Volume 11, Issue 4, April – 2026 International Journal of Innovative Science and Research Technology
ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

Skill Gap between Management Professionals and Training Institutions in Addressing IR 4.0 in Bangladesh

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Publication Date: 2026/05/13

Abstract: The Fourth Industrial Revolution (IR 4.0) necessitates a paradigm shift in managerial competencies to mitigate automation risks, which threaten up to 60% of employment in Bangladesh's critical RMG and furniture sectors by 2041 (Asif Uddin Ahmed, Asad-Uz-Zaman, Sojib, & Rebecca Sultana, 2019). This study analytically assesses the misalignment between current management skillsets and the demands of disruptive technologies. Utilizing a descriptive research design, data were synthesized from a dual-perspective survey of 200 management professionals and 15 educators.

Findings indicate a profound competency gap; while industry necessitates advanced proficiency in the Internet of Things (39.5%), Artificial Intelligence (35.8%), and Big Data analytics (35.8%), current professionals lack these technical foundations. Managerial requirements have shifted toward higher-order cognitive abilities, specifically Creativity and Innovation (48.9%) and Complex Problem-Solving (37.4%). Critically, a pedagogical disconnect exists: 80% of educators continue to employ traditional lecture-based instruction, despite 62.5% of professionals requiring blended learning environments and 45.8% favoring interactive, group-based delivery.

The persistent reliance on foreign expertise for high-level positions underscores the failure of local academic infrastructure to transition from "Education 1.0" to "Education 4.0" (Manyika, et al., 2017). Addressing this requires systemic curriculum reform, international institutional alignment, and the integration of tech-based, skill-oriented instruction to ensure the long-term sustainability of Bangladesh's manufacturing and service sectors.

How to Cite: S. M. Ariful Islam (2026) Skill Gap between Management Professionals and Training Institutions in Addressing IR 4.0 in Bangladesh. *International Journal of Innovative Science and Research Technology,* 11(4), 4403-4409. https://doi.org/10.38124/ijisrt/26apr2052

I. INTRODUCTION

The Fourth Industrial Revolution (IR 4.0) represents a paradigm shift characterized by the integration of cyber-physical systems, the Internet of Things (IoT), and Artificial Intelligence (AI) into a networked value chain (Kagermann, Anderl, Gausemeier, Schuh, & Wahlster, 2016). This transformation operates within a VUCA environment, marked by volatility, uncertainty, complexity, and ambiguity, which complicates organizational decision-making and risk management (Glaeser, 2015-2024). For emerging economies like Bangladesh, IR 4.0 presents existential challenges, including the threat of 60% job automation in the Ready-Made Garments (RMG) and furniture sectors by 2041 (Asif Uddin Ahmed, Asad-Uz-Zaman, Sojib, & Rebecca Sultana, 2019).

Fig 1 The Major Sectors in Bangladesh that Impacted for IR 4.0

A critical competency gap exists among management professionals who must navigate these disruptions. While the

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

industry increasingly demands technical proficiency in big data and AI alongside soft skills such as creativity, innovation, and complex problem-solving, many local managers lack the "Leadership 4.0" traits necessary for digital transformation (Petrie, 2011). This deficit is highlighted by the trend of Bangladeshi firms hiring foreign workers for high-level positions to compensate for the local lack of international communication and technical expertise.

Despite these pressing needs, there is a significant research and pedagogical gap in the Bangladesh context. Current literature often focuses on the technical aspects of industrialization rather than managerial abilities, and local educational institutions remain "ill-prepared," predominantly utilizing traditional "Education 1.0" lecture-based methods (Manyika, et al., 2017). Most academia lacks the tech-based classrooms and updated curricula required to transition to an "Education 4.0" model.

➢ *To Address these Challenges, this Study Establishes the Following Research Objectives:*

- To determine the current skillset of management professionals in Bangladesh.
- To investigate the future skill needs of management professionals to tackle the disruptions posed by IR 4.0.
- To investigate the preparedness of academia and recommend strategic ways forward for skill delivery.

