34th Australasian Association for Engineering Education Conference
3 - 6 December 2023 – Gold Coast, QLD

A Sustainable Approach to Establish Industry-Academia Collaboration by Engaging the Rural Community for the Developing Countries

Md Mahmudul Kabir Peyal[a]; Afrin Hossain Puspita[a]; Sabrina Alam[a]; Yousuf Mahbubul Islam [a]; A. M. Shahabuddin[b]; Mahady Hasan[a].
Independent University, Bangladesh[a], Sher-e-Bangla Agricultural University[b].
Corresponding Author Email: peyal@iub.edu.bd

ABSTRACT

CONTEXT

Skill and knowledge both play a vital role in sustainable career development. Universities were built to nurture knowledge thus the focus was on offering a knowledge-based curriculum. On the other hand, the industry's requirement is skill. Hence, the demand focuses on employees with real-world and hands-on skills. This gap between academia and industry impacts both students and industry. Furthermore, developing countries commonly lack the infrastructure needed to work with academia to support research that solves industry-specific problems.

PURPOSE OR GOAL

The motivation of the study is to work in rural development using engineering knowledge from academia. The research question driving the study is, "How can universities of developing countries mitigate the gap between theoretical learning and practical industrial skills?" Due to the rural environments, developing nations rely substantially on small-scale industries related to agriculture, fisheries, forestry, etc. The goal is to develop a model where students will be exposed to rural industry driven problems throughout their academic journey and work to solve the problems. Which will also prepare them for their future professional roles.

APPROACH OR METHODOLOGY/METHODS

The research utilizes case study approach by using data from students at Independent University, Bangladesh, where a three-credit Live-in-Field Experience course is in place. This course is a part of the foundational coursework and involves students living in rural areas, identifying issues in the rural sector, and formulating potential solutions. The effectiveness of this approach is evaluated incrementally, with successive student groups improving upon the previously devised solutions.

ACTUAL OR ANTICIPATED OUTCOMES

The study shows that incorporating the model into the academic curriculum offers various outcomes. First, the model promotes experiential learning, where students solve real-world problems, particularly in rural areas. This change in teaching practice broadens theoretical concepts and their practical applications. The model creates bridges between academia and industry. Industry personnel will be interested in working and teaching in academia, which will help students get exposure to current industry practices and gain the required skills.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The analysis proves that academic curricula that integrate industry-based problem-solving have an impact on both students and industries. The proposed model connects the bridge between academia and industry. Compared to the existing knowledge, this study could redefine our understanding of effective academic-industry collaborations and the role of universities in developing nations to adapt. The novel approach highlights the necessity of a change from knowledge-based education to one that emphasizes application and problem-solving skills.

KEYWORDS

Industry-Academia Gap, Education in Developing Countries, Live-in-Field Experience, Social and Economic Advancement, Educational Paradigm

Introduction

Higher education is enduring a continuous transformation in response to the changing expectations of students and industries. In developing countries like Bangladesh, the equilibrium between the theoretical knowledge provided by academic institutions and the practical skill set expected by industries plays a crucial role in forming sustainable career journeys. However, this equilibrium is usually disrupted in developing regions, resulting in a disconnect between academia and industry, commonly called the "knowledge-skills gap." Because of an inconsistency between what is taught at university and what is expected in the workplace, many graduates enter the workforce without the necessary technical expertise (Edeigba, 2022; Asonitou & Hassall, 2019; Bayerlein & Timpson, 2017). This gap poses dual challenges. Graduates, despite their academic successes, may find themselves unprepared for the professional world. On the other hand, industries struggle with a lack of skilled personnel which affects their development and productivity.

In the context of developing nations, rural regions significantly contribute to the economy through small-scale industries, including agriculture, fisheries, and forestry, among others. According to Health Nutrition and Population statistics (2023) most of the Bangladesh's population, specifically 60.29 percent, lives in rural areas. Yet, these sectors confront countless difficulties due to a lack of technological advancement and innovative solutions. Due to rural dependency on economic and industrial sectors, it is essential to address their challenges to secure the country's overall development.

