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# A Study on the Impact of University-Industry-Government Collaboration to Lead Technological Innovation in Bangladesh Using Triple Helix Model

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**Abstract**
Bangladesh's technical innovation ecosystem requires collaboration between universities, companies, and the government to promote economic growth. The Triple Helix Model, a synergistic growth model, emphasizes cooperation between government, business, and academia. Successful collaborations include biotech and IT initiatives. Universities provide research expertise, corporations provide funds, and governments regulate the ecosystem. The model encourages research partnerships, technology transfer, internships, and workforce development to strengthen institutions and spur social and economic advancement. This study aims to discuss the role of the Collaboration of the University-industry-government on technological innovation in Bangladesh. The collaboration of the university-industry-government is the implication of the Triple Helix Model. In this study, the information which is included here has been selected from secondary data by the literature review and recent articles. Particularly, several barriers to implementing the triple helix model in Bangladesh have been selected which are discussed in this study. Furthermore, this study also discussed some challenges and solutions for overcoming these barriers to implement the collaboration among Universities, Industry and Government in the context of Bangladesh.

**Keywords:** Technology, innovation, Triple Helix model, barriers, challenges.

## Introduction

The technical innovation environment in Bangladesh is ready for expansion, but cooperation between the government, businesses, and institutions is needed. The interrelated responsibilities that governments, businesses, and academic institutions play in promoting innovation are highlighted by the Triple Helix Model, a paradigm for synergistic growth [1]. To promote economic growth, the Triple Helix Model is a framework that highlights

cooperation between government, business, and academia. Academic research, corporate commercialization, and government finance are its three main pillars. Successful partnerships include IT and biotech projects [2]. Governments support and control the innovation environment, businesses supply money and useful insights, and universities contribute research skills and qualified graduates. Through research and development, curriculum creation, industry alliances, and knowledge transfer through technology licensing and commercialization, universities play a critical role in the advancement of technology [3]. Industries make contributions by determining the need for research, providing money for initiatives that support strategic objectives, investing in R&D, and offering internships and hands-on training. The government plays a crucial role in influencing the innovation landscape by enacting laws and regulations that promote collaboration, cut down on red tape, invest in infrastructure, and foster collaborations [4]. A sustainable agriculture project and a health technology device are examples of successful Triple Helix partnerships in Bangladesh. Clear communication, well-defined responsibilities and expectations, and reciprocal advantages for all parties involved are essential components of replication. Thus, this study mainly presents an extensive overview of the impact of University-Industry-Government Collaboration to lead Technological Innovation. For this purpose, the Triple Helix Model has been used to analyze the impact of this collaboration in Bangladesh aspect.

## 2. Literature review:

### 2.1 Overview of the Triple Helix Framework:

Etzkowitz and Leydesdorff's Triple Helix model outlines the collaboration between governments, businesses, and academic institutions to foster innovation, particularly useful in transitional economies where technical innovation is crucial for long-term growth. According to the economic theory, government financing for R&D and company research is justified by the Triple Helix model, a three-dimensional vector space that illustrates how the creation and sharing of socially structured knowledge propels economic development [5]. The three parties—government, business, and academia—support innovation and good governance. Technological advancements and intellectual frameworks are developing, and transforming academic institutions and R&D setups. New research objectives are developed in collaboration groups, over the internet, or through digital academies [6].

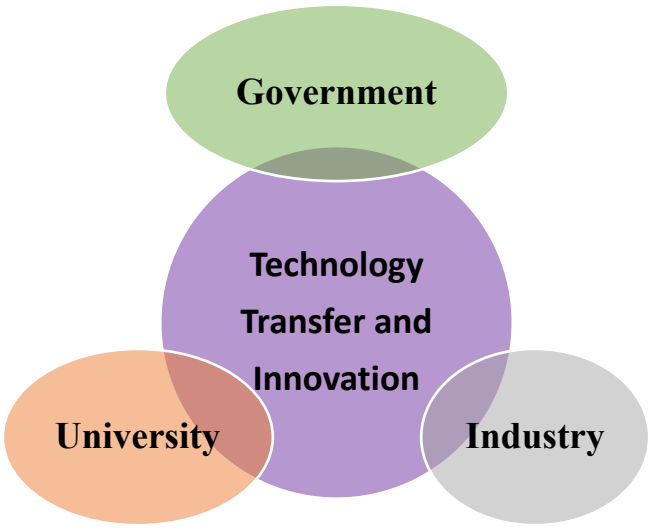


**Figure 2.1. The triple helix model university–industry–government relations** [7]

The triple helix theory is restated as a model that shows how interactions on organizational transport providers, market decisions, creativity motion, and system restrictions are mediated by transmission codes [8].