II. LITERATURE REVIEW

The literature establishes that Industrial Revolution 4.0 (IR 4.0) is a paradigm shift characterized by the integration of cyber-physical systems, the Internet of Things (IoT), and Artificial Intelligence (AI) into an agile value chain. It is well-documented that this revolution operates within a VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment, which demands a departure from traditional hierarchical management toward Leadership 4.0 (Bongomin, Ocen, Nganyi, Musinguzi, & Omara, 2020). Known managerial competencies for this era are categorized into technical skills (data literacy), managerial skills (complex problem-solving), and social skills (collaboration) (Gray, 2016). Globally, there is a recognized transition toward Education 4.0, which prioritizes self-learning and innovative tech-based delivery over traditional dictation (Maria, Shahbodin, & Pee, 2018). Furthermore, in the Bangladesh context, it is established that major sectors like RMG and furniture face a 60% risk of automation by 2041 (Islam P. M., 2014).

What is NOT Sufficiently Addressed?

➢ *The Report Identifies Several Critical Gaps in Existing Literature and Practice:*

- Managerial vs. Technical Focus: Previous research has predominantly focused on the technical requirements of IR 4.0, leaving the specific managerial abilities needed for industrialization poorly understood, particularly from an executive training perspective.
- Leadership 4.0 Scarcity: The field of Leadership 4.0 is still developing and suffers from a dearth of fresh research publications. There is a lack of "ready-to-use models" to assist in developing the collective leadership concepts required for the IR 4.0 era (Haleem, Javaid, & Singh, 2024).
- Academic-Industry Disconnect: There is insufficient data on the preparedness of Bangladeshi academia to transition from traditional lecture-based methods (Education 1.0) to the high-tech, skill-oriented instruction required by the private sector.

➢ *How This Study Contributes Uniquely*

This study provides a unique contribution by moving beyond theoretical frameworks to provide an empirical, dual-perspective assessment of the Bangladesh market.

- Dual-Pronged Analysis: It uniquely compares the "supply side" (educators) and the "demand side" (management professionals) to identify specific expectation gaps in training delivery and content.
- Contextual Granularity: By focusing on mid-level managers in Bangladesh's industrial zones (Dhaka, Gazipur, Chattogram), it highlights a specific "foreign talent paradox" where local firms hire foreign workers for high-level positions due to a local deficit in international communication and IR 4.0 technical skills.
- Pedagogical Critique: It provides rare empirical evidence of the mismatch in learning delivery, revealing that while 80% of educators rely on lectures, nearly 63% of professionals demand blended, interactive learning.

III. METHODOLOGY

➢ *Research Design*

This study employs a descriptive mixed-methods research design, integrating both qualitative and quantitative approaches to provide a holistic assessment of the IR 4.0 competency landscape in Bangladesh. The research is descriptive in nature, seeking to document the current phenomena regarding managerial skillsets and identify the gap between existing capabilities and the requirements of disruptive technologies. A dual-perspective framework was adopted, analyzing the "demand side" (management professionals) and the "supply side" (educational providers) to reveal misalignments in training and competency development.

➢ *Geographic and Sectoral Scope*

The study was strategically limited to major industrial and urban hubs in Bangladesh to ensure a representative sample of the nation's economic drivers. Data were primarily collected from Dhaka city, the Gazipur industrial area, Chattogram, and Khulna. These locations were selected due to their high concentration of sectors most vulnerable to IR 4.0 disruptions, specifically Ready-Made Garments (RMG), Furniture, Agro-food processing, Leather, and Tourism. Furthermore, the study focused on management professionals within NGOs, Banks, and Multinational Corporations (MNCs) to capture a cross-sectoral view of the digital transformation.

