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Integrating an educational supply chain model in the higher education sector: meeting the 21st century workforce demands in Bangladesh

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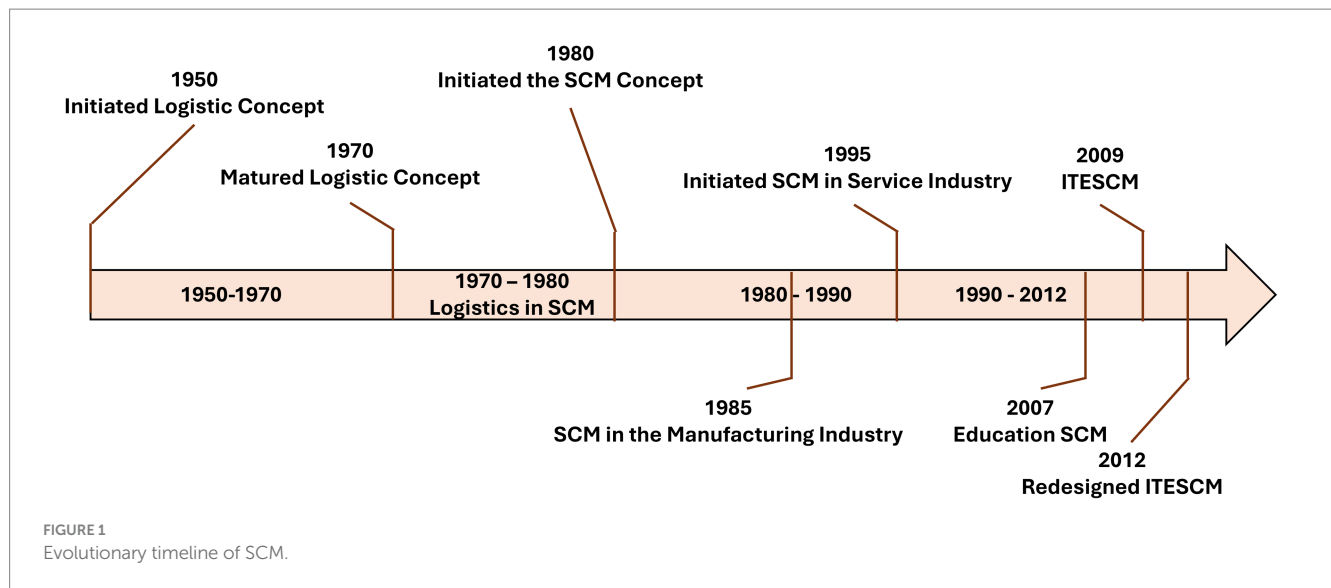
The higher education sector is facing challenges to meet the market demand of skilled workers in the era of the 4th Industrial Revolution (4IR). This study explores educational supply chain management systems in the higher education sector in Bangladesh. Qualitative data were collected through interview with stakeholders in educational supply chain management and analyzed to conceptualize a thematic framework for the educational supply chain. Findings of the study identify key skills required for developing a market-ready workforce and the ways to incorporate the skills in curriculum. The findings also illustrate the changes required in university culture, facilities and faculty capacity development at HEIs. The findings will guide policymakers, faculties, and relevant stakeholders to take strategic decisions about higher education supply chain management to create professionals aligned with the demand in the 21st century.

KEYWORDS

educational supply chain management, 4th industrial revolution (4IR), higher education, workforce skills development, curriculum integration

1 Introduction

Global shifts are compelling Higher Educational Institutions (HEIs) to embrace enterprise models as a strategic approach to enhance efficiency and resource optimization. For a developing economy like Bangladesh, where the higher education system is expanding, integrating Supply Chain Management (SCM) presents a promising opportunity to develop a skilled workforce for the demands of the 21st century. The objective of SCM is to effectively integrate activities within enterprises, to satisfy all stakeholders (Van der Vorst, 2004). SCM in academia, which is called Educational Supply Chain Management (ESCM), seeks to enhance societal values by generating high-caliber graduates and impactful research outcomes. Within the realm of academia, customers themselves are one of the main sources of process inputs. They contribute their physical and mental efforts, thoughts, possessions, and knowledge as inputs to the processes of service (Christopher, 1992). The phenomenon wherein customers also assume the role of suppliers is commonly known as “customer-supplier duality.” The concept of duality suggests that educational supply chains exhibit bidirectional characteristics, wherein production flows occur in both directions (Sampson, 2000). Figure 1 illustrates the evolutionary timeline of supply chain management, highlighting the emergence of Educational



Supply Chain Management (ESCM) in 2007 and the subsequent development of Integrated Tertiary Educational Supply Chain Management (ITESCM) in 2009 (Hye et al., 2014).

SCM is essential for enterprises for optimizing operational processes, enhancing outsourcing strategies, augmentation of profitability, improving customer satisfaction, attaining high-quality outcomes, mitigating competitive pressures, facilitating globalization, recognizing the growing significance of E-commerce, and managing the escalating complexity within supply chains (Habib, 2011). Though the manufacturing sector has been the focus of the majority of SCM-related analysis, Educational Supply Chain Management (ESCM) has been the subject of a few studies. According to Ballou (1978), one of the primary objectives of ESCM is to enhance the welfare of the final consumer or the broader community. For attaining this objective, educational institutions must possess a requisite level of understanding of the entities involved in their supply chains, encompassing suppliers, customers, and consumers. To facilitate comprehension of the conceptual framework, Habib and Jungthirapanich (2009b) illustrated a comprehensive perspective of the educational supply chain highlighting the interconnections among various stakeholders, processes, and resources that collectively influence the delivery of education (Figure 2). Raw materials in this supply chain consist of students, in addition to internal and external initiatives. Finished products consist of research outcomes and graduates.

The effectiveness of SCM is contingent upon the efficient collaboration of all parties involved in the supply chain, to achieve favorable results (Habib and Jungthirapanich, 2009a). The current organizational framework of universities does not readily facilitate the implementation of flexibility and prompt responsiveness. However, there exists a notable disparity between the culture prevalent at universities and that observed in industry (Bjerregaard, 2010).

