Supply Chain Research (2024) Volume 2 Issue 2
doi: 10.59429/scr.v2i2.10583
ISSN: 3029-1682 (O)

RESEARCH ARTICLE

The Impact of Program Curriculum Development and Instructor Portfolio Management on Skilled Graduates and Societal Betterment in Bangladesh

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ABSTRACT

This paper investigates the impact of Program Curriculum Development (PCD) and Instructor Portfolio Management (IPM) on producing Skilled Graduates (SG), and the subsequent effect on the Betterment of Society (BS) within the context of Bangladeshi universities. Building on the premise that aligning education with industry requirements is crucial for bridging the skills gap, this quantitative study utilized a sample of 400 respondents from educational institutions and employers in Bangladesh. Data were analyzed using Exploratory Factor Analysis, Confirmatory Factor Analysis (CFA), and Structural Equation Modeling (SEM). The findings reveal that both PCD (β=0.25, $p<0.001$) and IPM (β=0.16, $p<0.001$) significantly and positively influence the development of Skilled Graduates. Furthermore, Skilled Graduates significantly contribute to the BS (β=0.796, $p<0.001$). However, the direct impacts of PCD and IPM on the BS were found to be insignificant, highlighting that Skilled Graduates act as a crucial mediator in this relationship. The study concludes that an integrated approach focusing on robust curriculum development and effective instructor management is essential for producing graduates whose skills translate into tangible societal benefits. The findings offer significant implications for university administrators, policymakers, and industry stakeholders aiming to enhance the efficacy of the education supply chain in Bangladesh.

Keywords: Skills Gap; Program Curriculum Development; Instructor Portfolio Management; Skilled Graduates; Societal Betterment; Bangladesh.

1. Introduction

1.1. Background of the study

Bangladesh is currently experiencing a significant youth bulge, presenting a valuable opportunity to harness a demographic dividend through its youthful workforce. However, the effective utilization of this potential is contingent upon the alignment of the nation's education sector with the dynamic demands of the labor market. Paradoxically, an increase in the years of education has been associated with a higher likelihood of youth being categorized as Not in Education, Employment, or Training (NEET), a trend affecting both male and female adolescents[13, 33]. This underscores a critical disconnect between the educational system's outputs and the skill requirements of the contemporary job market.

ARTICLE INFO
Received: 3 October 2024 | Accepted: 22 October 2025 | Available online: 8 December 2024

CITATION
R. Chowdhury, M. M. Habib.The Impact of Program Curriculum Development and Instructor Portfolio Management on Skilled Graduates and Societal Betterment in Bangladesh. *Supply Chain Research* 2024; 2(2): 10583.doi: 10.59429/scr.v2i2.10583

Educational and training institutions in Bangladesh frequently fall short in equipping young adults with the necessary skills and competencies demanded by employers[19, 34]. This deficiency in robust skills significantly limits employment opportunities for young graduates, reflecting a substantial skills mismatch within a rapidly evolving job market, further exacerbated by structural economic transitions[13]. The advent of the 4IR is globally reshaping economic foundations, including those of developing nations like Bangladesh. Concurrently, the demand side has struggled with insufficient creation of quality jobs and economic growth to bridge this gap, disproportionately affecting the youth[5]. High graduate unemployment rates persist in many developing countries, indicating the labor market's failure to absorb educated young individuals[11, 35].

A considerable number of unemployed youth in Bangladesh have been seeking employment for over a year, highlighting a challenging transition from education to the labor market[10]. Disparities in employment outcomes based on education levels further accentuate this gap; while tertiary-educated youth face comparatively better employment prospects, they still grapple with substantial unemployment rates[16, 36]. Sector-specific studies have revealed pronounced skill gaps in industries crucial to Bangladesh's economy, such as the ready-made garments (RMG) sector, the agro-food industry, and a significant deficit in the information technology (IT) sector[17]. Furthermore, a stark digital literacy divide persists, with a large portion of the population lacking basic computer and ICT skills, severely impeding employability and productivity in an increasingly digital global economy[3, 4]. These challenges are compounded by issues such as early marriage and varying literacy rates among youth, impacting long-term professional and personal development.

1.2. The importance of bridging the skills gap through education supply chain to meet industry requirements

The imperative to bridge the skills gap is paramount for sustainable economic development and social progress in Bangladesh. A previous literature review by Chowdhury and Habib[7] highlighted the significance of conceptualizing education as a supply chain to meet industry requirements. This perspective emphasizes the flow of knowledge and skills from educational institutions (suppliers) to the industry (consumers), mediated by the competencies of graduates. Chowdhury and Habib[7] identified four key strategic areas within the university context in Bangladesh to address this gap: Program Curriculum Development (PCD), Instructor Portfolio Management (IPM), University Culture and Networking Platform (UCN), and University Facilities (UF). This study builds upon that foundational work by empirically investigating two of these crucial elements: Program Curriculum Development and Instructor Portfolio Management.

1.3. The role of program curriculum development (PCD) in production of skilled graduates (SG)

Program Curriculum Development (PCD) is a critical lever for aligning academic offerings with industry demands. A well-structured and contemporary curriculum ensures that graduates possess the knowledge and skills required by the current and future workplace, thereby enhancing their employability[2, 37]. Effective PCD involves continuous dialogue and collaboration between academia, industry, and government, as conceptualized in the Triple Helix Model, to foster innovation and responsive education systems[15]. By incorporating real-life learning experiences and regularly updating course content in line with technological advancements and industry trends, PCD can significantly contribute to the development of Skilled Graduates (SG) [15, 12].