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Table 1 Summary of Research Methodology

Component	Description
Research Design	Descriptive research design with a mixed-methods approach, integrating quantitative survey data and qualitative insights to capture the IR 4.0 managerial skill landscape holistically.
Research Approach	Dual-perspective (Supply–Demand) framework comparing industry expectations (management professionals) with academic readiness (educators).
Study Area	Major industrial and urban hubs of Bangladesh: Dhaka, Gazipur Industrial Area, Chattogram, and Khulna.
Target Population	Management professionals from public and private sectors (RMG, NGOs, Banks, MNCs) and educators involved in executive and postgraduate management training.
Sample Size	Total respondents = 215 (Demand side: 200 management professionals; Supply side: 15 educators).
Sampling Technique	Random sampling for management professionals (demand side); purposive sampling for educators (supply side).
Data Sources	Primary data collected through structured questionnaires, focus group discussions (FGDs), and expert interviews; secondary data obtained from academic journals, reports, and policy documents.
Data Collection Instruments	Google Forms–based structured questionnaires (separate for supply and demand sides), semi-structured interviews, and conventional FGDs.
Key Variables Studied	ICT skill requirements, managerial competencies for IR 4.0, training delivery modes, pedagogical practices, and supply–demand skill gaps.
Data Analysis Tools	Quantitative analysis using Google Analytics and Microsoft Excel; qualitative data analyzed through thematic analysis.
Time Horizon	Cross-sectional study based on data collected during the internship research period (2024).
Ethical Considerations	Voluntary participation, informed consent, anonymity and confidentiality of respondents maintained throughout the study.

➢ *Sampling Framework and Sample Size*

The study utilized a random sampling technique for the demand-side assessment and a purposive sampling approach for the supply-side analysis. A total of 215 respondents participated in the study.

- Demand Side (n=200): This cohort consisted of 200 management professionals from both the public and private sectors. Demographic analysis reveals that 54% of respondents belong to the 31–40 age group, representing the mid-level management tier responsible for implementing digital strategies. Approximately 90% of the sample occupied entry-level, intermediate, or middle-management positions, with over half possessing three to ten years of professional experience.
- Supply Side (n=15): To investigate the academic readiness and supply of skills, 15 educators and faculty members from the Bangladesh Institute of Management (BIM) were surveyed. This group included regular and guest faculty involved in delivering Postgraduate Diplomas (PGD) and short-term executive training.

➢ *Data Collection Instruments*

A multi-modal data collection strategy was employed to ensure data triangulation and depth.

- *Primary Data Collection*

✓ Structured Questionnaire Surveys: The primary quantitative instrument was a standardized questionnaire administered via Google Forms. Separate questionnaires were designed for management professionals and educators to capture differing perceptions of skill requirements and pedagogical effectiveness. The survey covered 16 ICT skill categories and 14 specific managerial competencies required for IR 4.0.

✓ Focus Group Discussions (FGDs): Two conventional FGDs were conducted with mid- and upper-level decision-makers and business-level managers. These sessions allowed for a deeper exploration of the "foreign talent paradox" and the specific challenges of upgrading factory infrastructure in Bangladesh.

✓ Semi-Structured Interviews: In-depth interviews were conducted with IR 4.0 and ICT experts both locally and internationally. These interviews provided qualitative insights into emerging trends such as IoT, AI, and Big Data applications within the Bangladeshi manufacturing context.

- *Secondary Data Collection*

A procedural desk review was conducted to synthesize existing literature in management science and information technology. This review focused on global frameworks like Leadership 4.0 and the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment, adapting these concepts to the specific socioeconomic realities of Bangladesh.

➢ *Analysis Tools and Procedures*

Quantitative data gathered through Google Forms were processed using Google Analytics for initial visualization and frequency analysis. Detailed statistical processing and comparative analysis were conducted using Microsoft Excel. The analysis focused on identifying disparities between the "supply" of education and the "demand" of the industry, particularly regarding training delivery modes (e.g., preference for blended learning vs. traditional lectures) and technical competency priorities. Qualitative data from FGDs and interviews were subjected to thematic analysis to provide

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

context for the quantitative findings and to formulate the study's policy recommendations.

➢ *Ethical Considerations and Limitations*

As an academic study, conventional methods were followed for sample selection to ensure representativeness while acknowledging constraints in time and funding. Participation was voluntary, and the anonymity of respondents from various public and private organizations was maintained throughout the data analysis phase. The study recognizes its limitation in focusing heavily on the faculty at BIM as the primary representation of the "supply side" due to resource constraints.

IV. RESULTS

The research highlights a significant disparity between the current skillsets of management professionals and the requirements of Industry 4.0 (IR 4.0) in Bangladesh.