**2.2 The Role of Universities, Industry and Government**

Universities play a vital part in technological innovation by conducting research and developing skills. However, their impact is frequently restricted because of insufficient finance, outmoded educational programs, and a lack of connection with industry. Enhancing university-industry collaboration can boost academic institutions' contributions to innovation ecosystems. To adopt cutting-edge technologies, industries, particularly those in textiles and information technology, must collaborate on research and development. Although the government plays an important role in encouraging collaboration, there are gaps in policy execution and financial distribution.

The university-industry partnership is critical for skill development, knowledge generation, innovation, and entrepreneurship. It aids in the coordination of R&D goals, encouraging private investment, and capitalizing on synergies. It broadens research relevance, commercializes public R&D results, and boosts labour mobility. Benefits are visible in developing countries like Chile and Colombia. Different types of university-industry collaborations have distinct goals, scopes, and institutional structures. Collaboration might be formal or informal, with emphasis on training, research, human capital mobility, and interactions at conferences and expert groups [6].

**2.3 Collaboration between universities, industries, and governments for technological innovation.**

Collaboration among universities, industries, and governments has shown to be an important engine of technological innovation. Universities supply innovative research and competent employees, businesses give practical applications and finance, and governments set rules and provide infrastructure support. The collaboration of these three institutions allows the commercialization of research and the development of novel solutions to problems facing society. In wealthy countries, these partnerships have resulted in substantial improvements in technology [9]. For example, the Silicon Valley ecosystem in the United States shows the effectiveness of such collaborations. In contrast, in developing nations such as Bangladesh, the interaction of these actors is frequently hampered by structural difficulties such as a lack of assets, insufficient buildings, and inadequate laws. Table 2.1 shows three types of Interaction that can occur between Universities and Industry.

**Table 2.1. A structure of university-industry interactions, from high to low-intensity [10].**

| | | |
|---|---|---|
| High (Strong Interaction) | Investigation Solutions | Contract research, consultancy, quality control, testing, certification, and prototype development are examples of research-related services commissioned by industrial clients from universities. |
| | Collaborative research | Inter-organizational frameworks for conducting cooperative research and development, such as scientific groups and collaborative initiatives |
| | Integrated network. | The adoption of university labs and equipment by businesses, incubators, and technology parks within institutions. |

| | | |
|---|---|---|
| Medium (Moderate Interaction) | Human Resources Development and Transfer | Academic inventors seek the development and commercialization of technologies through a company that they (partly) own (spin-off companies). |
| | Educational Entrepreneurship | Learning for industry employees, internship programs, graduate education in commerce, assignments to industry of university faculty and academic staff, and adjunct instructors of industry involvement. |
| Low (Little Interaction) | Industrialization of property rights | Distribution of university-generated intellectual property (such as patents) to businesses (for example, through licensing). |
| | Scientific articles or publications | Use of structured scientific information inside the industry. |
| | Unofficial engagement. | Social interactions are formed (for example, at conferences, meetings, and through social networks). |

### 2.4 Using the Triple Helix Model for Collaboration among Universities, Industries, and Governments

The Triple Helix Model is a framework for facilitating collaboration between universities, companies, and governments to promote innovation, economic growth, and social development [11]. It classifies universities as centres of knowledge creation, research, and human capital development, companies as producers of commodities and services, and governments as policymakers, regulators, and incentives. Interactions may include research collaborations, technology transfer, internships, and workforce development programs. The concept can be used in R&D initiatives, start-up ecosystems, policy design and implementation, and regional innovation systems. The most effective innovation ecosystems form when all three parties collaborate. Table 2.2 summarizes the literature on collaboration among Universities, Industries, and Governments using the Triple Helix model.