1.4. The role of instructor portfolio management (IPM) in production of skilled graduates (SG)

Instructor Portfolio Management (IPM), which involves the strategic engagement of working professionals from various industries into academic settings, is another vital component in producing skilled graduates. These industry practitioners bring invaluable real-world expertise, contemporary insights, and practical knowledge into the classroom, bridging the gap between theoretical learning and practical application [8, 20]. This academic-industry synergy enriches students' educational experiences, exposes them to current market trends and professional networks, and helps develop workplace-ready competencies[20, 1]. Effective IPM ensures that instructors, through a diversified portfolio of academic and practical experience, can deliver relevant and impactful education, thereby fostering the development of SG[9].

1.5. How skilled graduates (SG) can lead to betterment of the society (BS)

The production of Skilled Graduates (SG) is not merely an academic objective but a critical pathway to the BS. Graduates equipped with relevant and high-demand skills are more likely to secure meaningful employment, contributing to reduced unemployment rates and poverty alleviation[44]. Furthermore, a skilled workforce drives innovation, enhances productivity, and fosters economic growth, leading to improved living standards and overall societal well-being[45]. By effectively participating in the economy and contributing to various sectors, skilled individuals become agents of positive social change, strengthening community development and national competitiveness.

1.6. The purpose of the paper and hypotheses

This paper aims to empirically investigate the impact of Program Curriculum Development (PCD) and Instructor Portfolio Management (IPM) on the production of Skilled Graduates (SG) and, subsequently, on the BS within the context of Bangladeshi universities. Based on a sample size of 400, this research employs factor analysis, Confirmatory Factor Analysis (CFA), and Structural Equation Modeling (SEM) to test the proposed relationships. The study seeks to answer the following research questions, framed as hypotheses:

- **Hypothesis 1 (H1):** There is a significant relationship between Program Curriculum Development (PCD) and the production of Skilled Graduates (SG).
- **Hypothesis 2 (H2):** There is a significant relationship between Program Curriculum Development (PCD) and Betterment of the Society (BS).
- **Hypothesis 3 (H3):** There is a significant relationship between Instructor Portfolio Management (IPM) and Skilled Graduates (SG).
- **Hypothesis 4 (H4):** There is a significant relationship between Instructor Portfolio Management (IPM) and Betterment of the Society (BS).
- **Hypothesis 5 (H5):** There is a significant relationship between the combined effort of Program Curriculum Development (PCD) and Instructor Portfolio Management (IPM) creating Skilled Graduates (SG) and Betterment of the Society (BS).

The findings of this study are expected to provide valuable insights for policymakers, educational institutions, and industry stakeholders in Bangladesh, offering evidence-based strategies to enhance the education supply chain and foster a skilled workforce capable of contributing to national development.

2. Literature review

2.1. Program curriculum development (PCD)

Program Curriculum Development (PCD) is a fundamental process in educational institutions aimed at designing, implementing, and evaluating learning experiences to meet specific educational goals and societal needs. It serves as a critical mechanism for bridging the gap between academic instruction and the evolving demands of industry, particularly in an era of rapid technological advancement and changing labor market expectations[2, 43]. The capacity of higher education institutions to deliver industry-aligned curricula is pivotal for fostering graduate employability, economic competitiveness, and societal progress.

A key framework informing modern PCD is the Triple Helix Model, which emphasizes the dynamic interaction among academia, industry, and government to stimulate innovation and create responsive education systems[15]. This collaborative approach promotes the co-creation of knowledge and curricula, supporting the development of entrepreneurial universities that actively contribute to socio-economic development by equipping students with real-world skills. Consequently, curriculum development is not a static exercise but an iterative and ongoing process. A well-designed curriculum is essential for preparing graduates for current and future workplace demands, streamlining recruitment, minimizing the need for extensive on-the-job training, and boosting organizational efficiency[15, 38]. This involves continuous feedback, integration of experiential learning (such as internships and live projects), and regular content revision to align with industry trends.

Historical precedents demonstrate the value of academic-industry partnerships in curriculum innovation. For instance, collaborations like those between Seagate Technology and various universities have shown how private sector involvement can lead to specialized training programs tailored to high-tech industry needs, producing technically proficient and adaptable graduates[6]. In the contemporary globalized educational landscape, curricula must evolve to reflect international trends in digitalization, sustainability, entrepreneurship, and cross-cultural competencies. Regular curriculum updates are crucial for educational programs to remain relevant, rigorous, and responsive to both local and global labor market needs[18, 12], thereby maintaining institutional legitimacy.

Effective PCD should be inclusive and evidence-based, incorporating insights from employer surveys, labor market analyses, graduate tracer studies, and policy directives. This ensures alignment not only with immediate industry requirements but also with broader goals of sustainable development and technological innovation. In summary, an industry-responsive curriculum is indispensable for producing graduates who are academically knowledgeable and equipped with practical, transferable, and future-ready skills, thereby closing the education-to-employment gap and enhancing higher education's contribution to national development[2, 39]. For developing countries like Bangladesh, strategic PCD, guided by collaborative principles, represents a transformative tool for inclusive economic growth.