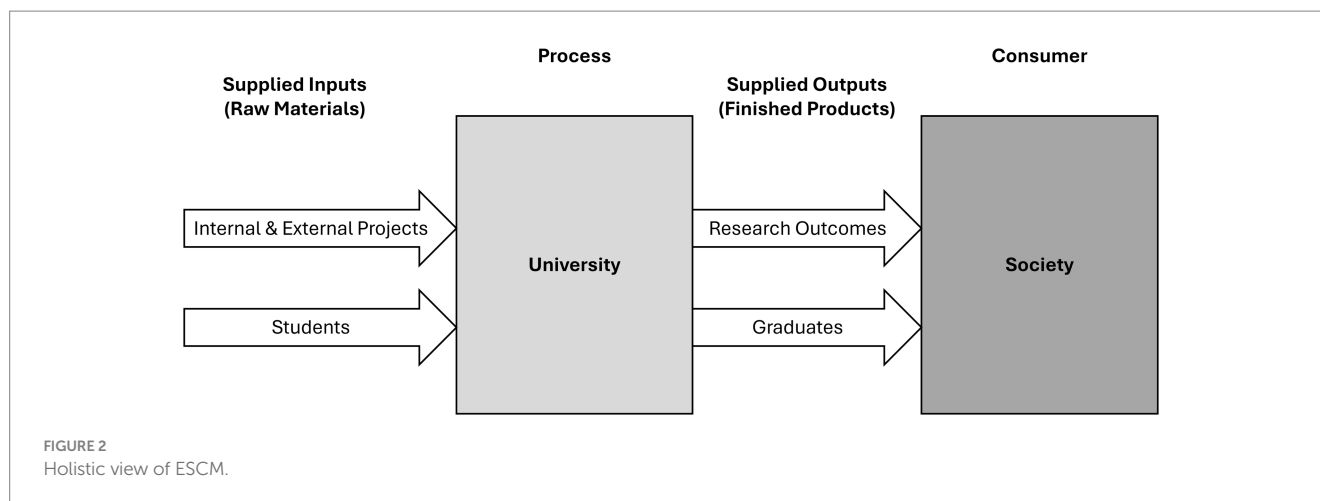
ESCM may function differently across diverse national contexts due to differences in educational policies, governance structures, funding mechanisms, and institutional collaborations (Jauhar et al., 2018). However, there has been limited research on developing suitable models for ESCM considering these diversified factors, particularly in the context of HEIs in developing countries such as Bangladesh. Furthermore, existing research emphasizes the significance of supply chain principles in education but lacks empirical evidence on the integration of ESCM to enhance curriculum design, faculty development,

and institutional infrastructure. The significance of stakeholder engagement among academia, industry, and policymakers in developing a market-ready workforce is still relatively unexplored. Hence, this paper aims to fill this gap by examining practices of SCM in the case of HEIs in Bangladesh. The purpose of this study is to develop a practical plan for integrating ESCM into the current HEIs of Bangladesh through exploring potential adjustments by examining the current conditions from a supply chain perspective. This paper presents the ideas of SCM as a potential option for HEIs to address societal and market demands. The research questions are:

- How can the academic programs of HEIs be developed for creating a 21st century workforce?
- What are the ways of improving faculty's capabilities in this regard?
- How can university culture be developed in terms of developing the 21st century workforce?
- How can the infrastructure of the HEIs be developed for the development of the 21st century workforce?

2 Literature review

Supply Chain Management (SCM) and the Fourth Industrial Revolution (4IR) represent two intertwined paradigms that have been rapidly reshaping the global economic landscape. SCM encompasses the strategic coordination of supplies, information, and finances from the primary supplier to the ultimate customer (Schneller et al., 2023). Simultaneously, the 4IR has ushered in a new era of technological innovation and transformation (Ndung'u and Signé, 2020). Consequently, the Integrated Tertiary Educational Supply Chain Management (ITESCM) model has been designed to illustrate the whole structure of the educational supply chain consisting of both the education supply chain and the research supply chain (Hye et al., 2014). However, the mismatch between the supply and demand of graduates from higher education institutions and industry needs remains a critical issue. Employers claim graduates often lack necessary knowledge, skills, and attitudes required for the workforce (Lee et al., 2023). Therefore, integrating ESCM in tertiary education is significant in the 21st century.



2.1 Integrated tertiary educational supply chain management model

ESCM plays a crucial role in ensuring the quality of graduates and their employability. Therefore, ESCM implementations models are required to address different aspects of education system, as education is key to national development (Ishah et al., 2022). Hye et al. (2014), the ITESCM model has been utilized to identify graduates as the ultimate results of the educational component within the university setting. The education components are composed of two distinct segments, namely Education Development (ED) and Education Assessment (EA). There exist four distinct subgroups, specifically programs establishment (PE), university culture (UC), faculty capabilities (FC), and facilities (FA; Figure 3).

2.2 Four-factor model for integrating SCM into higher education

Rahman et al. (2021) provided a four-factor model for the integration of SCM in HEIs, encompassing elements- Program Establishment, Faculty Capabilities, University Culture, and Facilities or infrastructure (Table 1).

- Programs establishment

The development of academic programs relies heavily on the careful design of the curriculum (Herron and Major, 2002). The process includes purposefully choosing desired educational outcomes, courses, and instructional approaches that effectively equip students with the requisite knowledge and skills (Torrisi-Steele, 2018). Furthermore, there is a growing emphasis on incorporating 4IR related skills into academic programs, such as critical thinking, creativity, digital literacy, and adaptability (Ilori and Ajagunna, 2020; Olaitan and Mavuso, 2022). Universities have started incorporating project-based learning, industry collaborations, and experiential learning opportunities to the students (Zukarnain et al., 2020).

- Faculty capabilities

Faculty training and professional development programs enable educators to stay updated with the latest advancements in their

respective fields and gain expertise in teaching 4IR-related topics (Nwosu et al., 2023). Faculty members may be provided with access to relevant workshops, seminars, and resources (Nwosu et al., 2023; Power, 2019).

- University culture

To effectively prepare students for the 4IR and the changing demands of the workforce, it is important to foster a culture of innovation, entrepreneurship, and adaptability within HEIs (Saulich and Lehmann, 2017). HEIs that foster innovation encourage experimentation, creativity, and risk-taking among students and faculty (Jakovljevic, 2019). By emphasizing entrepreneurship, HEIs instill a sense of ownership, adaptability and responsibility among students (Rusok et al., 2017). Students and faculty embrace new challenges, experiment with new ways of thinking, and learn from failures in HEIs that promote a culture of adaptability (Dawo and Sika, 2021; Niemeyer-Rens et al., 2022).

