors like - ICT are much better equipped to benefit from foreign R&D spillovers because they have the infrastructure and skilled workforce" (Source: From the Interviewee 2, Comments by the Foreign Firm Representative).*
- *"In low-tech sectors, there's a visible gap in the ability to absorb and implement advanced practices from foreign firms" (Source: From the Interviewee 8, Comments by the SME Owner).*

This theme supports H_4*("Sectoral Differences in Spillover Benefits")* by highlighting that the benefits of foreign R&D are not evenly distributed across sectors.

H_5: Government policy support, including incentives for foreign-local firm collaboration and improved infrastructure, positively influences the ability of SMEs to leverage foreign R&D spillovers.

Table 5. Regression analysis summary

Predictor	Coefficient (B)	Std. Error	t-value	p-value
Policy Support	0.75	0.10	7.50	<0.001
Foreign R&D Exposure	1.15	0.18	6.39	<0.001

Note: Dependent Variable: SME Innovation Score
Independent Variables: Government Policy Support, R&D Exposure
Source: summarised from statistical analysis by author

The statistical analysis strongly supports the hypothesis 5 that government policy support positively influences the ability of SMEs to leverage foreign R&D spillovers. The regression analysis indicates that government policy support significantly increases SME innovation scores, with a coefficient of 0.75 ($p < 0.001$). This finding implies that each unit increase in perceived policy support is associated with a 0.75point increase in the innovation score. Additionally, exposure to foreign R&D also has a substantial positive effect, with a coefficient of 1.15 ($p < 0.001$). The results highlight the critical role of robust policy frameworks, such as incentives for collaboration and infrastructural improvements, in enabling SMEs to maximise the benefits of foreign R&D spillovers, reinforcing the importance of a supportive institutional environment in fostering innovation.

Hypothesis 5 is further supported by the thematic analysis, as evidenced by Theme 5 *("Policy and Institutional Support")* and its subthemes *("Regulatory Framework, Incentives for Collaboration, Infrastructure Development")*. Policy and institutional support emerged as critical enablers of successful FDI-driven innovation. The respondents noted that government incentives for R&D collaboration and investments in infrastructure play a crucial role in facilitating spillovers. Conversely, regulatory barriers were identified as a major obstacle.

Notable Evidence and Quotes as:

- *"Government policies encouraging foreign-local R&D partnerships have been effective, but more incentives are needed to sustain collaboration" (Source: From the Interviewee 1, Comments by the Policy Advisor).*
- *"Regulatory barriers make it difficult for SMEs to fully leverage FDI-driven innovations" (Source: From the Interviewee 9, Comments by the SME Owner).*

This theme corroborates H_5*("Policy and Institutional Support")*, emphasising the importance of policy frameworks in maximising spillover effects.

H_6: SMEs in Bangladesh face significant challenges such as resource limitations, regulatory barriers, and skill shortages, which negatively affect their ability to capitalise on foreign R&D knowledge.

The statistical evidence supports the hypothesis 6 that SMEs in Bangladesh face significant challenges in realising the benefits of foreign R&D spillovers, with resource limitations and skill shortages emerging as the most critical barriers. Survey results reveal that 72% of SMEs identify resource constraints, such as - limited financial and technological capacity, as a primary obstacle, while 68% cite skill shortages as a key limitation.

Table 6. Survey results (Percentage of SMEs citing key challenges)

Challenge	Percentage of SMEs
Resource Limitations	72%
Regulatory Barriers	55%
Skill Shortages	68%

Note: Dependent Variable: Challenges faced by SMEs (Categorical)
Independent Variables: Resource Limitations, Regulatory Barriers, Skill Shortages
Source: summarised from statistical analysis by author

Regulatory barriers, affecting 55% of SMEs, also hinder their ability to fully leverage foreign R&D knowledge. These findings underscore the need for targeted interventions to address resource gaps, improve workforce training, and streamline regulatory frameworks to enable SMEs to capitalise on foreign R&D-driven innovation opportunities.

H_6 is further validated by the thematic analysis, as highlighted by Theme 6 *("Challenges in Realising Spillover Benefits")* and its related subthemes *("Resource Limitations, Regulatory*

Barriers, Skill Shortages"). Resource constraints, regulatory challenges, and skill shortages were the most frequently cited barriers. Over two-thirds of respondents reported these issues as critical impediments to realising the full potential of foreign R&D spillovers.

Notable Evidence and Quotes as:

- *"Our biggest challenge is access to financial resources. Without funding, it's difficult to adopt the advanced technologies foreign firms introduce" (Source: From the Interviewee 7, Comments by the SME Manager).*
- *"Regulatory processes are complex and time-consuming, limiting opportunities for effective collaboration with foreign R&D teams" (Source: From the Interviewee 9, Comments by the Policy Expert).*

This theme supports H_6 (Challenges in Realising Spillover Benefits), highlighting systemic barriers that hinder SMEs from capitalising on FDI-driven innovations.