The study focuses on the pivotal role of academic institutions in bridging this gap. We explore a unique methodology that fosters a collaborative learning experience by engaging students with rural industry-driven problems as part of their academic journey. This model, implemented at the Independent University, Bangladesh, encourages students to live in rural areas, identify industry-specific challenges, and conceptualize feasible solutions.

Given the thematic focus of this conference, "Adapting to the Changing Expectations of Students and Industry," this research adds a valuable perspective on how to bridge the academia-industry gap, particularly in the context of developing countries. Through the perspective of two case studies, the paper explores how universities can adapt to the changing landscape of education by integrating practical problem-solving within their curricula, thereby nurturing future. This method of experiential learning has great potential in shaping the future of education and industry in developing nations.

Literature Review

The gap between academics and industry in developing countries has a big impact on employment and economic growth. To solve these difficulties and create a workforce that is more qualified and work-ready, cooperation between industry and academia is essential. Despite extensive research in this area, a study (Ayofe & Ajetola, 2009) identified a gap between the academic curriculum and industry requirements. In this research, the study illustrates that there are extensive gaps in skills between academic programs at universities and IT companies. Another research (Ponnan & Ambalavanan, 2014) discusses educational institutions that may assist in preparing students for successful jobs in the industry by offering training throughout tertiary education and focusing on an effective curriculum. According to the research (Radermacher & Walia, 2013) titled “Gaps between industry expectations and the abilities of graduates,” students typically do not meet the technical, interpersonal, and professional criteria established by companies and academic institutions. By bringing these disparities to their observation, instructors may make well-informed decisions to improve their curriculum and methods of instruction. The research reveals students will be more capable of achieving success in their careers and fulfilling the demands of a continuously changing job market if these areas of shortcomings are addressed. Afterward, another study by (Kruss*, 2004) examined stakeholder expectations for higher education responsiveness in South Africa, emphasizing the need to integrate soft, transversal, life, and high skills into education. This research also highlights the US paradigm shift towards competency-based, industry-driven education, which is facilitated by collaborations among industry, academia, and government. They emphasize the need for effective learning data tracking to manage this transformation, align with industry demands,

and better prepare students for evolving job needs. Besides, several research efforts have attempted to integrate information systems (IS) curricula with job market demand to reveal the relationship between the proficiencies provided by universities and skills demanded by the industry (Litecky et al., 2004). The research is aimed at contributing to more relevant course selections at universities, better preparing students to meet the needs of industries. In pursuit of this goal, a range of methodologies, including interviews (Trauth et al., 1993), surveys (Lee et al., 1995), and data-centric methods (Stefanidis, 2014), have been employed.

Methodology

Overview

The suggested model adopts an innovative method named Live-in-Field Experience (LFE) course. The LFE course is an immersive learning program where students explore rural areas in Bangladesh and familiarize themselves with the community, their lifestyle, and the associated challenges. All students, both local from urban Bangladesh and international, are required to take the LFE course. Many are unfamiliar with rural life. As part of their foundational coursework, students enrol in this course at a cost of 310 AUD, which is covered entirely by students. In return, the university facilitates transportation, food, and accommodation. Figure 1 depicts how students participating in this course travelled around the country, engaging themselves in rural communities to obtain a practical understanding of the issues these communities face. The communities and industries actively support the students in accomplishing the tasks.

The course is incorporated into the foundational coursework, introducing students to the realities at the early stage of their academic journey. The course helps students to gain in-depth knowledge about how developing-country economies are controlled by rural communities. Additionally, it inspires students to empathize with these people, motivating them to develop solutions that can enhance their safety and simplify their everyday lives.