- Facilities

Al-Maskari et al. (2022) and Ishah et al. (2023) emphasize on technology integration, developing smart campuses, labs, classrooms, and libraries to facilitate knowledge generation and innovation. Harmse and Wadee (2019) highlights the need for ICT curriculum aligned with the requirements of ICT industry. Universities may set up research centers focusing on areas relevant to the 4IR, such as robotics and automation (Mkansi and Landman, 2021; Othman et al., 2016; Taecharungroj, 2023). HEIs may create platforms facilitating collaboration among students, faculty, and industry partners (Badzińska and Timonen, 2020). Industry-Academia collaboration, Industry-Based Learning (IBL), and collaborative PhD programs foster partnerships between universities and industries, facilitating knowledge exchange and practical experience while enhancing professional skills of the students (Rajibussalim et al., 2016; Roberts, 2018).

2.3 Educational management for HEIs

The ESCM model encompasses three decision levels, as presented in Figure 3, which play a crucial role in the university's operational processes (Hye et al., 2014).

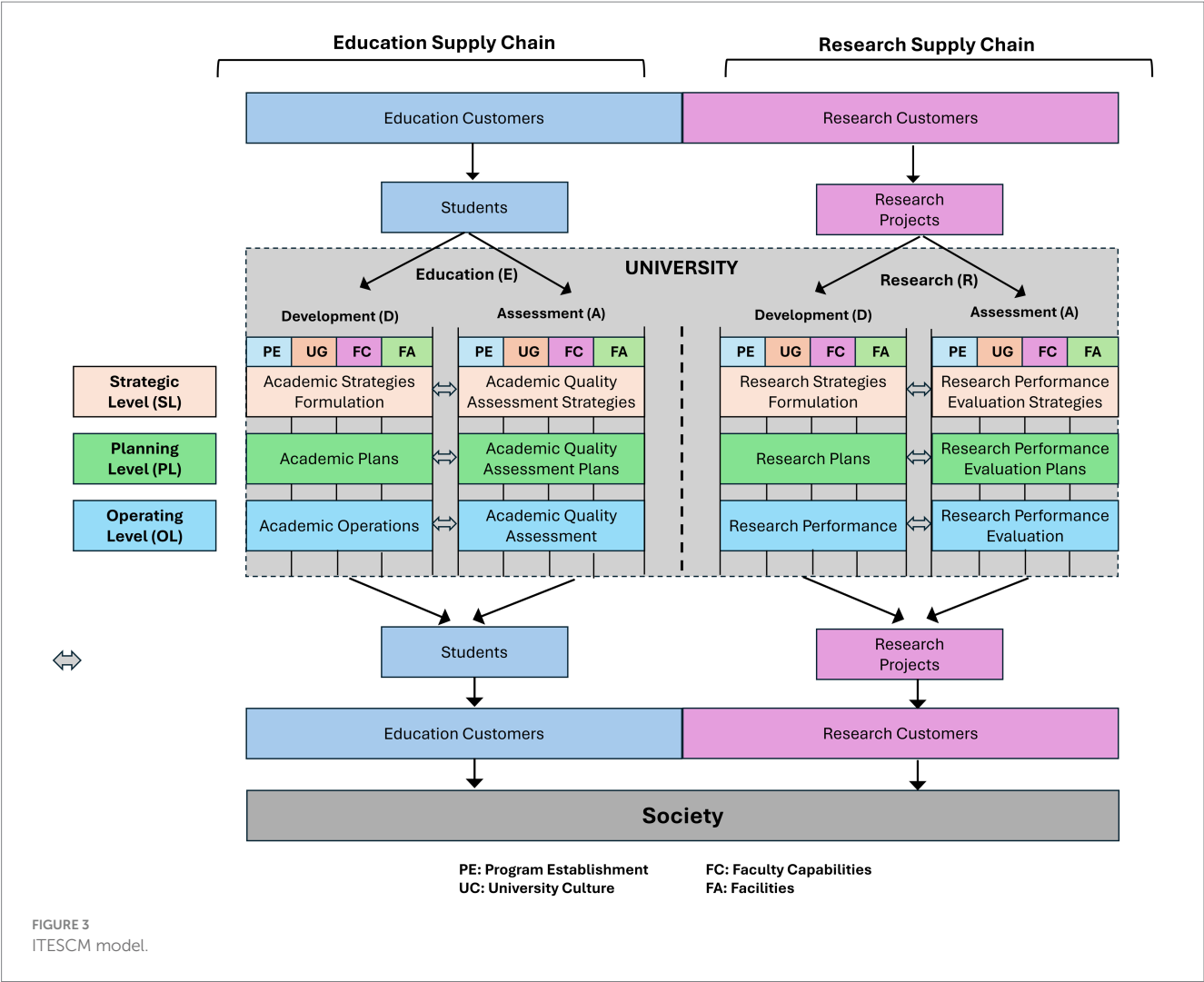


TABLE 1 Four factor model for integrating SCM in HE.

Factors	Involvement in educational supply chain model
Programs establishment (PE)	The objective is to develop diverse academic programs to improve educational and research practices. This includes enhancing teaching-learning methodologies, creating conducive learning environments, fostering practical knowledge and skills through hands-on experiences, visual aids, and field visits, incorporating information and communication technology (ICT) and library resources, and integrating industrial placements, such as internships and employment opportunities.
Faculty capabilities (FC)	The provision of academic services such as instruction, research, creation of learning materials, and curriculum development is crucial for creating an optimal classroom atmosphere, facilitating effective communication.
University culture (UC)	The organizational culture of universities, influenced by various factors, including the administrators or management, geographical location, and social customs, collectively shape the cultural environment within the universities.
Facilities (FA)	The presence of IT infrastructure, digital libraries, well-equipped laboratories etc. guarantee the utilization of internet-based education, the integration of advanced online learning technology in classrooms, and the availability of research facilities with convenient access to online resources such as e-books, conference proceedings, and e-journals.

