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Developing Multidisciplinary Perspectives for Reviewing the BSc Computer Science Curriculum: Approaches, Opportunities and Challenges

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Abstract

This paper explores the approaches, opportunities, and challenges involved in developing multidisciplinary strategies for reviewing the Bachelor of Science (BSc) in Computer Science (CS) at the State University of Zanzibar (SUZA) in Tanzania. In an era where technological advancements are rapidly evolving, the review process of BSc CS programs must incorporate diverse perspectives, ranging from technology and engineering to business, ethics, and social sciences. The paper outlines various methodologies for integrating multidisciplinary approaches into curriculum development, including collaboration with industry experts, incorporation of interdisciplinary knowledge, and the adoption of modern teaching tools as drives innovation across diverse fields. A total of 122 diverse stakeholders participated in the study, during three stages self-assessment, tracer study, and stakeholder meeting to improve the curriculum. Data were analysed quantitatively using statistical methods to generate numerical summaries and identify patterns, and qualitatively through thematic analysis to interpret meanings, explore experiences, and provide deeper contextual understanding. The findings highlight opportunities such as improved relevance of the curriculum to the job market, encouraging innovation, and enhancing student employability. Conversely, the paper discusses challenges such as resource constraints and the difficulty of balancing multiple disciplines within a coherent academic framework. Eventually, the study aims to provide insights for Higher Learning Institutions (HLIs) in creating a robust and adaptive CS program that equips graduates with the necessary skills to address complex global challenges. This paper recommends adopting sustained multidisciplinary collaboration, strengthening industry partnerships, investing in resources, and continuously updating curricula to balance disciplines effectively, ensuring graduates remain adaptable, innovative, and aligned with evolving technological and societal demands.

Keywords: *Multidisciplinary, Competences, Computer Science, Reviewing curriculum processes*

Introduction

This paper explores the approaches, opportunities, and challenges in integrating multidisciplinary perspectives into the review of the BSc Computer Science (BSc CS) curriculum at the State University of Zanzibar (SUZA). As computing increasingly intersects with other domains, curriculum reform is essential to prepare graduates for complex, real-world environments. The study employs a comprehensive methodology that includes academic self-assessment, tracer study of graduates and employers, as well as benchmarking with peer institutions. Findings highlight both the benefits, such as enhanced employability and relevance, and the barriers, including institutional resistance and limited resources. The paper offers insights to guide Higher Learning Institutions (HLIs) in developing dynamic, future-oriented CS programs.

In today's interconnected world, computer science (CS) extends beyond traditional software development, requiring graduates to collaborate across disciplines and address real-world problems holistically. The rise of data-driven decision-making, industrial automation, and digital transformation has created demand for computing professionals who combine technical expertise with interdisciplinary problem-solving skills. As a result, higher learning institutions (HLIs) are increasingly integrating multidisciplinary perspectives into CS curricula, through joint programs, interdisciplinary modules, and collaborative projects (Peracaula-Bosch & González-Martínez, 2024; Guzdial & Tew, 2010).

Computational thinking has emerged as a universal skill applicable across fields such as biology, economics, and social sciences, reinforcing the value of integrating computing with other disciplines. Multidisciplinary curricula aim to develop not only technical competencies but also communication, ethical awareness, and teamwork skills essential for complex, hybrid work environments. Despite this trend, implementation remains uneven, particularly in developing regions, due to rigid curricular structures, limited faculty training, and insufficient institutional support.

Curriculum review serves as a critical mechanism to evaluate program relevance, rigour, and responsiveness to societal and professional needs. Successful interdisciplinary curriculum development relies on faculty engagement, administrative support, and frameworks that enable cross-department collaboration (Christiansen, Juebei & Xiangyun, 2023). Signature pedagogies in CS, as described by Laurillard (2013), encourage experiential learning through problem-solving scenarios reflecting real-world practice. Examples include integrating ethics into technical courses, service-learning projects, and industry partnerships to provide hands-on experience. The curriculum review is a continuous, reflective process that ensures CS programs remain agile, relevant, and capable of equipping graduates with diverse, interdisciplinary skill sets demanded by modern employers. Engaging stakeholders such as faculty, alumni, and industry partners strengthens this process and fosters educational transformation aligned with global and local workforce needs.

Multidisciplinary integration in computer science (CS) education combines computing principles with methods from other fields, enhancing students' problem-solving skills and preparing them for careers where computing intersects with business, health, education, and the arts. Leading higher learning institutions have implemented thematic tracks within CS degrees, such as computational media, social computing, and data science, which blend computing with disciplines like cognitive science, psychology, and digital media (ACM & IEEE-CS, 2013; Adeyemi et al., 2023).

Co-teaching models, where faculty from different departments jointly design and deliver courses, expose students to diverse pedagogical approaches and foster interdisciplinary inquiry (McKown, 2021). Project-based learning further supports integration by involving students in real-world, cross-domain projects, often in collaboration with industry or NGOs, enhancing experiential learning (Gorlatova et al., 2023). Human-Computer Interaction (HCI) exemplifies a multidisciplinary subfield, combining CS, psychology, design, and ergonomics to develop user-centered technologies, requiring students to understand human behavior, user needs, and design alongside programming (Pittarello & Pellegrini, 2017).