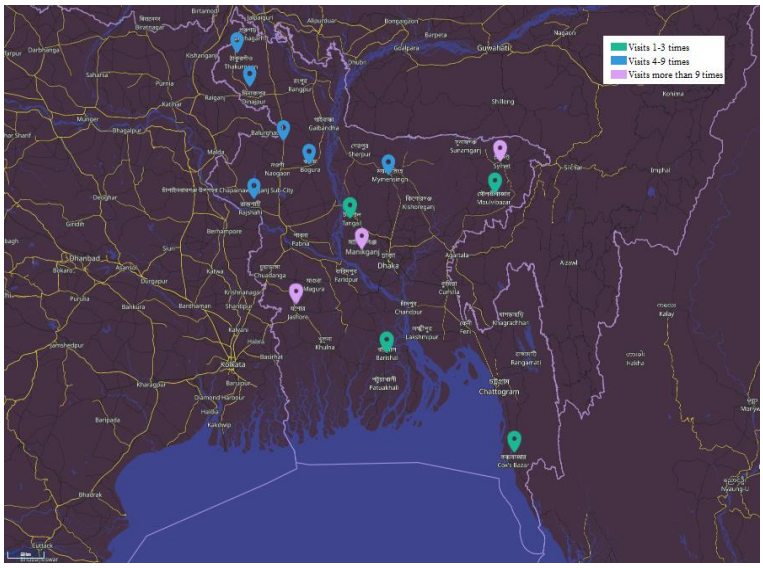


Figure 1: Students from Independent University, Bangladesh visit the locations for the LFE course

Model Description

By building the foundational course named LFE(Life in Field), the curriculum is designed to nurture students' problem-solving skills throughout their studies. It is structured in such a way that students can meet industry standards and be able to develop at least one product while graduating. This experience helps students gain knowledge about skills required for the industry and ideas about product development which are industry demands. The diagram of the proposed model is given in Figure 2. Figure 2 describes how students go through the proposed education model in their four years of study.

In the first year of the study, Freshers take the LFE course and identify one problem based on their engagement with rural society. Data collection is an integral part of the LFE course. During their stay in rural areas, students conduct surveys to gain a deeper understanding of the problems. Personal interactions with the community members and first-hand experiences further contribute to the richness of the collected data. After returning to university, they discuss and analyse problems in different foundation courses like language, sociology, and humanities courses. They also build academic skills in their courses to survive in core courses and succeed in an academic setting. Next, if students get proper knowledge of foundation courses and understand their major fields, they start taking core and major courses respectively. According to the approved curriculum students take core courses and get in-depth knowledge about their major field. They start applying their information in different situations. They do lab work, industry visits and learn to use proper tools to solve problems. They also learn how to analyse and evaluate different facts and ideas. In the core and major courses

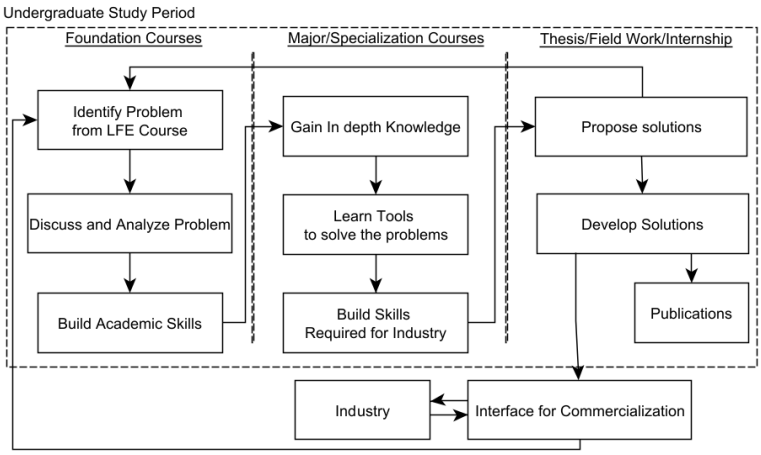


Figure 2: Block diagram of the proposed model

students also develop different industry skills from experienced faculties and industry experts. Furthermore, as part of their final year project and internships, students are expected to develop comprehensive solutions to the problems identified during the LFE course. Here, students get a chance to create or develop industry solutions from their whole year of learning. While developing solutions they use their earned skills and get help from professionals. Students are encouraged to publish their developed solutions in peer-reviewed conferences and journals also. Finally, their solution goes to an interface for commercialization which is another section of the university that works with industries collaboratively and is run by industry mentors. After that, products or solutions are sent to the industry so that the industry can use them, and the university can get feedback from users to work more on those problems. As students continuously come from LFE courses, they get the opportunity to find different solutions to the same problems. Even they get a chance to work on the same solution to make the product more usable and efficient. Based on the whole system the curriculum is divided into three parts which are foundational courses, major courses, and minor courses. For all departments, the curriculum maintains a ratio to offer courses. For example, the department of CSE provides 40 credits for foundation, 75 credits for major, and 15 credits for minor courses. The usual ratio for offering courses is depicted in Figure 3.