➢ *ICT and Technical Skillsets*

The study identifies two tiers of ICT requirements for management professionals:

- Current Operational Skills: The most essential skills for existing roles are basic computer literacy (59.5%), email and internet browsing (51.1%), and data analysis and database management (40.5%).
- IR 4.0 Specific Skills: To address future technological disruptions, professionals prioritize Internet of Things (IoT) (39.5%), Big Data and Data Analytics (35.8%), and Artificial Intelligence (AI) (35.8%).
- Comprehensive Demand: Interestingly, 38% of respondents indicated that they require all 11 identified ICT-based skill sets to successfully navigate the Fourth Industrial Revolution.

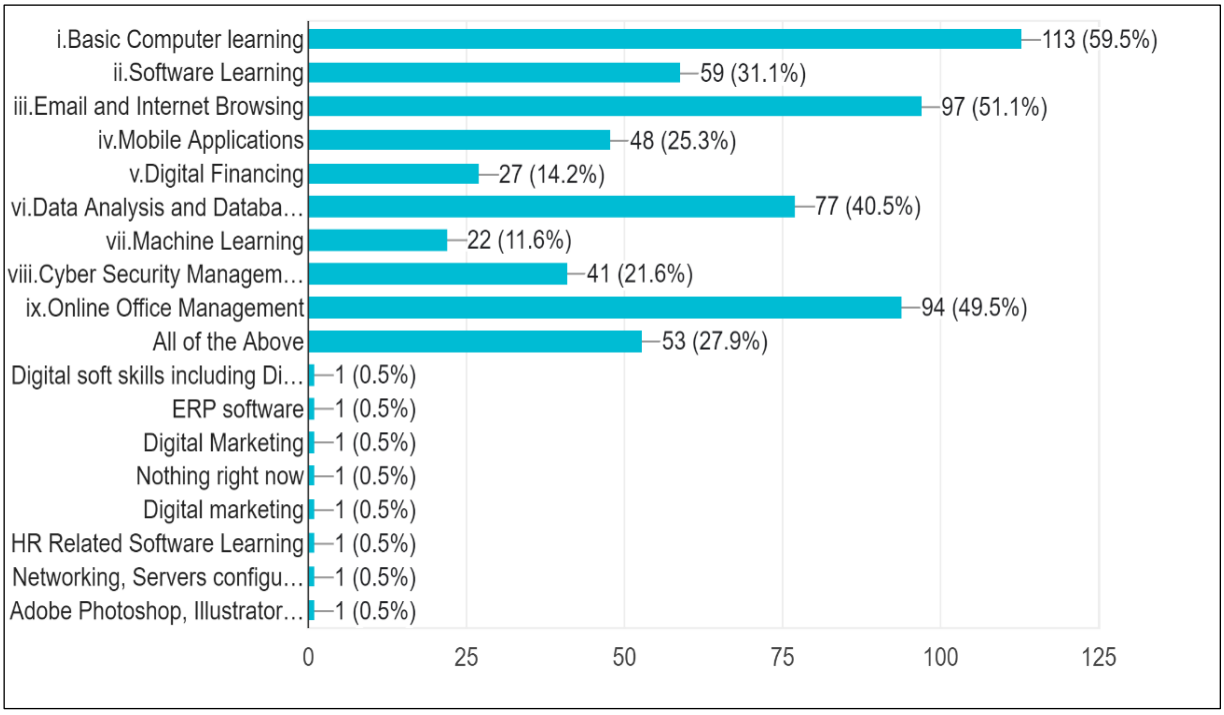

Fig 2 The Requirements for ICT Skillset for Current Job at the Organization

➢ *Managerial Skillsets*

The findings categorize managerial competencies into general career development and IR 4.0 readiness:

- Career Development: Managers rank communication and motivation (45.3%) and problem-solving/decision-making (41.6%) as the most critical skills for their current advancement.
- IR 4.0 Competencies: For the upcoming challenges of disruptive technology, the highest-rated competencies are creativity and innovation (48.9%), decision-making (40.0%), and analytical skills (39.2%).
- Holistic Requirement: A significant 47.9% of respondents believe that all 14 identified managerial competencies are essential for handling the demands of IR 4.0.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