- **Strategic level:** Plans are devised to enhance the production of graduates and research outcomes, focusing on the creation and evaluation of education and research activities.
- **Planning level:** Academic and research plans are developed, including quality assessment plans for both education and research.
- **Operating level:** Academic and research activities, including the assessment of academic quality and research performance, are conducted.

3 Methodology

This study employed a qualitative approach to explore stakeholder perspectives on the integration of SCM in Bangladeshi HEIs. A purposive sampling technique was utilized to choose a total of 15 participants from three stakeholder groups: employers ($n = 4$); educators ($n = 5$) from HEIs; and recent graduates ($n = 6$). This sampling technique facilitated to meet the objectives of the study as

well as to maximize diversity and expertise of participants to incorporate perspectives from diverse institutions and personnel. The study engaged a diverse group of participants including educators, recent graduates, and employers. The educators comprised a representative from the University Grants Commission (UGC), one from the Bangladesh Accreditation Council (BAC), a faculty member from a private institution, a faculty member from a public university, and a faculty member from the National University. The recent graduate participants were three graduates from public institutions, two from private universities, and one from an engineering and technology university. The employer group comprised a banker, a technology specialist, a project manager, and a university professor.

Data was collected through focus group discussions (FGDs) with fresh graduates who are entering employment opportunities, in addition to semi-structured interviews and Key Informant Interviews (KIIs) with academicians and employers. The data collection tools were systematically developed to ensure relevance, validity, and alignment with the study objectives, guided by a literature review that identified essential themes related to ESCM and workforce alignment. These data collection tools were reviewed by two experts in education and supply chain management to ensure their validity, relevance and comprehensiveness.

Furthermore, to enhance the validity of the study, the data was triangulated, comparing and contrasting data from the various participant groups. Additionally, this study employed an inductive approach to systematically organize the gathered data, facilitating the emergence of patterns and themes from the participants' responses. Member checking, or participant validation, was performed where selected participants reviewed the interpretations to verify the accuracy and authenticity of the findings. To ensure reliability, the data analysis process employed a thematic analysis technique grounded in a four-factor model with predefined domains (PE, FC, UC, and FA). Moreover, sub-themes within all domains were identified and refined through iterative analysis until thematic saturation was attained.

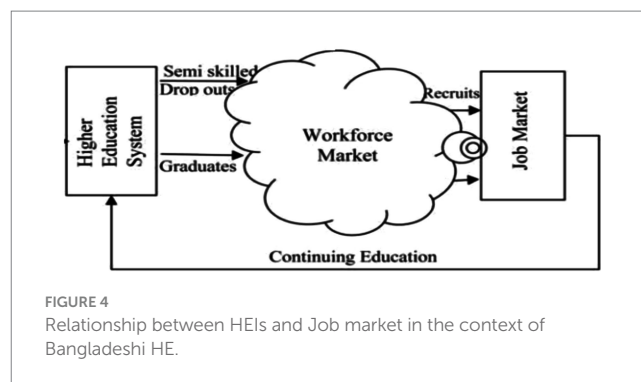
4 Findings

The participants of this study reached a consensus that HEIs in Bangladesh not only facilitate the production of graduates but also contribute to the provision of semi-skilled labor and the generation of students who do not complete their studies. It was found that employees are returning to HEIs for the purpose of pursuing continuing education to enhance their professional development (Figure 4).

The findings on SCM integration within the HEIs in Bangladesh were classified into four domains: program establishment, faculty competencies, university culture, and available facilities, to align with the specific research inquiries and discussed in the following sections:

4.1 Programs establishment

Stakeholders identified key skills and ways of incorporating these skills into the curriculum for developing a workforce ready for the 21st century job market.



4.1.1 Required skills for the 21st century workforce

The participants identified problem-solving, critical thinking, digital literacy, analytical skills, communication skills, technological proficiency, collaboration abilities, negotiating skills, programming knowledge, artificial intelligence, software skills, language skills and the adherence to certain values as the competencies that are deemed necessary for the contemporary workforce in the 21st century.

4.1.1.1 Problem solving and critical thinking skills

Most participants posited that the fundamental proficiencies required for the contemporary workforce in the 21st century encompass knowledge acquisition, skills development, generating innovative ideas, critical thinking, and the capability to analyze and resolve problems. Hence, the academic curriculum should engage the learners to analyze the multifaceted aspects of any issue, and to formulate a strategic approach to resolve it. According to Employer-4 (Project manager),

"It is imperative to prioritize project-based activities and problem-solving assignments in the academic institutions."

4.1.1.2 Creative and analytical skills

Few participants suggested that HEIs might place greater emphasis on developing creativity and analytical skills among students. According to the BAC member,

"While applying acquired knowledge outside the classroom, the student will face some challenges and realize that whatever he has learnt, is not directly applicable in the real field. So, he needs innovation skills and creativity to modify his learnt knowledge in the practical sector. Then he needs to have analytical skills to evaluate how appropriate and relevant his innovation is."

4.1.1.3 Language and communication skills

All participants prioritized effective communication skills, specifically in Bangla and English, among the students. Recent graduates also emphasized implementing English as the medium of instruction. According to a recent private university graduate,

"In private universities, the medium of instruction is English, and for that we get the benefit of developing our communication skills."

Additionally, the participants emphasized skills related to writing resumes. The recent private university graduate extended,

“Some of us cannot even write our own CVs. We need to develop skills on giving our CVs a professional look by using proper words. Although we have learnt the basic format of writing CV at the secondary level, we still don’t know how to write a CV in a unique way, so that it stands out from all other CVs; so that it impresses the employers! Sometimes even the person with higher potential gets rejected at the primary selection due to having an average looking CV. It’s not about what is written in the CV, rather it is about how it is written.”

In addition, the respondents emphasized equipping graduates with proficient email writing abilities. According to a recent graduate,

“We are taught about the basic format of emails, but we don’t know how to write persuasive emails to convince the client that our company can provide better product/ service. So, the university should teach us not only the communication skills, but also the ‘professional communication skills’”.

Policy makers prioritized language proficiency to effectively participate in the global marketplace. According to the BAC member,

“Every graduate, irrespective of arts & humanities, social science etc. discipline, must be fluent in at least Bangla & English.”