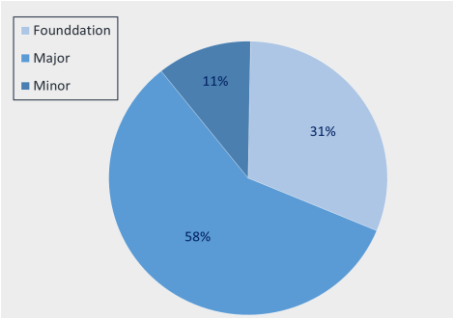


Figure 3: The typical ratio of credits for foundation, major, and minor courses

Course Delivery

The course delivery process within this model is designed to be both industrial and research oriented. For delivering classroom courses teachers follow outcome based education (OBE). Besides lectures, assignments, exams, etc. projects are introduced in all courses to give students hands-on experience. Some courses are also designed in such a way that industry professionals come to the university to take a whole course or a portion of a course. That helps students build networks as well as get knowledge about industry demands.

The Live-in-Field Experience (LFE) course contrasts typical classes by immersing students in rural Bangladeshi life. Students live in rural areas, interacting with locals and learning firsthand about rural challenges. Faculty members and mentors guide students during this process, aiding their understanding and interpretation of collected data. Reflection sessions and discussions are integral for shared learning.

Finally, the thesis and internship components offer practical, industry-relevant experience. Students conduct in-depth research and internships, applying skills from LFE and major courses to address real-world rural issues. Faculty mentors and industry experts guide students the whole term of their work. Internships also allow students to engage with professionals, build networks and gain valuable hands on experiences.

Student Engagements

Student engagement is a key property of the proposed model as the model creats a meaningful connection between students and real-world challenges. Through data collection, research, and the development of innovative solutions, students are inspired to apply their theoretical knowledge in practical scenarios that mitigate the gap between academia and industry. This engagement enhances their critical thinking skills and nurtures genuine interest in addressing the demanding issues faced by rural industries. By immersing students in real-world contexts, the model inspires sustainable development, ensuring that they become capable professionals equipped to contribute meaningfully to the growth and progress of their nation's rural sectors. Two case studies demonstrate the involvement of students under the proposed model.

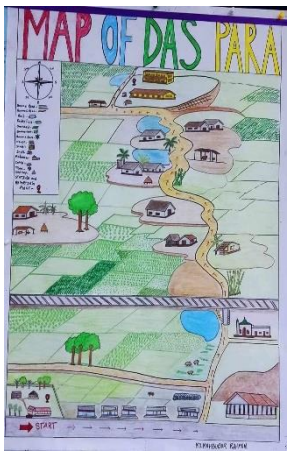
Case Study 1: Live-in-Field Experience of Students

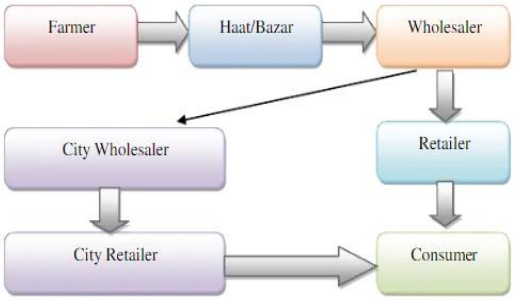
The first case study illustrates how students engage with rural communities through the Live-in-Field Experience (LFE) course. The LFE program has a set of objectives, focusing on showing students the socio-economic realities of rural Bangladesh. These objectives include understanding rural poverty and developments, social changes over periods, the common human health and environmental conditions, and the rural market system. Furthermore, the program aims to familiarize students with qualitative data collection methods and communication techniques in different environments and situations.