2.2. Instructor portfolio management (IPM)

Instructor Portfolio Management (IPM) refers to the strategic approach of integrating working professionals from diverse industries into academic environments, either as adjunct faculty, guest lecturers, mentors, or even full-time instructors with substantial industry experience. This practice has gained considerable traction globally as a means to enhance the quality, relevance, and applicability of academic programs, particularly within tertiary education. By merging traditional academic instruction with real-world expertise, IPM enriches students' educational experiences and equips them with the practical skills and professional acumen necessary for career success[45].

This synergy between academia and industry fosters a pedagogical environment where theoretical knowledge is contextualized through practical examples and case studies drawn directly from professional practice. The collaboration between academic faculty and industry practitioners creates a hybrid learning model that is both engaging and deeply informative[8, 40]. Students benefit from this fusion by developing a more nuanced understanding of how abstract concepts are operationalized in real-world scenarios, thus bridging the gap between conceptual knowledge and practical application.

Industry professionals bring distinct perspectives and current insights that are often underrepresented in traditional academic settings. Their active engagement in their respective fields allows them to offer firsthand accounts of contemporary challenges, market trends, and workplace dynamics[20]. This includes detailed knowledge of organizational systems, operational workflows, strategic decision-making, and technological innovations, all of which enhance the practical orientation of academic curricula. Such exposure improves students' confidence and preparedness for transitioning into the workforce.

Beyond enriching course content, the inclusion of industry professionals strengthens institutional linkages between academia and industry. These practitioners often possess vast professional networks, which can provide students with access to internship placements, mentorship opportunities, and job referrals, thereby enhancing their social capital and employability[20]. Furthermore, their feedback can inform curriculum design, ensuring alignment with evolving industry standards and future workforce needs. This model supports outcome-based education (OBE) by focusing on developing graduates who are workplace-ready.

In regions like South Asia, particularly India, the strategic engagement of industry professionals as full-time university instructors is an emerging trend, reflecting a recognized need to harmonize academic learning with industry realities[1, 41]. Such collaborations extend beyond teaching to include mentorship, hands-on skill development, career counseling, and job placement facilitation. This shift fosters experiential, application-based education, crucial for developing problem-solving and innovation-focused graduates. This is especially pertinent at the postgraduate level, where instructors are expected to maintain a diversified teaching portfolio combining academic rigor with practical applications like case studies, simulations, and live projects[9]. Universities that successfully embed industry expertise within their teaching frameworks are better positioned to bridge the gap between academic preparation and workforce expectations, contributing significantly to economic development and societal advancement. For Bangladesh, adopting such models could substantially enhance the impact and competitiveness of its higher education sector.

2.3. Skilled graduates (SG)

The concept of 'Skilled Graduates' (SG) in the context of Bangladesh refers to individuals emerging from the higher education system equipped with a combination of technical competencies, soft skills, and practical knowledge that align with the demands of the contemporary labor market. Producing such graduates is critical to addressing the pervasive issue of the gap, which describes the mismatch between the skills employers seek and those possessed by job applicants.

The challenge of the gap among youth in Bangladesh is significant. As the 4IR intensifies global labor market competition, employers increasingly expect candidates to possess a diverse array of skills beyond formal academic qualifications. A comprehensive online survey[14], involving 100 prominent non-governmental organizations in Bangladesh, identified essential skills required for employment. Insights from HR managers and other high-ranking officials highlighted specific competencies that are often lacking in fresh graduates[42]. These typically include critical thinking, problem-solving, communication skills, digital literacy, adaptability, teamwork, and industry-specific technical skills.

The absence of these skills contributes directly to the high rates of youth unemployment and underemployment observed in Bangladesh[13, 10]. Many graduates find themselves in a prolonged and challenging transition from education to the labor market, sometimes categorized as NEET (Not in Education, Employment, or Training) despite their educational attainment[13]. The deficit is evident across various crucial sectors, including RMG, agro-food, and IT, indicating a systemic issue in aligning educational outputs with industry requirements[17]. Furthermore, the lack of basic computer and ICT skills among a significant portion of the population acts as a major barrier to employability in an increasingly digital world[3, 4].

Therefore, Skilled Graduates (SG) are those who not only possess foundational academic knowledge but have also developed these sought-after practical and soft skills. They are adaptable, ready for continuous learning, and capable of contributing effectively to the workplace from an early stage. The development of such graduates is the primary objective of interventions like improved Program Curriculum Development (PCD) and effective Instructor Portfolio Management (IPM), as these strategies are designed to directly address the identified skill deficiencies and enhance the overall employability and productivity of the workforce.

Figure 1 illustrates the sequential relationship between educational processes and societal outcomes. It shows that program curriculum development shapes educational content, which in turn supports instructor portfolio management that enhances teaching effectiveness. These components collectively lead to the creation of skilled graduates who serve as mediators of educational impact, ultimately contributing to the betterment of society through positive social outcomes.