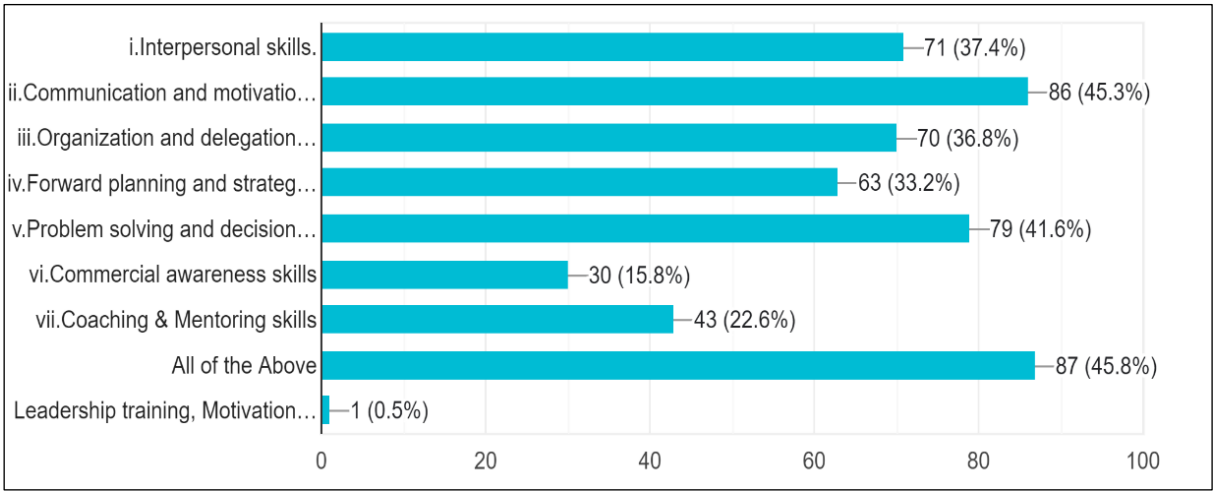

Fig 3 Managerial Skillset Needed for Career Development to Meet the Challanges of IR 4.0

➢ *Supply vs. Demand Mismatch*

The data reveals a stark misalignment between the training provided by academia (supply) and the needs of the industry (demand):

- Pedagogical Disconnect: While 80% of educators still rely on traditional theoretical lectures, the majority of professionals (45.8%) prefer interactive group discussions.
- Delivery Mode: Approximately 66.7% of the supply side favors physical classroom instruction, whereas 62.5% of the demand side prefers a blended approach combining physical and online learning.
- Skill Prioritization: Professionals place a high priority on AI, Big Data, and IoT, while educators prioritize Google Cloud and cybersecurity.
- Expertise Gap: Although nearly half of the professionals desire training across 14 comprehensive managerial skillsets, only 6.7% of surveyed educators have applied this full range of skills in their own professional careers.
- Economic Impact: This mismatch forces many local companies to hire foreign workers from countries like India, Sri Lanka, and China for high-level management positions to remain competitive.