As part of the LFE course, students work on two primary data: Participatory Rural Appraisal (PRA) and a questionnaire survey. PRA involves asking open-ended questions to villagers, allowing students to collect qualitative information about villagers' lives. This approach requires relation-building with the villagers to create an environment of trust, enabling more authentic disclosures. In contrast, the questionnaire survey component allows students to gather more structured, quantitative data. Students select twenty-five households from the village and run surveys to collect primary data. These surveys cover a wide range of topics, aligning with the objectives of the LFE course.

Students also involve in various activities, such as Village Resource Mapping, analysing the rural production cycle, wealth ranking and income assessment, studying health and environmental conditions, and exploring the rural market's economic activities, structure, and distribution channels. Pictures of activities done by students in the course is included in Figure 4.

One notable activity shown in Figure 4 is the value chain analysis of products. This task exposes students to the complex processes of rural industries, allowing them to understand the steps from raw material sourcing to product distribution, as well as identifying potential areas of improvement.





(a) (b) (c)

Figure 4: (a) Village mapping done by students during the LFE course (b) Students are collecting data (c) Distribution Channel of Agro-based products from Farmer to Consumer

The data collected from the activities offer a complete understanding of the socio-economic situations of rural Bangladesh. This approach underscores the value of immersive, experiential learning in bridging the gap between academia and industry.

Case Study 2: Students' Solutions to Develop an IoT-Based Fisheries Monitoring System

The second case study follows the journey of a group of students from the Computer Science and Engineering (CSE) department. During their Live-in-Field Experience (LFE), these students identified problems in the fisheries industry, particularly within the context of rural Bangladesh.

Through their observations, they recognized the potential of fish farming in the country characterized by a favourable climate and resources which are not touched. However, they also noticed the drawbacks that stop the farmers' ability to improve production. Primarily lack of proper supervision and a scarcity of technical knowledge is the cause behind the problem.

Addressing the challenges, the students took the final year senior project. They used their knowledge and skills gained from their academic journey to develop an internet of things-based monitoring system for the fisheries industry. The system aimed to enhance the sustainability and output of traditional fish farming by adapting cutting-edge technological solutions. A real-time monitoring system was designed to detect potential issues, prevent loss, and increase productivity. The system was also designed to automatically collect, evaluate, and generate statistical reports from collected data. This feature provides farmers with an essential tool for making decisions. Moreover, the student developers develop a user-friendly user interface for data monitoring, alerting thus simplifying the interaction between the users and the devices. Furthermore, recognizing the rising demand for electricity in rural areas, the system was designed to utilize solar energy, making it both eco-friendly and cost-efficient. Figure 5 depicts the different activities of students with faculty advisors during the final semester and shows how they are getting hands-on experiences and skills to meet industry expectations.

Their solution results in a revolutionary system that can merge the control system of large fisheries onto a single monitoring screen. It gave farm owners the ability to oversee fish health, feeding rates, growth rates, and death rates, and even detect potential disease outbreaks. This affordable and user-friendly system represents a significant breakthrough for rural fishermen and the broader fisheries industry. It demonstrates the power of integrating practical, real-world problem-solving within an academic curriculum, highlighting the effectiveness of such academia-industry collaborations in delivering substantial impacts on both students and industries.

Figure 5: (a) Students are working to set up devices. (b) Testing the device prototype during the initial phase of the pilot project. (c) Faculty advisor mentoring students and testing their work

Result Analysis

The outcomes from the two case studies, Live-in-Field Experience (LFE) and Students' Solutions to Rural Industry Problems demonstrate the effectiveness of the proposed approach in bridging the gap between academia and industry in developing countries.

Analysis of Case Study 1:

The LFE course has proven to be a transformative experience for students. Through immersive data collection in rural areas, students gained valuable insights into the challenges faced in rural industry. The collected data informed the development of problem-solving skills, fostering empathy and a deeper understanding of the needs of the rural population. This hands-on learning approach laid the foundation for students to propose comprehensive solutions during their major courses and internships. The number of students participating in LFE courses last fourteen years is given in Figure 6. The figure shows the trend is rising upper and students are getting more interested to join in the program to meet their expectations. Last year 3078 students from universities joined in LFE program.