4.1.1.4 Technological skills and digital literacy

In the era of technological advancement, foundational technological proficiency was essential for all students, regardless of their academic discipline. According to the faculty member of a private university,

“I am not saying that everyone must learn programming languages, but at least they must have the soft skills related to tech communication. They must know how to communicate using technology, how to share technological ideas etc.”

The participants prioritized the enhancement of digital literacy skills among the students. They specified that the Bangladesh National Qualification Framework (BNQF) has identified digital literacy as a crucial skill for all graduates. Recently graduating students also emphasized the significance of digital skills such as graphics design, content creation on platforms like YouTube, video editing, and audio editing.

Participants also recommended incorporating courses on Microsoft Office applications into the curriculum for all first- and second-year students. Courses on research-related skills, such as SPSS, NVIVO, Zotero etc. should be prioritized in the third and fourth year. Laboratory activities should be incorporated into the teaching-learning process of these software-based courses.

Few participants emphasized that possessing solely offline technological knowledge is insufficient. Rather, the students should acquire proficiency in internet-based applications. According to the private university faculty member,

“Even if we are to learn about Microsoft office works, it should be cloud based; it can be Microsoft office cloud, google docs etc. Office, excel, PowerPoints etc. are important, but internet literacy and internet courtesy are more important.”

4.1.1.5 Programming skills

Experts expressed that to thrive in the contemporary workforce, graduates need programming proficiency. According to the research firm personnel,

“All the learners should have an expertise on basic programming languages like python, C++, and advanced statistics that they will be able to use in their work.”

4.1.1.6 Artificial intelligence and data analytics

Stakeholders emphasized the necessity of utilizing modern technologies such as ChatGPT and other artificial intelligence based generative models. Currently, there was a growing trend toward data-driven automation in educational institutions. According to the research firm personnel,

“Data statistics, data visualization, data presentation, machine learning, are indispensable for navigating the contemporary world. Comprehensive understanding of artificial intelligence is necessary for both teacher and student.”

4.1.1.7 Negotiation skills

Several recent graduates expressed that negotiation skills are often disregarded in most educational institutions, except for business schools. They emphasized that HEIs need to prioritize negotiation skills development among students. According to a recent graduate,

“Even though negotiation skills are taught in the Marketing (BBA/ MBA) courses, these skills are needed in any corporate job. We don’t have any prior knowledge on such skills as: skills for persuading clients, skills for communicating with customers, negotiating skills; yet we need those skills to thrive in the job sector.”

4.1.1.8 Collaborative skills

Participants prioritized acquiring collaborative skills rather than competing skills, to foster harmonious collaboration within workplace settings. According to a recent graduate,

“Peer learning opportunities in the classroom settings help the students learn collaborative skills and inclusiveness.”

Additionally, the employees expressed that teamwork abilities are also necessary. According to Employer 2 (the technology expert),

“In the private sector, there are a lot of tasks assigned to a group rather than to an individual. So, without collaborative skills a graduate will not be able to contribute to the group task.”

4.1.1.9 Interdisciplinary skills

Several participants emphasized possessing transdisciplinary abilities by integrating interdisciplinary learning and prioritizing lifelong learning to equip students with the necessary skills for continuous development in an evolving market.

4.1.1.10 Values

Some participants prioritized ethics and values in higher education. According to a public university faculty member,

"I think human skills and social skills are very important for the graduates to have in this 21st century."

4.1.2 Ways of incorporating these skills in the curriculum

Stakeholders shared ways to incorporate the necessary skills in HEI curriculum ranging from industry-academia collaboration to alumni-engagement in curriculum development.

4.1.2.1 Formal and hidden curriculum

The participants suggested that HEIs can include essential skills through both the formal and hidden curriculum. According to the BAC member,

"Leadership skills and team building skills as an intended learning outcome cannot be brought only through theories of formal curriculum. These skills are important for the job sector in the 21st century, and these should be taught through practical experiences. So, there are two ways: to create a learning environment where all sorts of skills can be incorporated, and curricular experiences."

4.1.2.2 Hands-on activities

Several professionals expressed that the present labor market emphasizes practical, hands-on work. Nevertheless, at the undergraduate level, theoretical courses carry greater significance compared to practical courses. According to the research firm personnel,

"Due to lack of internship and collaboration with any industry, students get detached. All departments should provide internship opportunities for 6 months to get hands-on experiences."

4.1.2.3 University and industry collaboration

Stakeholders emphasized embedding effective academia-industry collaboration within the curriculum. They recommended inviting industry specialists, both domestic and international, to conduct classes. According to the research firm personnel,

"While designing the courses, the departments need to collaborate with the industry. Experts of industry will come to take classes in university and the students will go to industry for internships. Only then, the students will have exposure to the current trends."

By close collaboration with corporations, universities may ensure that their curricula are in line with job market demands. According to Employer 1 (Banker),

"Collaboration between universities and companies is crucial in developing a workforce that meets the 4IR requirement. Universities can incorporate practical training and internships into their curriculum, allowing students to gain hands-on experience."

According to Employer 1,

"Companies can offer mentorship programs and guest lectures, allowing students to learn directly from professionals and gain valuable industry insights."

Employers suggested that universities may establish collaborations between industry professionals and professors to conduct research and develop projects as part of industry-academia partnerships. They recommended that corporate organizations may contribute through offering assistance in the form of guest lectures, seminars, and hackathons, thereby granting students firsthand knowledge of industry challenges and practices.

Participants also recommended that the institutions should provide learners with information on employment opportunities congruent with their respective academic departments. According to a recent university graduate,

"I am a graduate of the English department, but I thought that teaching was the only job sector for me! I was totally unaware of the other jobs that align with my major."

4.1.2.4 Curriculum revision

The stakeholders identified the government, regulatory bodies, industry, employers, and the broader society as stakeholders for curricular needs assessment. Once the needs were identified, they should be translated into measurable outcomes. HEIs are encouraged to align all curriculum elements with these outcomes. According to the BAC member:

"The curriculum developers should ask these sources: Which skills do you want from the graduates of a certain department? The alumni working at various job sectors should be asked- which contents do you think must be included in the current curriculum according to your job experience?"

The integration of elements from the 4IR into an existing academic program was also vital. According to the UGC member,

"Issues like climate change, sustainable development goals, IR 4.0, innovation etc. can be incorporated in any academic course, there is no need to launch separate academic programs for this."