**Table 2.2. summary of literature review on the impact of University-Industry-Government Collaboration to lead technological innovation using the Triple Helix model.**

| SL | Title | Methodology | Key Target | Reference |
|---|---|---|---|---|
| 1 | Technology Transfer: An Opportunity for Small Open Economies | Qualitative (practical case) | The model shows many ways that can be employed based on the features of the agents. The approach emphasizes the significance of a new actor capable of "translating" the language spoken by the transmitter and receiver. | [12] |

| | | | | |
|---|---|---|---|---|
| 2 | A Model for Technology Transfer in Practice | Qualitative (conceptual model) | The model proposes a triple helix-based system approach in which the major agents are the university as a technology creator, the industry as a technology receiver, and the technology transfer office (TTO) as an intermediary agent that facilitates the transfer process. | [13] |
| 3 | A Model for Technology Transfer in Practice | Qualitative (practical case) | Describes seven measures that should be followed to facilitate technology transfer. | [14] |
| 4 | Pathways to impact and the strategic role of universities: New evidence on the breadth and depth of university knowledge exchange in the UK and the factors constraining its development | Qualitative (practical case) | According to the paradigm, university research can provide three degrees of value: science, technology, and application. The transfer may occur at any level. | [15] |
| 5 | System Thinking Approach in Solving Problems of Technology Transfer Process | Qualitative (conceptual model) | The concept describes both formal and informal technical transfer.<br>The concept is based on the university's existing objective, which is to assist the industry in generating innovation. | [16] |

**3. Methodology:**

A qualitative method is used to conduct this study by collecting secondary data. This study is mainly exploratory type. Here, we have analysed the importance of the impact of the University-Industry-Government Collaboration to Lead Technological Innovation in Bangladesh. The Triple Helix model has been used to explain the current situation of the collaboration between universities, industry and government. This model also has been used to discuss the barriers and challenges in implementing this collaboration in Bangladesh aspect. The secondary data has been collected through observations, case studies, previous literatures.

**4. Discussion:**

**4.1 University-Industry-Government Collaboration in the context of Bangladesh**

With few frameworks for collaboration and little industry knowledge of the advantages of academic collaborations, Bangladesh's University-Industry-Government (UIG) collaboration is still in its infancy[17]. While some university-ICT industry cooperation has been sparked by the government's "Digital Bangladesh" plan, these partnerships are still rather small.

Universities and companies continue to rely mostly on donor organizations or foreign money, indicating a lack of policy and financial support for research and collaboration. In Bangladesh, most research focuses on academia and has few real-world applications [18]. One of the most frequently mentioned gaps between university curricula and market demands is skill development and employment. Government-led projects like Bangabandhu Sheikh Mujibur Rahman Industrial City and the Hi-Tech Parks Authority, as well as academia-industry partnerships like BUET and the LCT project, are important instances of progress. Additionally underrepresented are public-private partnerships, some of which are mainly focused on the telecommunications and ICT sectors.

### 4.2 Barriers to University-Industry-Government Collaboration in Bangladesh

The effectiveness and sustainability of university-industry-government collaboration in Bangladesh are hampered by several obstacles. Numerous institutional, cultural, and systemic variables contribute to these difficulties. To implement the triple helix model, Bangladesh faces several barriers, including a lack of a clear framework, financial constraints, cultural and attitudinal barriers, knowledge and skill gaps, regulatory and policy issues, infrastructure and technological barriers, geographical and logistical challenges, lack of incentives and motivation, and human capital challenges [19].

#### 4.2.1 Structural and Organizational Barriers

Ineffective links and inefficiencies are caused by the absence of a clear structure and policy for cooperation between government, business, and academia.

#### 4.2.2 Financial Limitations

Budgetary restrictions and a lack of venture capital impede research and development as well as collaborative ventures at Bangladesh's institutions. This undeveloped startup environment hampers creativity and teamwork when it comes to bringing research findings to market [20].

#### 4.2.3 Barriers related to society and mindset

While corporations concentrate on immediate commercial results, universities frequently place a higher priority on scholarly research than on market-driven innovation. There may be a gap between these sectors and government policies. A traditional collaborative mindset impedes cross-sector collaboration, and trust concerns occur between government agencies, businesses, and academic institutions [19].

#### 4.2.4 Lack of Skill and Knowledge

Universities may lack industry-specific knowledge, hindering efficient business interactions and collaboration between government officials and academic researchers due to their lack of experience in converting research into commercially viable products [1], [21].