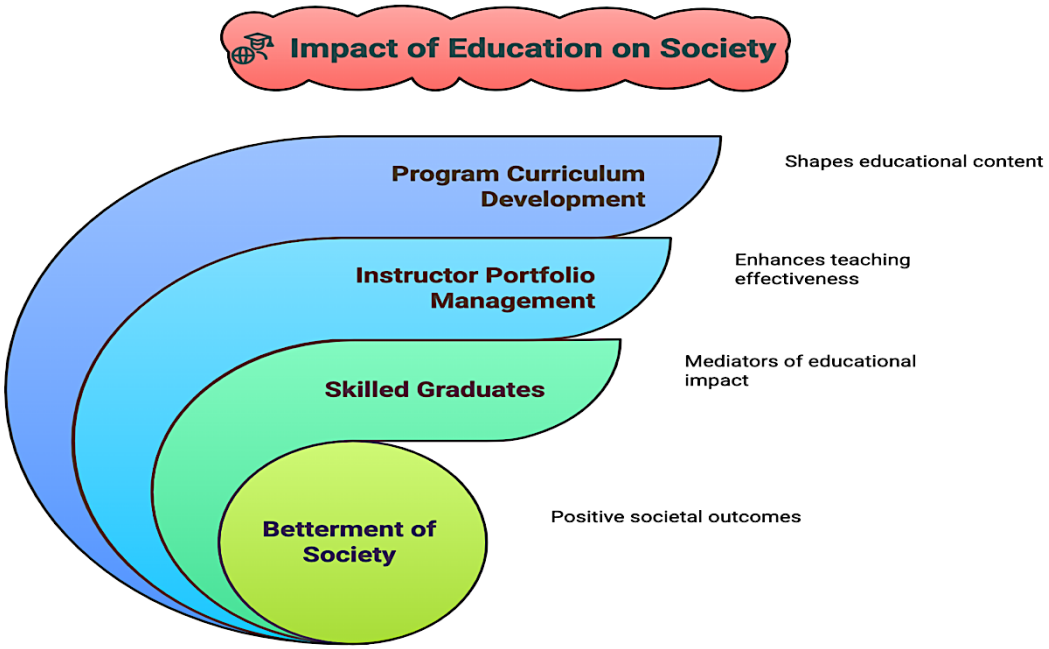


Figure 1. Conceptual framework

3. Methodology

This chapter outlines the methodological approach adopted for this research. It details the research design, the population and sampling strategy, the instrument used for data collection, and the statistical techniques employed for data analysis to address the research questions and test the proposed hypotheses.

3.1. Research design

This study employed a quantitative research approach to empirically investigate the relationships between Program Curriculum Development (PCD), Instructor Portfolio Management (IPM), Skilled Graduates (SG), and the Betterment of Society (BS) in Bangladesh. A cross-sectional survey design was utilized, where data were collected from respondents at a single point in time to examine the proposed model.

The target population for this study comprised individuals involved in the educational and employment sectors in Bangladesh, including academics, administrators in educational institutions, and employers or hiring managers in various industries. Given the large and dispersed nature of this population, a non-probability snowball sampling technique was adopted to reach the intended respondents[26]. This method was deemed appropriate for accessing a diverse group of participants who meet the study's criteria.

The sample size for this research was determined using the Taro Yamane[27] method. The formula for this method is: n=1+N(e)2N Where:

- n = sample size
- N = population size
- e = margin of error (level of precision)

Considering the extensive population (N) in the education industry and corporate hiring sector in Bangladesh, which exceeds 100,000 individuals, and setting a margin of error (e) of 0.05 (5%), the calculation guided the determination of an appropriate sample size. Primary data were collected from 400 respondents, which constitutes the final sample size for this study, ensuring adequate statistical power for the subsequent analyses. Data were gathered through a self-administered questionnaire distributed electronically via Google Forms.

3.2. Instruments

A structured, self-administered questionnaire was developed to collect primary data for this study. The questionnaire was designed to measure the key constructs of the research model: Program Curriculum Development (PCD), Instructor Portfolio Management (IPM), Skilled Graduates (SG), and Betterment of Society (BS). Items for these constructs were adapted from existing literature and contextualized to the Bangladeshi higher education and employment landscape.

Respondents were asked to indicate their level of agreement or perceived importance regarding various statements related to these constructs using a 5-point Likert scale. The scale was anchored as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree[21, 23]. This scaling method allows for the quantification of perceptions and attitudes, facilitating statistical analysis.

3.3. Data analysis

The data collected from the 400 respondents were analyzed using quantitative statistical methods. The primary software used for these analyses included IBM SPSS for preliminary analysis and reliability testing, and IBM AMOS for Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The analysis process involved several stages:

3.3.1. Exploratory analysis and reliability assessment

Initially, inferential statistics were employed to make inferences about the population based on the sample data[24]. An exploratory factor analysis (EFA) was conducted to identify the underlying factor

structure of the measurement items and to condense the observed variables into unobserved latent constructs or factors[25]. During this phase, factor loadings were examined to ensure that items appropriately represented their respective constructs. The internal consistency and reliability of the measurement scales for each construct were assessed using Cronbach's alpha coefficient.

3.3.2. Confirmatory factor analysis (CFA)

Following the exploratory analysis, Confirmatory Factor Analysis (CFA) was performed using IBM AMOS. CFA is a statistical technique used to test the extent to which the measured variables accurately represent the hypothesized constructs of the study. Unlike EFA, CFA provides a more rigorous framework for confirming the predetermined structure of the constructs. This step was crucial for evaluating the goodness-of-fit of the measurement model, ensuring its validity (convergent and discriminant) and reliability before proceeding to test the structural relationships.

3.3.3. Structural equation modeling (SEM) and hypothesis testing

Structural Equation Modeling (SEM) was the primary statistical technique used to test the hypothesized relationships among the latent variables (PCD, IPM, SG, BS). SEM allows for the simultaneous examination of multiple dependence relationships and is particularly suited for testing complex theoretical models[22]. The structural model was assessed using IBM AMOS to determine the significance and strength of the hypothesized paths.