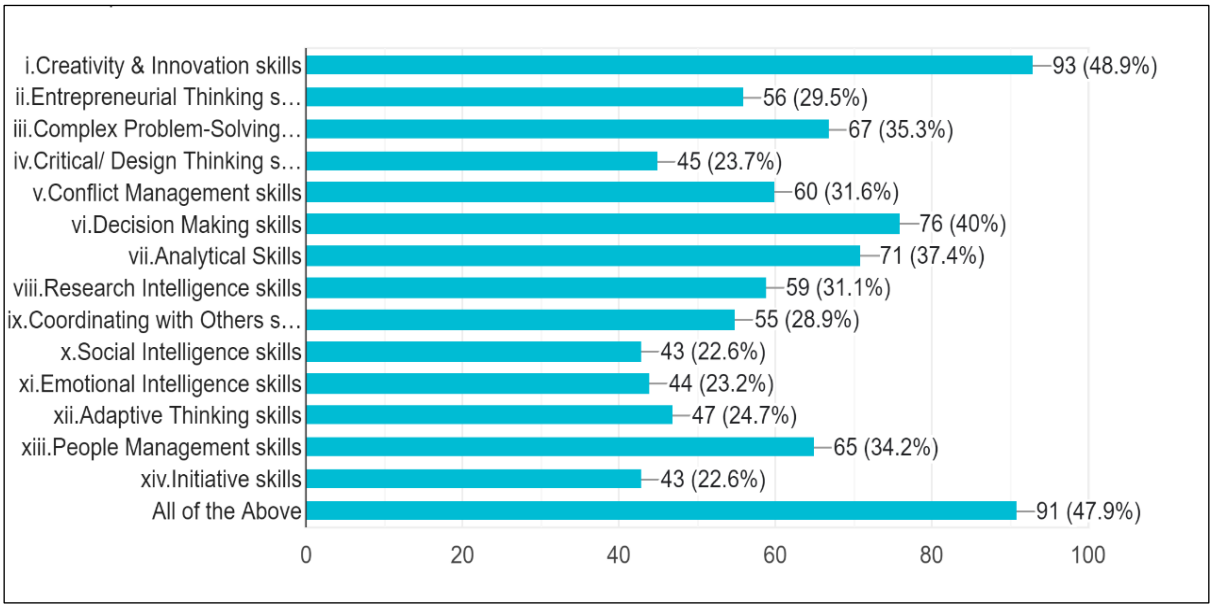

Fig 4 IR 4.0 Skillset are Required for Upcoming Challenges from Disruptive Technologies of the Fourth Industrial Revolution

V. DISCUSSION

The study's findings corroborate the global shift toward Leadership 4.0, which moves beyond traditional Taylorism (Leadership 2.0) and matrix-based Leadership 3.0 toward collective, innovative, and technology-integrated leadership models (Petrie, 2011; Haleem, Javaid, & Singh, 2024). Contemporary leadership literature emphasizes that modern industrial systems operate within a VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment, requiring managers to demonstrate creativity, adaptability, and complex problem-solving capabilities (Glaeser, 2015-2024). Consistent with this framework, the empirical results reveal that Bangladeshi managers are currently ill-equipped

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

to navigate such uncertainty, as evidenced by the high demand for creativity and innovation (48.9%) and complex problem-solving skills (37.4%), which aligns with prior global findings on Industry 4.0 skill deficiencies (Gray, 2016).

Furthermore, the findings validate the widely discussed transition from Education 1.0 (lecture-based instruction) to Education 4.0 and 5.0, which emphasize self-learning, digital technologies, and flexible, learner-centered pedagogies (Manyika, et al., 2017). However, a substantial disconnect persists in the Bangladeshi context. While global literature highlights the importance of virtual learning environments, IoT-based education, and experiential training in preparing Industry 4.0-ready professionals, 80% of surveyed educators in Bangladesh continue to rely on traditional theoretical lectures. This mismatch explains the emergence of the "foreign talent paradox," where local firms bypass domestic graduates and recruit expatriate professionals from India, Sri Lanka, and China who possess superior international communication and advanced technological competencies such as IoT, Artificial Intelligence, and Big Data analytics (Asif Uddin Ahmed, Asad-Uz-Zaman, Sojib, & Rebecca Sultana, 2019).

➢ *Implications for Academia*

- Curriculum Overhaul: Academic institutions must transition from Education 1.0 toward curricula that emphasize cognitive flexibility, analytical reasoning, and technical literacy to address Industry 4.0 disruptions. Prior studies confirm that graduates in developing economies often lack adequate management science competencies to respond effectively to digital transformation (Manyika, et al., 2017).
- Infrastructure Investment: The findings underscore an urgent need for tech-based classrooms and computer-based learning platforms, consistent with global evidence that technological infrastructure is a prerequisite for delivering effective Industry 4.0 education (Maria, Shahbodin, & Pee, 2018). The fact that 80% of faculty members identified infrastructure deficiencies highlights systemic institutional unpreparedness.
- Pedagogical Shift: Academia must move away from theory-driven delivery toward blended learning and interactive group-based approaches, which are strongly preferred by 62.5% and 45.8% of professionals, respectively. Similar pedagogical shifts have been recommended in higher education reforms worldwide to close industry, academia skill gaps (Lašáková, Bajzíková, & Dedze, 2016).