Some participants reported that the Outcome-based Education (OBE) implemented by HEIs through curricular revisions has the potential to facilitate the development of a competent workforce. Nevertheless, participants identified challenges in implementation of OBE at HEIs. According to the BAC member:

"In practice, we are shaping out 'outcomes' from the existing contents, for converting the current curriculum into outcome-based curriculum. But this is not the true essence of OBE! We should start from the need assessment."

4.1.2.5 Content mapping

Few participants argued that it is imperative for the HEIs to thoroughly review and update the materials of the existing courses. According to the research firm personnel,

"There is a latency about what is being taught in the name of the existing courses."

The learning objectives of each course should align with the industry standards and demands. Participants emphasized engaging

stakeholders across job sectors in university settings to facilitate discussions on skills required by the market, drawing upon their experiential knowledge. According to the private university faculty,

“Those days are gone, when only the teachers alone used to make the curriculum. The universities must involve people from the outside.”

4.1.2.6 Reforming policies

Participants opined that the recruitment process of government jobs in Bangladesh needs to prioritize skills rather than the mere retention of memorized facts. According to the public university faculty,

“Unless government changes the recruitment process (for govt. jobs), universities cannot take the students out of memorizing the BCS (Civil Service) guidebooks.”

4.1.2.7 Career clubs

Some of the participants emphasized the importance of career clubs which may arrange workshops related to outsourcing, freelancing, entrepreneurship etc.

4.1.2.8 Internships

Participants argued that, though an internship does not guarantee alignment between one's academic career and the subsequent employment sector entered, however, internships provide individuals with the opportunity to develop the capacity to effectively adjust to specific circumstances, enabling their transition into the job sectors. According to Employer 3,

“Integration of experiential learning opportunities, such as internships, co-op programs, and industry partnerships bridge the gap between theory and practice.”

4.1.2.9 Prioritizing laboratory activities

Laboratory courses, including courses on artificial intelligence, website development, algorithms, data structures etc. were identified as vital to meet the demands of 4IR. Participants argued that the credit for the lab courses must be at least as high as that of the theoretical courses. According to the research firm personnel,

“There should be full 3 credit courses for lab work, rather than having less/ 1.5 credit by being a “tail” of their theoretical courses, because students don't take the sessional courses seriously as these courses have less credit.”

4.1.2.10 Alumni feedback

Participants emphasized assessing the proficiency acquired by graduates within a span of 5 to 10 years after their graduation, to ascertain the extent to which graduates can effectively use the information and skills acquired from academic institutions in their respective industries. According to the private university faculty,

“We need to ask them (employers)- ‘Are the skills and knowledge that we teach our graduates useful to run your company? Which more skills do you expect?’”

It is imperative to establish a comprehensive feedback mechanism that encompasses input from both graduates and industry stakeholders. According to the public university faculty,

“At 3 years' interval, the employer, the current students and the alumni should collaborate and compile the emerging thoughts & issues to review curriculum.”

4.1.2.11 Inquiry-based learning

A limited number of respondents mentioned inquiry-based learning to enhance the competence of graduates. According to the national university faculty member,

“The faculty must shift from the lecture method to an inquiry-based approach. They will play the role of a facilitator so that the students may learn through collaboration and can practice higher order thinking.”

4.2 Faculty capabilities

Along with program establishment and curricular changes, stakeholders shared that faculty awareness of current job market trends, and their pedagogical and technological skills are also key factors of developing a skilled workforce.

4.2.1 Awareness of current job market demand and trends

The findings of the study reveal that the university faculties persist in their teaching for years yet lack awareness of contemporary market demands and trends due to lack of industry collaboration. HEIs can organize regular workshops for faculty to enhance their collaboration with alumni and industry. According to the research firm personnel,

“The faculties are seen to use their 10 years old class notes to teach in the class with 15 years old examples as they are not up to date.”

4.2.2 Motivating skills

Participants emphasized that teachers could inspire students, fostering a sense of self-assurance and instilling the belief that they had the capacity to effectively address any challenges they encounter.

4.2.3 Pedagogical strength

Participants emphasized assessing the proficiency acquired by graduates within a span of 5 to 10 years after their graduation, to ascertain the extent to which graduates can effectively use the information and skills acquired from academic institutions in their respective industries. According to the BAC member,

“There needs to be a checklist for monitoring pedagogical trajectory, including: what resources they need to achieve the aimed outcomes? Which resource person can help the teacher in this regard? By which time will the teacher aim to achieve the targeted goals? How to monitor the development of the teacher? In this way, HEIs can ensure the continuous pedagogical development of faculty members.”

4.2.4 Technological skills

Participants also highlighted that some veteran faculty members lack technological skills. HEIs should take necessary steps for integrating technology into educational systems. HEIs need to foster a trust and facilitate opportunities to encourage collaboration and learning for faculty members so that junior yet technologically proficient colleagues can share their skills with veterans.

4.3 University culture

Stakeholders emphasized the importance of a dynamic, student-centric, collaborative university culture for supporting the development of students and a skilled workforce to meet the market demands.

4.3.1 Student-centric approach

The findings emphasize the significance of student-centered pedagogy in connecting academic learning with real-world applications. This highlights the necessity for faculty development in digital pedagogy, allowing institutions to establish a dynamic learning environment that corresponds with modern educational and workforce requirements. The BAC member emphasized,

“This generation is the technology-based generation. And the teachers must learn to transform themselves technologically so that they can connect with the current generation. They need to have students at the center of all their activities.”

4.3.2 Supportive environment

HEIs should facilitate learning experiences that involve real-world scenarios, collaborative work environment for students that fosters personal and social skill development through active engagement. It is imperative for the HEIs to organize a variety of co-curricular activities, sports events, research training sessions, seminars, and job fairs throughout the academic year.

4.3.3 Career orientation

HEIs must implement compulsory workshops to foster a career focused mindset in students and the required skills for job placement including professional email writing, CV writing, content creation, research, report writing, digital marketing, and coding. According to a recent graduate of a private university,

“We have our major courses and general courses; but we also need to have some ‘professional development courses’ for all the departments.”