Correlation analysis was conducted to understand the associations between variables. The hypotheses (H1-H5) were tested by examining the standardized path coefficients, their statistical significance (p-values), and critical ratios obtained from the SEM output. This included assessing the direct effects of PCD and IPM on SG and BS, the mediating role of SG, and the combined influence as specified in the hypotheses. This comprehensive approach allowed for a robust evaluation of the proposed research model.

4. Results

This chapter presents the results of the data analysis conducted to examine the research model and test the proposed hypotheses. The analysis includes reliability analysis through Exploratory Factor Analysis (EFA), assessment of model fit using Confirmatory Factor Analysis (CFA) and Structural Equation Model (SEM) fit indices, and finally, the results of the hypothesis testing.

4.1. Reliability analysis

To begin the analysis, the reliability of the measurement scales was assessed. Exploratory Factor Analysis (EFA) was employed to determine the inherent relationships among the items for each construct, as proposed by Hair et al.[29]. This technique is vital for evaluating how individual items correlate with specific factors within the constructs. In the current research, EFA was harnessed to probe the data and shed light on the optimal number of factors to aptly represent the data[28]. This Exploratory Analysis of the Variables included an examination of factor loadings and the calculation of Cronbach's alpha for each construct.

Table 1. Exploratory analysis of the variables

Variables/Dimensions	Factor loading	Cronbach's alpha
PCD		0.88
PCD_1	0.82	
PCD_2	0.78	

Variables/Dimensions	Factor loading	Cronbach's alpha
PCD_3	0.81	
PCD_4	0.81	
IPM		0.893
IPM_1	0.77	
IPM_2	0.84	
IPM_3	0.80	
IPM_4	0.77	
SG		0.864
SG_1	0.73	
SG_2	0.83	
SG_3	0.78	
SG_4	0.70	
SG_5	0.72	
BS		0.885
BS_1	0.80	
BS_2	0.84	
BS_3	0.76	
BS_4	0.76	
BS_5	0.75	

Table 1. (*Continued*)

Based on the EFA, each item demonstrated strong psychometric properties. Factor loading scores for all items ranged from 0.70 to 0.84. These loadings are well above the recommended minimum threshold of 0.40[28], indicating that all items significantly contributed to their respective latent constructs. As a result, no items were dropped from the analysis.

Cronbach's alpha was utilized to assess the internal consistency and construct reliability for each variable within the research framework. The Cronbach's alpha coefficients indicated that all indicators are reliable. All the scales achieved high alpha scores, with values above 0.864. These scores are well above the generally accepted cut-off point of 0.70, which suggests good internal consistency[28]. From these findings, it can be concluded that the constructs possessed adequate reliability for subsequent stages of analysis, including CFA and SEM.

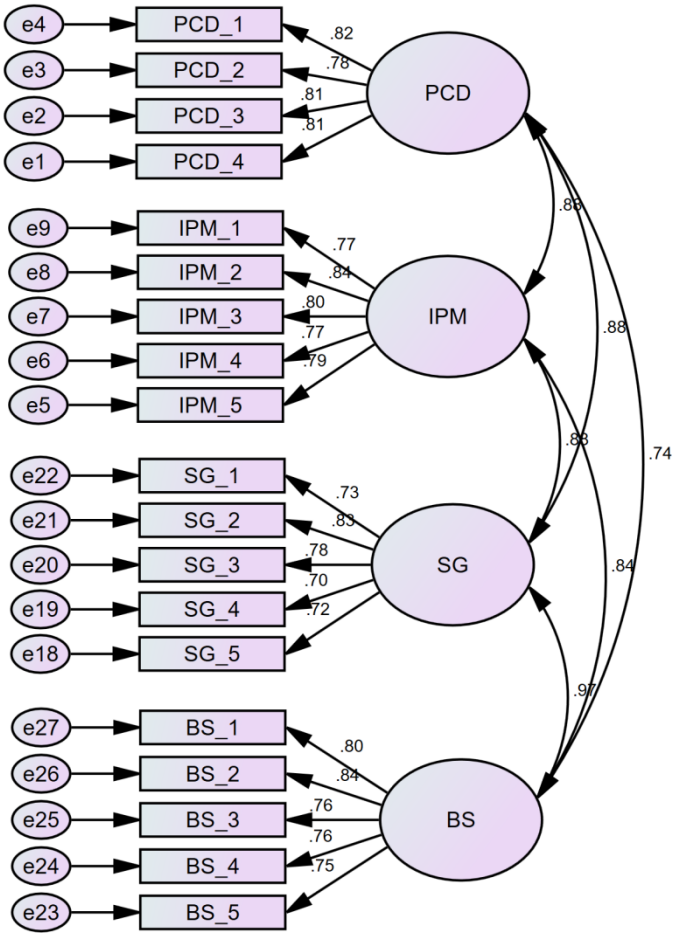
4.2. Criteria for fit index

Following the establishment of scale reliability, the measurement model and structural model were assessed for their goodness-of-fit to the collected data.