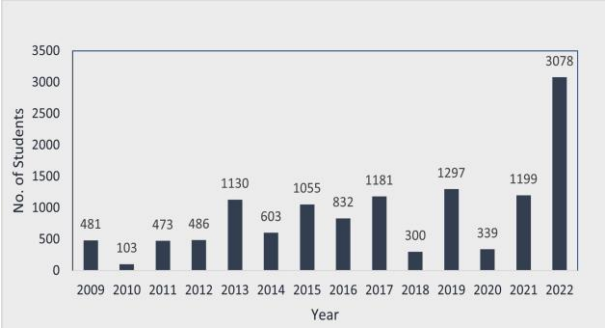


Figure 6: Number of students participating in LFE courses last fourteen years

Analysis of Case Study 2:

The solutions developed by students in their major courses and final year projects have showcased the potential of academia-industry collaboration in addressing rural industry problems. These solutions, ranging from low-cost mechanization to eco-friendly solutions, have had a positive impact on rural industries, enhancing productivity and sustainability. The before-and-after photos of implemented solutions demonstrate tangible improvements in rural industry practices, providing evidence of the transformative outcomes of this approach.

Impact on Students:

Experiential learning through LFE empowers students to transcend traditional classroom boundaries and gain practical insights into the real world. This exposure nurtures empathy, adaptability, and critical thinking, aligning with the evolving expectations of students who seek meaningful and hands-on learning experiences. By actively engaging with industry-specific problems, students develop a deeper understanding of industry requirements and are better prepared to meet the demands of a

rapidly changing job market. Figure 7 illustrates fourteen years trend of students entering industry by schools within the university and it is showing the trend is rising dramatically. It proves this model able to meet the expectations of students at any period.

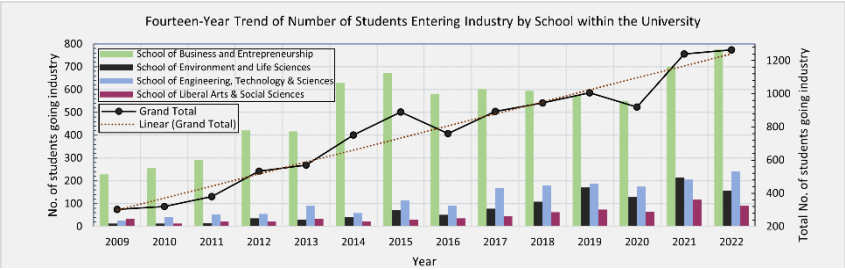


Figure 7: Trend of number of students entering industry by schools within university

Moreover, students interested in publications have also gotten advantage of this model. The model also promotes students to publish their works and Figure 8 is showing the number of publications by students last three years increased a lot.

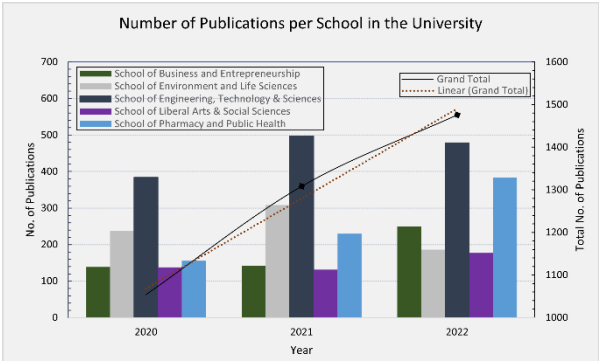


Figure 8: Number of publications from students per school in university

Impact on Industry:

The solutions devised by students in response to rural industry problems exemplify the transformational potential of academia-industry collaboration. By tapping into the innovative ideas and problem-solving skills of students, industries benefit from cost-effective and sustainable solutions that enhance their productivity and competitiveness. Moreover, industry personnel engaging with academia fosters an ecosystem of knowledge exchange, research collaboration, and talent development, ensuring that industry expectations are met with fresh perspectives and relevant skills.