4.3.4 Introducing dual majoring

The participants recommended the implementation of dual majoring by enrolling in courses from multiple disciplines according to their interests, at no additional cost, consequently developing multidisciplinary knowledge and skills. According to a recent university graduate,

“Though I am from the English department, I got the opportunity to take a course on Architecture; in which I have learnt about woodcraft which I got very fond of, and one may pursue a start-up/entrepreneurship based on this crafting skill.”

4.3.5 Avoiding diploma disease

The study revealed that frequently, students attend a department solely to earn a certificate, rather than to attain the intended learning outcomes. Participants expressed that in most cases students are unaware about the correlation between curriculum content and its practical application in the labor market.

4.3.6 Interdisciplinary collaboration and entrepreneurship

The stakeholders emphasized that by integrating emerging fields and technologies into the curriculum, fostering a culture of innovation and entrepreneurship within the curriculum, and encouraging interdisciplinary collaboration, students can acquire the technical expertise and adaptability necessary in the contemporary workplace.

4.3.7 Recruitment of adjunct faculties

The stakeholders emphasized recruiting guest faculties from the industry with specialized knowledge. According to the research firm personnel,

“The way the guest teacher with expertise on hands-on-activities from the industry will motivate the students, will be more efficient than that faculty who has been teaching theory for 10 years with no firsthand experience.”

4.3.8 Redefining teacher recruitment process

The findings revealed that both political hiring and hiring based on CGPA have a detrimental impact on the recruitment of qualified academic members. Instead, HEIs should prioritize pedagogical expertise of faculty members and student feedback in recruitment and tenure. According to the research firm personnel,

“While recruiting teachers, regular seminars should be arranged each week, where the candidates will talk about their research activities. The students will be invited to provide feedback. As a result, only those will be recruited who can connect with the students and impress the existing faculties with their research.”

4.3.9 Collaboration with local organization

The findings suggested that HEIs may form collaborative agreements with local organizations to offer students practical training opportunities such as research initiatives, mentorship programs, or the establishment of on-campus incubation centers to facilitate student engagement in entrepreneurial endeavors as preparation for the industry's requirements.

4.3.10 Teachers' evaluation and audit

Participants also proposed implementing an auditing system at HEIs to enhance the proficiency of teachers. According to the research firm personnel,

“Fellow teacher may sit at the back of the classroom to audit classes. The audit must be meaningful, not only for the namesake.”

HEIs should mandate the implementation of this audit system for all individuals. The personnel extended,

“There must be a provision that if any teacher does not go through the audit system, his/her promotion, salary increment, research fund, consultancy license etc. will be withheld or he/she will have to show cause or lose job. Only this will ensure faculty accountability.”

The incorporation of feedback from industry professionals and students was also identified as crucial in the audit procedure. The research firm personnel emphasized,

“The industry personnel should be asked if the course materials aligned with the current demand of the 21st century job sector. The teacher will improve the course materials if the industry experts find it outdated.”

4.3.11 Research orientation

This study suggested that it is crucial to offer the course to a teacher who has undertaken research in the specific field of the course. According to the research firm personnel,

“A good researcher is always a good teacher of the course related to his research area. Because he already knows about the current trends of that subject area, or the future of it.”

It is imperative to establish a mandatory requirement for the teachers across all HEIs to engage in research activities, accompanied by a stipulation that failure to comply will result in the denial of promotion opportunities.

4.3.12 Normalizing teacher training at HEIs

HEIs should provide training for teachers to improve their Technological Pedagogical Content Knowledge (TPACK) capabilities.

4.3.13 Dynamic culture

HEIs must possess the capability to adapt to sudden and dynamic changes to remain competitive in the global arena. According to the UGC member,

“At first, we need to understand what our target group wants. The university should deliver all the infrastructural facilities that our students/ target groups want. If we can do so, we will be able to cope with any challenge of any century, be it 21st or 22nd century.”

4.3.14 Addressing students' demands

To facilitate the fulfillment of students' aspirations in the 21st century, it is imperative to establish a robust student feedback system that holds university faculty accountable for their performance. According to the UGC member:

“I think the question should not be about the 21st century, rather it should be about the “present time”. What are the needs of the present time? The most important indicator of the needs of the present time is the students. The students will say what they seek & demand in the present time.”

4.3.15 Research funding

The administration should offer financial assistance for projects, theses, and internships. According to the research firm personnel,

“In the undergraduate level projects, internships, thesis etc. students do not work seriously as there is no payment for their work. Even if they have to go to collect data, they need to spend money from their own pocket. Due to lack of financial support their motivation decreases.”

The findings suggest that the administration should allocate research grants to committed scholars, rather than favoring certain personnel through nepotism.

4.3.16 Job fairs and professional programs

HEIs should organize programs that cater to diverse professional pathways, such as government jobs, corporate positions, entrepreneurship, freelancing, teaching, and research opportunities in academia. According to a recent graduate from a public university,

“The government jobs exams are based on general knowledge, global and national politics etc. The career programs arranged by the university administration may provide this knowledge to the students who aspire for government jobs. Thus, even a student with no academic background on these, will be able to learn about these things which are needed for their job preparation.”

Furthermore, the participants contended that these professional programs should be led by experts in relevant fields. The public university graduate emphasized that,

“A successful freelancer will teach about freelancing, a BCS (Civil Service) cadre will give a talk on preparation for government job exams, a successful entrepreneur will teach about entrepreneurship, a banker will teach about banking etc.”

HEIs should provide support and resources to assist students in their job search endeavors. According to a recent graduate,

“Most of us don't even know how to search for a job! The administration should make an online profile for each student where his/her achievements will be recorded. In these profiles there should be notification for job circular according to the interest areas, expertise and achievements of the students.”

4.3.17 Removing inter-university discrepancies

There is a contention that most of the students having academic excellence study at public universities; students of lower socioeconomic status and lower academic achievement tend to enroll in the national university, while students of higher socioeconomic status and lower academic achievement choose to enroll in private institutions. To address such discrimination, all HEIs should recruit high-quality educators, ample laboratory facilities, well-designed classrooms, and other necessary resources to ensure the provision of excellent education.

4.4 Facilities

Stakeholders emphasized expanding cutting-edge facilities to support student learning and development at HEIs.