4.2.1. Confirmatory factor analysis (CFA)

Following the employment of EFA to discern the relational patterns among scale items, Confirmatory Factor Analysis (CFA) was utilized to assess the legitimacy of the measurement model, specifically a

four-factor model representing Program Curriculum Development (PCD), Instructor Portfolio Management (IPM), Skilled Graduates (SG), and Betterment of Society (BS), as indicated by Hair et al.[29]. For evaluating the four-factor measurement model, the advocated benchmark values for acceptable model fit include: a CMIN/DF (Chi-square divided by degrees of freedom) value of less than 5.0; Comparative Fit Index (CFI) and Incremental Fit Index (IFI) values exceeding 0.90; and a Root Mean Square Error of Approximation (RMSEA) value falling below 0.10[30].



GFI	Measurement Model
Chisq/df = <5.0	4.886
TLI > 0.90	0.922
CFI > 0.90	0.926
RMSEA < 0.10	0.026
Comment on Model	Good Model

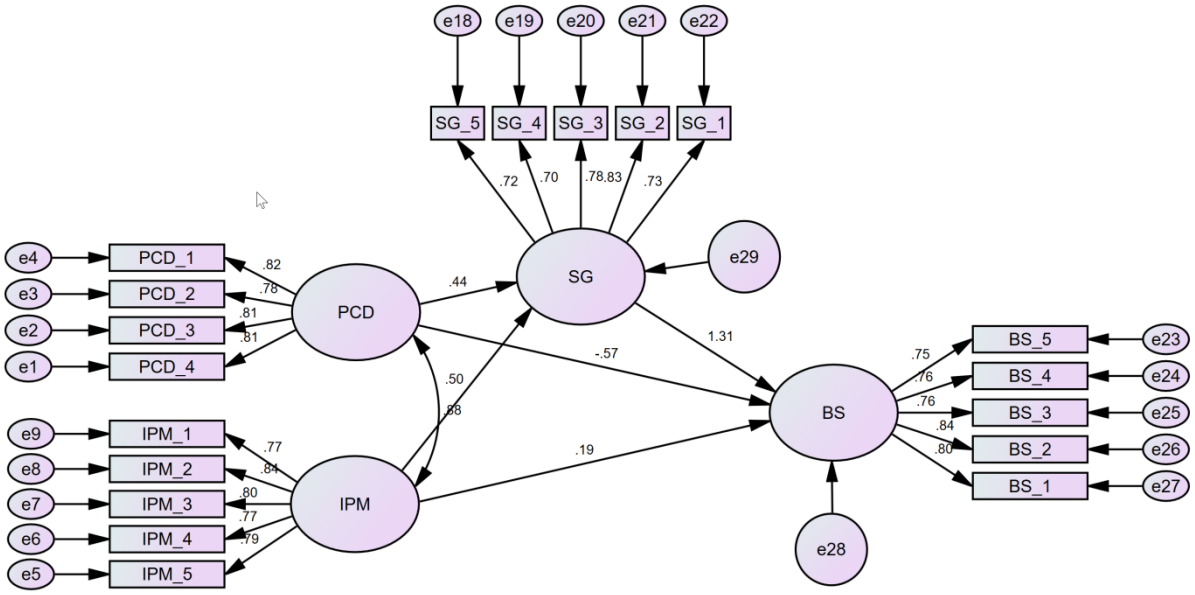
Figure 2. Measurement model

Drawing insights from the Modification Index (MI) outcomes during the CFA process, adjustments were made by linking error terms where theoretically justifiable, aiming to enhance the model's compatibility with the data. The preliminary outcomes from the Measurement Model Based on Variables displayed a CMIN/DF (Chisq/df) = 4.886, Tucker-Lewis Index (TLI) = 0.922, Comparative Fit Index (CFI) = 0.926, and Root Mean Square Error of Approximation (RMSEA) = 0.026. These fit indices indicated that the

measurement model employed in this study provided a good fit to the data, as they met or exceeded the recommended threshold values.

4.2.2. Structural Equation Model (SEM)

After confirming the adequacy of the measurement model, the structural model was evaluated. This segment evaluates the suggested structural model by juxtaposing its fit indices with those of the overall measurement model. The objective here is to ascertain if the finalized measurement model aligns with the initially outlined structural model, which proposes specific relationships between the constructs.



GFI	Structural Equation Model (SEM)
Chisq/df = <5.0	4.774
TLI > 0.90	0.994
CFI > 0.90	0.972
RMSEA < 0.10	0.043
Comment on Model	Good Model

Figure 3. Results of structural model

The initial Structural Equation Model results showed the following fit indices: CMIN/DF (Chisq/df) = 4.774, Tucker-Lewis Index (TLI) = 0.994, Comparative Fit Index (CFI) = 0.972, and Root Mean Square Error of Approximation (RMSEA) = 0.043. These values are within the acceptable ranges for good model fit, indicating that the structural model employed in this study is a good fit to the data and suitable for testing the hypothesized relationships.

4.3. Hypothesis analysis

The envisioned theoretical framework and its associated hypotheses were dissected using Structural Equation Modeling (SEM). Figure 3 (to be inserted below) conveys the results of the suggested structural model, highlighting both significant and non-significant paths concerning the hypothesized direct relationships. The outcomes pertaining to these path connections are covered in this segment.