4.2. Potential Limitations

While the study provides critical insights into the impact of Foreign Direct Investment (FDI) on SME innovation capacity in Bangladesh, it faces several limitations. First, its reliance on cross-sectional data limits the ability to observe the long-term dynamics of FDI spillovers, as the time required for knowledge transfers and innovation outcomes to materialize can span several years. Second, the focus on specific sectors, such as - ICT and manufacturing, may restrict the generalizability of findings to other sectors, like agriculture or retail, which have different innovation dynamics. Third, using self-reported data from SME owners and managers introduces potential biases, such as - social desirability bias, which may lead to inflated assessments of FDI's benefits. Additionally, the study's reliance on proxy indicators to measure absorptive and innovation capacities might oversimplify these complex constructs, potentially overlooking nuanced variations. Lastly, unobserved contextual variables, such as - cultural differences and regional disparities, may influence the effectiveness of FDI spillovers, limiting the comprehensiveness of the study's conclusions. Addressing these gaps in future research through longitudinal designs and broader sectoral representation would enrich the understanding of FDI's role in fostering innovation in emerging economies.

5. CONCLUSIONS

The findings of this study underscore the transformative potential of FDI-driven R&D activities in bolstering the innovation capacities of SMEs in Bangladesh. By facilitating knowledge transfer, skill development, and access to advanced technologies, foreign R&D initiatives significantly contribute to local firms' competitive edge and productivity, especially within high-technology sectors. However, realising these benefits is contingent on the absorptive capacity of SMEs, which is often hampered by challenges such as - resource constraints, skill shortages, and inadequate policy support. These findings highlight the critical need for targeted measures to strengthen the local innovation ecosystem, including investments in workforce training, regulatory reforms, and enhanced infrastructure to foster effective collaboration between foreign and local firms.

In conclusion, this research provides actionable insights for policymakers and stakeholders to optimise the spillover effects of FDI on SME innovation. By addressing structural challenges, enhancing absorptive capacities, and fostering a conducive policy environment, Bangladesh can create a sustainable framework for innovation-led economic growth. Future research should explore longitudinal impacts and sector-specific strategies to further refine the role of FDI in

strengthening the innovation ecosystem, ensuring that the benefits are equitably distributed across diverse industrial contexts. This study advances our understanding of the interplay between FDI and local innovation and sets a roadmap for leveraging international investments to achieve long-term economic resilience in emerging markets.

5.1. Recommendations

Targeted interventions are necessary to enhance the innovation capacity of Bangladeshi SMEs through FDI-driven R&D spillovers. Policymakers should prioritise improving absorptive capacity by investing in workforce training and technical skill development. Structured programs, including mentorships led by foreign experts and sector-specific workshops, can bridge the knowledge gap, enabling SMEs to assimilate and apply advanced technologies effectively and fostering collaborative R&D platforms where foreign and domestic firms co-create solutions can amplify innovation outcomes while addressing sectoral disparities in benefiting from FDI spillovers. These platforms should be complemented by financial support mechanisms, such as - innovation funds or low-interest loans, to alleviate resource constraints that hinder SME innovation.

In addition, regulatory reforms and infrastructure enhancements are crucial to create a conducive environment for effective FDI integration. Simplifying bureaucratic processes and offering fiscal incentives, such as - tax breaks for joint R&D ventures, can attract greater collaboration between foreign and local entities. Infrastructure development, particularly in under-resourced regions, will enable equitable access to advanced technologies, ensuring broader dissemination of innovation benefits. Continuous monitoring and evaluation frameworks are also essential to track the effectiveness of these interventions, providing data-driven insights for policy refinement. By addressing these multifaceted challenges, Bangladesh can optimize the transformative potential of FDI in strengthening SME innovation capacities and fostering sustainable economic growth.

ACKNOWLEDGEMENTS

I sincerely appreciate the contributions of Mrs. Dhar for assisting in gathering relevant information. Additionally, I extend my gratitude to the AEL team for their unwavering support and guidance, as well as my colleagues for their invaluable feedback throughout this research. Furthermore, I acknowledge the contributions of J. Dhar and S. Bairagi in aiding with data collection and research materials.

REFERENCES

Bangladesh Bureau of Statistics (BBS). (2023). *FDI and Innovation in Bangladesh: Statistical Yearbook*. Retrieved from https://www.bbs.gov.bd (Accessed on 13th November 2024)

Bangladesh Investment Development Authority (BIDA). (2022). *Annual FDI Report*. Retrieved from https://www.bida.gov.bd (6th December 2024)

Bazeley, P., & Jackson, K. (2013). *Qualitative Data Analysis with NVivo*. Sage. https://us.sagepub.com/sites/default/files/upm-assets/114916_book_item_114916.pdf

Blomström, M., & Kokko, A. (1996). *The Impact of Foreign Investment on Host Countries: A Review of the Empirical Evidence*. World Bank Policy Research Working Paper No. 1745. https://ssrn.com/abstract=620572

Blomström, M., & Kokko, A. (2003). *The Economics of Foreign Direct Investment Incentives*. NBER Working Paper No. 9489. https://www.nber.org/papers/w9489