4.4.1 Computer laboratory

The participants suggested adequately equipped computer laboratories for students of each academic year across all departments of HEIs. According to BAC member,

“Not mere facilities, but HEIs need to ensure adequacy and access. There are many laboratories where students don’t get the access to the instruments.”

4.4.2 Technology-enabled classrooms and audio-visual support

The participants emphasized the provision of microphones within the classroom setting to ensure effective verbal communication. Audio-visual supports operationalize theoretical concepts within real-world scenarios through experiential learning. According to the public university faculty member,

“To create a technology-enabled classroom, there should be projector, multimedia, menti, Socrates etc. online tools; and the teachers and students should be oriented with these online platforms.”

4.4.3 Online library and E-resources

The participants prioritized online libraries over physical libraries. They opined that the integration of internet facilities inside the classroom environment would enable students to access resources conveniently during instructional sessions. According to the BAC member,

“There should be automation in libraries where one can see which books are available and access those from home.”

Participants also emphasized the establishment of e-resources, e-books, and e-journals to facilitate remote studying. The UGC has initiated the University Digital Library (UDL), which involves the participation of several universities as members. The UGC member expressed that,

“At present students love to read materials virtually on screens rather than on paper. We have to renovate the library system in such a way that the students feel ease of access and motivated to use library services.”

Stakeholders also emphasized granting unrestricted access to internationally reputed research papers and journals for students, as the financial burden associated with obtaining such resources is considerably high for them. According to the public university faculty,

“There should be agreements between libraries and prominent journal publishers so that their updated publications be available at the libraries, enabling students to get access through their institutional id and password.”

4.4.4 Infrastructural and professional facilities

The findings revealed a lack of certain facilities at HEIs, and the administration should provide logistics support, classroom, computer & high-speed internet facilities, constant teachers training, regular communication with ministry for funds, arrange resource persons for

training, provide research fund, incentives, promotion, and study leave to teachers.

5 Discussion

The study highlights the significance of HEIs in preparing graduates to adapt to the ever-changing demands of the job market. Four significant areas - program design, faculty capabilities, university culture, and facilities - are identified as essential components in incorporating SCM to produce a workforce that can handle the challenges of the 21st century.

The participants stress the need for academic programs to be aligned with market demands, which is consistent with existing literature that stresses the significance of a flexible and responsive curriculum that addresses the competencies required by the job market (AlKahtani and Syed, 2018; Anastasiu et al., 2017). Findings also revealed that incorporating industry-specific skills into curricula can enhance the employability of graduates. Furthermore, the study prioritizes hands-on activities and industry alliances for skill development, which is in line with research that highlights the significance of real-world projects (Joshi and Kulkarni, 2022; Navalgund et al., 2021).

This study found the role of faculty in shaping the 21st-century workforce crucial. It is imperative for faculty to possess a diverse set of skills, including technological proficiency and awareness of market demands. This is in line with previous research that emphasizes ongoing professional development for educators to stay updated with industry trends (Alexiou-Ray and Bentley, 2015; Short and Keller-Bell, 2019). Furthermore, the findings emphasized a combination of industry experience and pedagogical strength for faculty to effectively impart 21st-century skills, that aligns with the findings of Ghafar (2020).

The study highlights the significance of university culture on student performance and the incorporation of SCM. This is in line with existing research, which stresses the importance of a student-focused approach, interdisciplinary collaboration, and a supportive environment (Marbun et al., 2020; van der Velden, 2016). The findings concur with the argument that promoting an entrepreneurial culture within HEIs enhances workforce development (Mansor and Othman, 2011). However, there are mixed findings regarding the role of job fairs in university culture, with some claiming that they have a limited impact on actual skill development (Tholen, 2019).

The importance of technological infrastructure in HEIs is a recurring theme of the findings, which include computer laboratory, audio-visual support, technology-based classrooms, and online resources. This aligns with the argument that investing in technological facilities enhances the learning environment. However, concerns have been raised that overreliance on technology might hinder the development of interpersonal skills that are essential for the workforce (Almpanis, 2015; Limani et al., 2019).

Therefore, this study adds to the existing literature on preparing graduates for the 21st-century workforce through the integration of supply chain management in HEIs. While there is a significant amount of overlap with existing research, the study’s nuanced findings highlight specific strategies, such as hands-on activities, industry

TABLE 2 Framework for education development (ED) and education assessment (EA) in HEIs.

Decision levels	Programs establishment	University culture	Faculty capabilities	Facilities
Strategic				
Planning				
Operating				

alliances, and faculty development, that can be tailored to individual institutional contexts.

The HEIs can use the following Table 2 to implement effective SCMs through need assessment and strategic planning and implementation toward achieving identified goals. Table 2 can be used as a framework for both ED and EA at the HEIs.

6 Limitations of the study

Due to the limited scope of this study, stakeholders' perspectives from different HEIs like engineering and technology universities and TVET institutions have not been captured. However, there is an opportunity of conducting case studies for individual HEIs; exploring current students' and diverse employers' perspectives to determine the industry needs; identifying the scopes of academia-industry collaboration which has not been explored in detail in this study.

7 Conclusion

This study presents a model for higher education that emulates the supply chain framework utilized in business operations. It acknowledges the importance of customized academic programs aimed at addressing market and societal demands from an educational supply chain perspective. The findings of this study offer valuable insights for policymakers and other relevant stakeholders in relation to the adoption of educational supply chain management in HEIs in developing countries like Bangladesh. HEIs can utilize the proposed framework for assessing their unique needs and strategic planning for program development and evaluation across the four domains of SCM integration, namely program development, faculty capacity, university culture and facility development. Skills identified by stakeholders in this study, along with the proposed strategies to integrate those in program curriculum can guide HEIs in developing a skilled workforce to meet the need of 4IR. Future research may focus on developing structured pedagogical methods to achieve the identified skills. Finally, the suggested framework requires a further evaluation across various country contexts. Hence, future research is also recommended to examine its flexibility and effectiveness across various educational contexts to ensure its greater adoption and robustness.

Data availability statement

The raw data supporting the findings of this study will be made available by the authors upon reasonable request, without any undue restrictions.

Ethics statement

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SC: Conceptualization, Data curation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. RS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. MA-A: Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft. MS: Resources, Software, Validation, Visualization, Writing – review & editing.

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