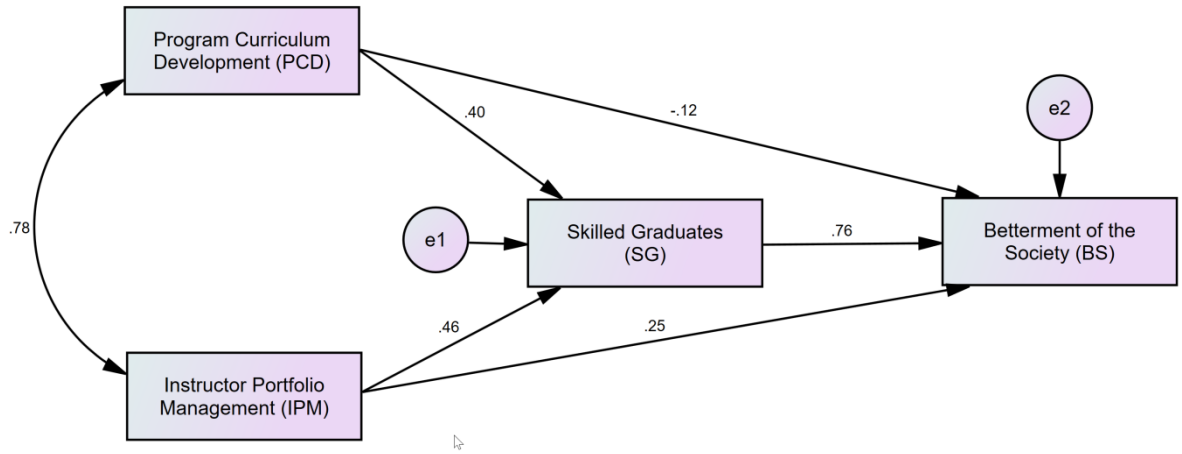


Figure 4. Results of the hypotheses

As shown in Figure 3, tests for the direct hypotheses were conducted. A summary of the path coefficients, critical ratios (CR), and p-values for each hypothesized relationship is presented in Table 2. The results of the direct hypotheses are presented as follows:

Table 2. Hypothesis testing results

Hypotheses	Paths	Estimate (β)	S.E.	C.R.	p	Results*
H1: There is a significant relationship between Program Curriculum Development and Skilled Graduates.	PCD--->SG	0.25	0.032	5.498	***	Supported
H2: There is a significant relationship between Program Curriculum Development and Betterment of the Society.	PCD--->BS	0.122	0.06	2.233	0.545	Not Supported
H3: There is a significant relationship between Instructor Portfolio Management and Skilled Graduates.	IPM--->SG	0.16	0.048	4.665	***	Supported
H4: There is a significant relationship between Instructor Portfolio Management and Betterment of the Society.	IPM--->BS	0.145	0.049	3.714	0.718	Not Supported
H5: There is a significant relationship between Skilled Graduates and Betterment of the Society.	SG--->BS	0.796	0.048	14.357	***	Supported

** **Note:** *: p< 0.05, **: p<0.01, ***: p<0.001*

- **H1: There is a significant relationship between Program Curriculum Development (PCD) and Skilled Graduates (SG).** The analysis revealed a significant positive relationship between Program Curriculum Development and Skilled Graduates (β = 0.25; CR = 5.498; p = 0.000). Therefore, H1 is supported.

- **H2: There is a significant relationship between Program Curriculum Development (PCD) and Betterment of the Society (BS).** The analysis showed an insignificant relationship between Program Curriculum Development and Betterment of the Society (β = 0.122; CR = 2.233; p = 0.545). Therefore, H2 is not supported.
- **H3: There is a significant relationship between Instructor Portfolio Management (IPM) and Skilled Graduates (SG).** A significant positive relationship was found between Instructor Portfolio Management and Skilled Graduates (β = 0.16; CR = 4.665; p = 0.000). Therefore, H3 is supported.
- **H4: There is a significant relationship between Instructor Portfolio Management (IPM) and Betterment of the Society (BS).** The relationship between Instructor Portfolio Management and Betterment of the Society was found to be insignificant (β = 0.145; CR = 3.714; p = 0.718). Therefore, H4 is not supported.
- **H5: There is a significant relationship between Skilled Graduates (SG) and Betterment of the Society (BS).** The analysis indicated a strong significant positive relationship between Skilled Graduates and Betterment of the Society (β = 0.796; CR = 14.357; p = 0.000). Therefore, H5 is supported.

In summary, the study examined five hypotheses concerning the relationships between Program Curriculum Development, Instructor Portfolio Management, Skilled Graduates, and Betterment of the Society. Three of these hypotheses (H1, H3, and H5) were supported by the data, while two hypotheses (H2 and H4) were not supported.

The findings of this study can be theoretically interpreted through the lens of Human Capital Theory[31] and the Triple Helix Model[32]. Human Capital Theory posits that investment in education and training enhances the productivity and societal contribution of individuals. In this study, both Program Curriculum Development and Instructor Portfolio Management serve as institutional mechanisms for such investment, fostering the development of Skilled Graduates who, in turn, act as conduits for societal betterment. This mediating pathway underscores that educational inputs must be transformed into employable skills before generating social and economic value. Meanwhile, the Triple Helix Model emphasizes the collaborative interaction among universities, industry, and government as a driver of innovation and socio-economic progress. The significant relationships found between curriculum design, instructor expertise, and graduate skill formation reflect this interdependence, highlighting that educational institutions alone cannot bridge the skills gap without active engagement from external stakeholders. Therefore, the study contributes theoretically by integrating human capital and innovation system perspectives to explain how educational strategies translate into social outcomes through the mediation of skilled human resources.