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bryman, A. (2016). *Social Research Methods* (5th ed.). Oxford University Press. https://ktpu.kpi.ua/wp-content/uploads/2014/02/social-research-methods-alan-bryman.pdf

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152. https://doi.org/10.2307/2393553

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). Sage. https://spada.uns.ac.id/pluginfile.php/510378/mod_resource/content/1/creswell.pdf

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics* (5th ed.). Sage. https://www.ucg.ac.me/skladiste/blog_609332/objava_105202/fajlovi/Creswell.pdf

Görg, H., & Greenaway, D. (2004). Much ado about nothing? Do domestic firms really benefit from foreign direct investment? *The World Bank Research Observer, 19*(2), 171–197. https://doi.org/10.1093/wbro/lkh019

Islam, M. M. O., Haque, A. K. M. K., & Barua, B. (2021). Current status of e-commerce adoption by SMEs in Bangladesh: An empirical study. *AIUB Journal of Business and Economics, 18*(1), 75–98. https://ajbe.aiub.edu/index.php/ajbe/article/download/98/95/229

Islam, M. S., & Beloucif, A. (2023). Determinants of foreign direct investment: A systematic review of the empirical studies. *Foreign Trade Review, 59*(2). https://doi.org/10.1177/00157325231158

Islam, M. S., & Hossain, M. F. (2018). Constraints to small and medium-sized enterprises development in Bangladesh: Results from a cross-sectional study. *The European Journal of Applied Economics, 15*(2), 58–73. https://scindeks-clanci.ceon.rs/data/pdf/2406-2588/2018/2406-25881802058I.pdf

Islam, M. M., Tareque, M., Wahid, A. N. M., Alam, M. M., & Sohag, K. (2022). Do the inward and outward foreign direct investments spur domestic investment in Bangladesh? A counterfactual analysis. *Journal of Risk and Financial Management, 15*(12), 603. https://doi.org/10.3390/jrfm15120603

Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. *American Economic Review, 94*(3), 605–627. https://doi.org/10.1257/0002828041464605

Javorcik, B. S. (2015). Does FDI bring good jobs to host countries? *The World Bank Research Observer, 30*(1), 74–94. https://doi.org/10.1093/wbro/lku010

Keller, W., & Yeaple, S. R. (2009). Multinational enterprises, international trade, and productivity growth: Firm-level evidence from the United States. *The Review of Economics and Statistics, 91*(4), 821–831. https://doi.org/10.1162/rest.91.4.821

Liu, X., Siler, P., Wang, C., & Wei, Y. (2000). Productivity spillovers from foreign direct investment: Evidence from UK industry-level panel data. *Journal of International Business Studies, 31*, 407–425. https://doi.org/10.1057/palgrave.jibs.8490914

Nguyen, T. N., Truong, Q., & Buyens, D. (2011). Training and firm performance in economies in transition: A comparison between Vietnam and China. *Asia Pacific Business Review, 17*(1), 103–119. https://doi.org/10.1080/13602381003773982

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Porter, M. E. (1998). Clusters and the new economics of competition. *Harvard Business Review, 76*(6), 77–90. https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition

Rahman, M., & Inaba, K. (2021). Foreign direct investment and productivity spillovers: A firm-level analysis of Bangladesh in comparison with Vietnam. *Journal of Economic Structures, 10*(17). https://doi.org/10.1186/s40008-021-00248-2

Rahman, M., Hack-Polay, D., Shafique, S., & Igwe, P. (2024). Institutional and organizational capabilities as drivers of internationalisation: Evidence from emerging economy SMEs. *International Journal of Emerging Markets*. https://doi.org/10.1177/14657503221106181

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research Methods for Business Students* (8th ed.). Pearson. https://www.pearson.com/en-gb/subject-catalog/p/research-methods-for-business-students/P200000003473/9781292208787

Sharma, C. (2019). Effects of R&D and foreign technology transfer on productivity and innovation: An enterprise-level evidence from Bangladesh. *Journal of Science and Technology Policy Management, 10*(1), 46–70. https://doi.org/10.1080/19761597.2019.1597634

Silveira, N. J. C., Ferraz, D., Polloni-Silva, E., de Mello, D. S., Falguera, F. P. S., & Moralles, H. F. (2021). Modeling the building blocks of country-level absorptive capacity: Comparing developed and emergent economies. *Bulletin of Economic Research, 74*(3), 783–824. https://doi.org/10.1111/boer.12319

Wooldridge, J. M. (2019). *Introductory Econometrics: A Modern Approach* (7th ed.). Cengage Learning. https://www.cengage.uk/c/introductory-econometrics-a-modern-approach-7e-wooldridge/9781337558860/

World Bank. (2021). *Special Economic Zones in Bangladesh: Mobilizing Private Investment and Creating Better Jobs*. https://www.worldbank.org/en/results/2021/05/05/special-economic-zones-in-bangladesh-mobilizing-private-investment-and-creating-better-jobs

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). Sage. https://us.sagepub.com/en-us/nam/case-study-research-and-applications/book250150

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185–203. https://www.jstor.org/stable/4134351