Overall, the proposed approach of aligning academia and industry through experiential learning positively impacts the adaptability of both students and industry to changing expectations. By bridging the knowledge-skills gap and empowering students with practical expertise, this model not only prepares students for dynamic careers but also contributes to the growth and sustainability of industries, thereby supporting the evolving needs of both stakeholders in the modern landscape.

Impact on Communities:

The LFE program significantly benefits the participating rural communities. As students immerse themselves, they collaborate with locals to address community-specific challenges, introducing innovative and sustainable solutions. This both empowers communities with new problem-solving tools and promotes unity and mutual understanding. Moreover, the union of local knowledge with modern academic approaches leads to comprehensive solutions that provide unique community needs. In the long term, the LFE program stimulates regional development, potentially influencing local infrastructure improvements and policy modifications that align with genuine community needs. This engagement ensures that while students receive invaluable insights, communities benefit from progressive approaches, creating a harmonious growth pathway for all parties involved.

Conclusions

The study provides an innovative model for establishing academia-industry collaboration in developing countries, focusing particularly on rural community engagement. Integrating practical, real-world problem-solving into the academic curriculum helps meet industry and students' expectations in quickly changing worlds. This approach promotes experiential learning and prepares students for their future professional roles. Furthermore, it creates new opportunities for industries. This model proves particularly effective in developing nations, where small-scale rural industries play a significant role. By redefining academic-industry collaborations, universities can contribute more effectively to sustainable development and community empowerment. As such, the study calls for a paradigm shift in education, transitioning from solely knowledge-based curricula towards one emphasizing practical applications and problem-solving skills.

References

Asonitou, S., & Hassall, T. (2019). Which skills and competences to develop in accountants in a country in crisis?. *The International Journal of Management Education*, *17*(3), 100308.

Ayofe, A. N., & Ajetola, A. R. (2009). Exploration of the gap between computer science curriculum and industrial IT skills requirements. *arXiv preprint arXiv:0908.4353*.

Baumann, T., Harfst, S., Swanger, A., Saganski, G., Alwerfalli, D., & Cell, A. (2014). Developing competency-based, industry-driven manufacturing education in the USA: Bringing together industry, government and education sectors. *Procedia-Social and Behavioral Sciences*, *119*, 30-39.

Bayerlein, L., & Timpson, M. (2017). Do accredited undergraduate accounting programmes in Australia meet the needs and expectations of the accounting profession?. *Education+ Training*, *59*(3), 305-322.

Edeigba, J. (2022). Employers' expectations of accounting skills from vocational education providers: The expectation gap between employers and ITPs. *The International Journal of Management Education*, *20*(3), 100674.

Health Nutrition and population statistics. DataBank. (2023, June). https://databank.worldbank.org/source/health-nutrition-and-population-statistics#

Kruss*, G. (2004). Employment and employability: Expectations of higher education responsiveness in South Africa. *Journal of education policy*, *19*(6), 673-689.

Lee, D. M., Trauth, E. M., & Farwell, D. (1995). Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation. *MIS quarterly*, 313-340.

Litecky, C. R., Arnett, K. P., & Prabhakar, B. (2004). The paradox of soft skills versus technical skills in IS hiring. *Journal of Computer Information Systems*, *45*(1), 69-76.

Ponnan, R., & Ambalavanan, B. (2014). Innovations to Broadcasting Curriculum to meet Workplace expectations. *Procedia-Social and Behavioral Sciences*, *123*, 160-169.

Radermacher, A., & Walia, G. (2013, March). Gaps between industry expectations and the abilities of graduates. In *Proceeding of the 44th ACM technical symposium on Computer science education* (pp. 525-530).

Stefanidis, A. (2014). *Undergraduate information systems in the UK: analysing curriculum skills and industry needs* (Doctoral dissertation, Loughborough University).

Trauth, E. M., Farwell, D. W., & Lee, D. (1993). The IS expectation gap: Industry expectations versus academic preparation. *Mis Quarterly*, 293-307.

Acknowledgments

The research is supported by the Department of CSE, Independent University, Bangladesh. Additionally, we would like to express our gratitude to Sher-e-Bangla Agricultural University for their commitment to fostering multidisciplinary research.

Copyright Statement