5. Conclusion

This chapter summarizes the main findings of the study, discusses its academic and managerial contributions, acknowledges the limitations encountered during the research, and offers suggestions for future research endeavors in this domain. The study aimed to empirically investigate the impact of Program Curriculum Development (PCD) and Instructor Portfolio Management (IPM) on producing Skilled Graduates (SG), and how these factors, along with skilled graduates, contribute to the Betterment of Society (BS) in the context of Bangladeshi universities.

The study empirically confirms that well-designed curriculum structures and strategically managed instructor portfolios are pivotal in producing skilled graduates who act as mediators between education and

societal progress. Program Curriculum Development and Instructor Portfolio Management both significantly enhance graduate skill formation, while Skilled Graduates, in turn, exert a strong positive influence on the BS. The findings affirm that improving educational quality alone does not directly yield societal benefits unless it translates into human capital capable of innovation and service. Beyond Bangladesh, the proposed model offers a framework adaptable to other developing and emerging economies facing similar skill mismatches between higher education outputs and labor-market demands. By emphasizing alignment among curriculum relevance, instructor expertise, and graduate employability, this model can guide policymakers and academic leaders globally in designing education systems that produce workforce-ready graduates who contribute meaningfully to social and economic advancement.

5.1. Academic and managerial contributions

Academic Contributions: This study makes several contributions to the academic literature:

- It empirically validates a model linking specific educational inputs (PCD and IPM) to outputs (Skilled Graduates) and outcomes (BS) within the Bangladeshi higher education context, extending the conceptual work of Chowdhury and Habib[7].
- The research distinctively highlights the mediating role of Skilled Graduates in the relationship between educational strategies and societal betterment, offering a nuanced understanding of the education-to-society impact pathway.
- It adds to the body of knowledge on addressing the gap in developing countries by providing empirical evidence on actionable strategies within the education supply chain framework.
- The application of Structural Equation Modeling (SEM) provides a robust methodological example for future research in this area.

Managerial and Practical Contributions: The findings also offer valuable insights for various stakeholders:

- **For University Administrators and Educators:** The study underscores the imperative to strategically invest in and continuously improve Program Curriculum Development to ensure relevance and alignment with industry needs. It also emphasizes the importance of robust Instructor Portfolio Management systems to bring practical, real-world expertise into the learning environment. The findings advocate for a focus on producing genuinely skilled graduates as the primary means to contribute to society.
- **For Policymakers:** The research provides evidence to support policy initiatives aimed at enhancing the quality and relevance of higher education in Bangladesh. It suggests that policies should not only focus on individual aspects of education but foster an integrated ecosystem where curriculum and instruction are geared towards producing skilled individuals who can effectively contribute to national development and societal well-being.
- **For Employers and Industry Stakeholders:** The study reaffirms the value of collaborating with educational institutions, particularly in areas like curriculum development and providing opportunities for industry professionals to engage in teaching and mentorship, to ensure a supply of graduates equipped with relevant skills.

5.2. Limitations of the study

While this study provides valuable insights, certain limitations should be acknowledged:

- **Sampling Method:** The use of non-probability snowball sampling may limit the generalizability of the findings to the entire population of educational institutions and employers in Bangladesh.
- **Cross-Sectional Data:** The study is based on cross-sectional data, which captures relationships at a single point in time. Therefore, while associations are identified, definitive causal inferences cannot be drawn.
- **Scope of Variables:** This research focused on two independent variables (PCD and IPM) from the four identified by Chowdhury and Habib[7]. Other factors such as University Culture and Networking (UCN) and University Facilities (UF) could also play significant roles and were not included in this model.
- **Self-Reported Data:** The data were collected through self-administered questionnaires, which may be susceptible to common method bias or social desirability bias, although steps were taken to ensure anonymity.
- **Context Specificity:** The findings are specific to the Bangladeshi context and may not be directly transferable to other countries with different socio-economic and educational landscapes.

5.3. Suggestions for future research

Based on the findings and limitations of this study, several avenues for future research are proposed:

- **Longitudinal Studies:** Future research could employ longitudinal designs to track the impact of PCD and IPM on graduates' skills and their subsequent contribution to society over time, allowing for stronger causal inferences.
- **Comparative Studies:** Conducting comparative studies across different types of universities (public vs. private) or across different regions within Bangladesh, or even across other developing countries, could provide broader insights.
- **Expansion of the Model:** Future studies could incorporate the other variables identified by Chowdhury & Habib[7]—University Culture and Networking (UCN) and University Facilities (UF)—to develop a more comprehensive model of the education supply chain.
- **Qualitative Investigations:** In-depth qualitative research, such as case studies or interviews with stakeholders, could provide richer, nuanced understanding of the processes and mechanisms through which PCD and IPM influence skill development and societal contributions.
- **Exploring Interaction Effects:** Investigating the potential interaction effects between PCD and IPM on the development of skilled graduates could offer deeper insights into their synergistic operation.
- **Objective Measures:** Future research could attempt to incorporate more objective measures of skilled graduates (e.g., employer assessments, job placement rates in relevant fields) and societal betterment (e.g., economic indicators, innovation rates).

By addressing these areas, future research can further enhance our understanding of how educational systems can be optimized to bridge the gap and contribute more effectively to societal progress.

Conflict of interest

The authors declare no conflict of interest

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