➢ *Implications for Training Institutions*

- Skill-Oriented Delivery: Training institutions such as the Bangladesh Institute of Management (BIM) must pivot from conventional lecture-heavy programs toward practical demonstrations, lab-based instruction, and applied learning, which have been shown to enhance employability in Industry 4.0 contexts (Bongomin, Ocen, Nganyi, Musinguzi, & Omara, 2020).
- International Collaboration: The strong preference (88.8%) for foreign-affiliated training validates prior findings that international certifications enhance labor market competitiveness in developing economies (Armstrong, Parmelee, & Santifort, 2018). Strategic partnerships with reputed international institutions could significantly elevate the credibility and effectiveness of local executive training programs.
- Targeting Mid-Level Managers: Training initiatives should prioritize the 31-40 age cohort, which represents the core implementation layer of digital transformation strategies within organizations. Prior studies emphasize that mid-level managers play a pivotal role in translating strategic visions of Industry 4.0 into operational performance (Susilo, 2019).

➢ *Implications for Policy Makers*

- National Human Capital Strategy: Policymakers must urgently address the 60% automation risk projected for the RMG and furniture sectors by 2041 through large-scale up-skilling and re-skilling initiatives (Asif Uddin Ahmed, Asad-Uz-Zaman, Sojib, & Rebecca Sultana, 2019).
- Conducive Higher Education Policy: A cohesive policy framework is required to support research laboratories, cybersecurity regulations, and intellectual property protection, which are essential for sustaining a secure and innovation-driven digital ecosystem (Islam P. M., 2014).
- Reducing Foreign Dependency: To retain economic value within national boundaries, policy incentives should promote the development of local managerial expertise in disruptive technologies such as IoT, AI, and Big Data. Reducing reliance on foreign professionals is critical for long-term economic resilience and sustainable industrial growth (Armstrong, Parmelee, & Santifort, 2018).

VI. CONCLUSION

The transition to Industry 4.0 (IR 4.0) presents a critical challenge for Bangladesh, where emerging smart-factory infrastructure is not adequately matched by managerial and workforce readiness to operate within a VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment (Schwab, 2016). This study identifies a significant pedagogy-competency gap: although industry increasingly demands advanced capabilities in the Internet of Things (IoT), Artificial Intelligence (AI), and Big Data analytics, the local workforce continues to lack these core Industry 4.0 competencies (Manyika, et al., 2017).

This mismatch is further reinforced by outdated training and educational models, wherein a majority of educators persist with traditional lecture-based instruction despite professionals' strong preference for blended and interactive learning environments. Similar misalignments between academia and industry have been documented in other developing and emerging economies undergoing digital transformation (Maria, Shahbodin, & Pee, 2018). Consequently, Bangladeshi firms increasingly rely on expatriate managers to fill advanced technical and leadership

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26apr2052

roles, exacerbating the so-called foreign talent paradox (Armstrong, Parmelee, & Santifort, 2018).

Without immediate and coordinated intervention, key sectors such as Ready-Made Garments (RMG) and furniture manufacturing face substantial automation risks, estimated at up to 60% by 2041, posing serious socio-economic consequences for employment and industrial sustainability (Asif Uddin Ahmed, Asad-Uz-Zaman, Sojib, & Rebecca Sultana, 2019).

From a theoretical perspective, this study advances the Leadership 4.0 framework by contextualizing it within an emerging-economy setting. It emphasizes that successful Industry 4.0 adoption requires a competency-based, collective leadership approach, prioritizing cognitive flexibility, creativity, and complex problem-solving over purely technical adoption (Petrie, 2011).

Practically, the study recommends immediate curriculum reform, strategic international certification and institutional partnerships, and the development of a coordinated national higher education and human capital policy. Such measures are essential to align academic outputs with industry requirements, reduce dependence on foreign expertise, and safeguard the long-term sustainability of Bangladesh's workforce in the Industry 4.0 era (Manyika, et al., 2017).

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