#### 4.2.5 Policy and Regulatory Concerns

Universities and businesses face challenges in commercializing research outputs due to weak IP policies, inconsistent government policies, and complex regulatory processes. These factors hinder collaboration and risk IP theft or disputes, requiring a stable policy climate for successful collaboration [1].

#### 4.2.6 Technical and Infrastructural Barriers

Bangladesh's universities struggle with limited research infrastructure and technological constraints, hindering top-tier studies and hindering productive cooperation between businesses and academic institutions.

### 4.2.7 Difficulties in Logistics and Geography

Collaboration between rural and regional universities and industries, especially in rural-urban areas, might be hampered by the concentration of resources in urban areas, especially in centres of higher education and industry like Dhaka.

### 4.3 Challenges in Implementing the Triple Helix Model in Bangladesh

There are various obstacles to Bangladesh's Triple Helix model implementation. Universities and industry's capacity to work together efficiently is hampered by a lack of financing for research and innovation. The policy gap is also present in the Bangladesh context. The development of efficient mechanisms for collaboration is hampered by inadequate policies and a lack of enforcement. Cultural Obstacles also hampered the implementation of the Triple Helix model such as Cooperation between government agencies, businesses, and academic institutions is frequently hampered by a lack of mutual trust and understanding [2]. Policy reform, incentives for cooperation, capacity building, and strengthening public-private partnerships are required to reduce barriers to university-industry collaboration. It places a strong emphasis on R&D financing, IP protection, and research commercialization. It also recommends bolstering public-private collaborations and R&D infrastructure. Collaboration is further hampered by inadequate infrastructure support, such as technology centres and innovation centres. To overcome these obstacles, all parties must cooperate, with a focus on creating an environment that promotes collaboration [21].

## 5. Conclusion

The Triple Helix model presents a robust framework for fostering technological innovation through university-industry-government collaboration. While Bangladesh faces numerous challenges in implementing this model, targeted interventions and policy reforms can pave the way for a more vibrant innovation ecosystem. Drawing lessons from successful case studies in other countries, Bangladesh has the potential to harness the synergy of the Triple Helix actors to achieve sustainable technological growth.

### 5.1 Implementation Pathways Strengthening Collaboration in Bangladesh

The Bangladeshi government is suggesting infrastructure design, public-private partnerships, innovation centres, capacity enrichment, awareness campaigns, human resource development, and regulatory reforms to increase cooperation between universities, industry, and the government[22]. Enhancing research capability, investing in universities, establishing innovation hubs, raising awareness through seminars and workshops, updating university curricula, fostering public-private partnerships, expanding broadband access, establishing Special Economic Zones, and utilizing international connections to provide knowledge and funding for innovation initiatives are some of these actions.

### 5.1.1 Policy Reforms:

Create and execute policies to promote collaboration and financial support for joint R&D initiatives [23].

### 5.1.2 Capacity Enriching:

Invest in universities' research capability and industry-oriented programs.

### 5.1.3 Innovation Hubs:

Create clusters of innovation and technology incubators to encourage interaction between the three entities.

**5.1.4 Awareness Campaigns:**
Promote the benefits of collaboration through workshops, seminars, and public-private dialogues.

**5.1.5 Developing human resources:**
University curriculum should be revised to better meet industrial demands, vocational training institutes should help with skill development, and incubation centres should stimulate entrepreneurship [24].

**5.1.6 Encouraging Public-Private Partnerships (PPPs)**:
Joint R&D financing, incubators, and open innovation platforms are being used to promote fintech, agritech, health tech, and energy efficiency innovation.

**5.1.7 Designing supporting infrastructure:**
The proposal involves improving broadband access, establishing Special Economic Zones for technology-driven enterprises, and constructing research centres in universities to meet industrial needs.

**5.1.8 Leveraging Global Connections:**
Bangladeshi professionals working abroad are encouraged to contribute expertise and capital to innovation projects through international collaborations, diaspora participation, and funding for innovation infrastructure development [25].
To improve collaboration between academia, business, and the government, the Bangladeshi government is putting several development, and regulatory reforms into practice. Policy reforms, university investments, innovation hubs, curriculum updates, public-private partnerships, broadband access expansion, the creation of Special Economic Zones, and utilizing global connections for funding and expertise are all part of the plan. Additionally, the government promotes the growth of supporting infrastructure, public-private partnerships, and human resources.

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