Despite these successes, challenges persist, including faculty unfamiliarity with other disciplines and rigid curricula that limit flexibility. Effective multidisciplinary integration demands institutional commitment, innovative teaching models, and partnerships to foster collaboration, broaden student learning, and align education with real-world applications.

Implementing multidisciplinary education in computer science offers significant benefits but faces institutional, pedagogical, and cultural challenges. Structurally, many universities operate in disciplinary silos, making collaboration across departments difficult due to scheduling conflicts, credit allocation, and differing assessment standards (Katcherovski, 2024). Without leadership support and enabling policies, faculty may be discouraged from pursuing interdisciplinary initiatives. Staff resistance is common, as instructors may feel unprepared to teach outside their primary field or fear a dilution of technical rigor. Professional development and team-teaching models can help but require time and institutional backing.

Resource constraints further limit implementation, particularly in low-resource higher learning institutions, where funding, infrastructure, and staff training are insufficient. Interdisciplinary courses often face low enrollment, reducing administrative and financial incentives (Photen & Pfirman, 2007). Pedagogical challenges also arise in curriculum design, as poorly integrated courses can confuse students or fail to meet learning outcomes, emphasizing the need for collaboration among curriculum designers, subject experts, and industry stakeholders.

Cultural barriers, including entrenched disciplinary norms and communication styles, hinder cross-field collaboration, reducing teamwork and the integration of diverse perspectives (Roberts, 2011). Strategies such as interdisciplinary midpoints, team-teaching, regular curriculum reviews, and recognition systems for faculty can promote multidisciplinary adoption and foster an institutional culture supportive of cross-disciplinary learning (Katcherovski, 2024; Roberts, 2011).

Research on multidisciplinary computing education has expanded over the past two decades, yet gaps remain, especially in resource-limited developing countries. Most studies focus on case studies, theoretical frameworks, or isolated innovations, with limited exploration of integrated tools like self-assessment, tracer study, and benchmarking for curriculum reform. Self-assessment encourages reflection among academic staff, but few studies examine its role in multidisciplinary curriculum development or faculty preparedness. Tracer study track graduate outcomes but are rarely used to evaluate interdisciplinary readiness. Similarly, benchmarking against peer institutions can inform best practices in curriculum design, teaching methods, and learning outcomes, yet it is often informal and undocumented, reducing its effectiveness in guiding systematic curriculum improvements (Andrade & Valtcheva, 2009; Adeyemi et al., 2023).

This study aims to address these gaps by adopting a holistic methodology that combines self-assessment, tracer study, and benchmarking to inform the review of a BSc CS program. By involving multiple stakeholders and triangulating data from various sources, the study seeks to provide a comprehensive understanding of the opportunities and challenges in developing multidisciplinary perspectives. In doing so, the study contributes not only to academic discourse but also to practical strategies for curriculum reform in diverse educational contexts. Therefore, this study seeks to answer the following questions.

1. How can self-assessment, tracer study, and benchmarking be effectively integrated to inform the review and improvement of a BSc CS program?

2. What are the key opportunities in developing multidisciplinary perspectives within the BSc CS curriculum, as identified by multiple stakeholders?

Materials and Methods

This study adopts a qualitative and participatory approach to explore the approaches, opportunities, and challenges in developing multidisciplinary perspectives for reviewing the BSc CS curriculum. The methodology is structured around three key components: self-assessment by academic staff, tracer study involving graduates and employers, and benchmarking against other institutions. Each component provides a unique lens through which to understand the current state and future possibilities for curriculum development.

Context and Participants

The study was conducted physically and online, involving 125 participants through four key components: self-assessment, tracer study, benchmarking, and stakeholder meeting. A structured self-assessment questionnaire was administered to 25 academic staff from various departments at SUZA to examine the extent of multidisciplinary integration, teaching practices, and collaboration. The tool combined Likert-scale items and open-ended questions to capture both quantitative and qualitative insights on curriculum flexibility, professional development needs, and instructional approaches.

A tracer study involving 50 graduates and 15 employers was conducted to assess curriculum relevance and workforce preparedness. Online surveys and interviews, focusing on employment status, skills application, and competency gaps were used. Employers provided additional perspectives on graduate performance and the demand for interdisciplinary skills. Benchmarking compared the program with selected local and international universities, alongside ACM and IEEE standards, to identify best practices in curriculum design, course structure, and multidisciplinary integration. In addition, SWOT analysis synthesized findings from all methods to evaluate strengths, weaknesses, opportunities, and threats. This comprehensive approach ensured an evidence-based assessment to guide curriculum improvement, enhance relevance, and support long-term program sustainability.

Curriculum Development Processes

The process of reviewing the BSc CS curriculum content was vital for maintaining its relevance in a constantly evolving technological landscape. Initially, a departmental development team was formed to assess the existing curriculum against industry trends, academic standards, and societal needs. The review process, supported by the Higher Education for Economic Transformation (HEET) project, aimed to strengthen the learning environment and improve labour market alignment of priority programs at beneficiary higher education institutions, as well as enhance the management of the higher education system in Tanzania.

The existing content was mapped to cover essential technical skills and align with emerging fields like AI, data science, and cybersecurity. Self-assessments identified gaps, especially in interdisciplinary areas such as business, ethics, and health computing. Tracer studies and benchmarking against global best practices contextualized the findings. These insights were synthesized into a Curriculum Review Report, forming the basis for further discussions and decisions on curriculum redesign. Figure 1 shows overall the process followed during the curriculum review.

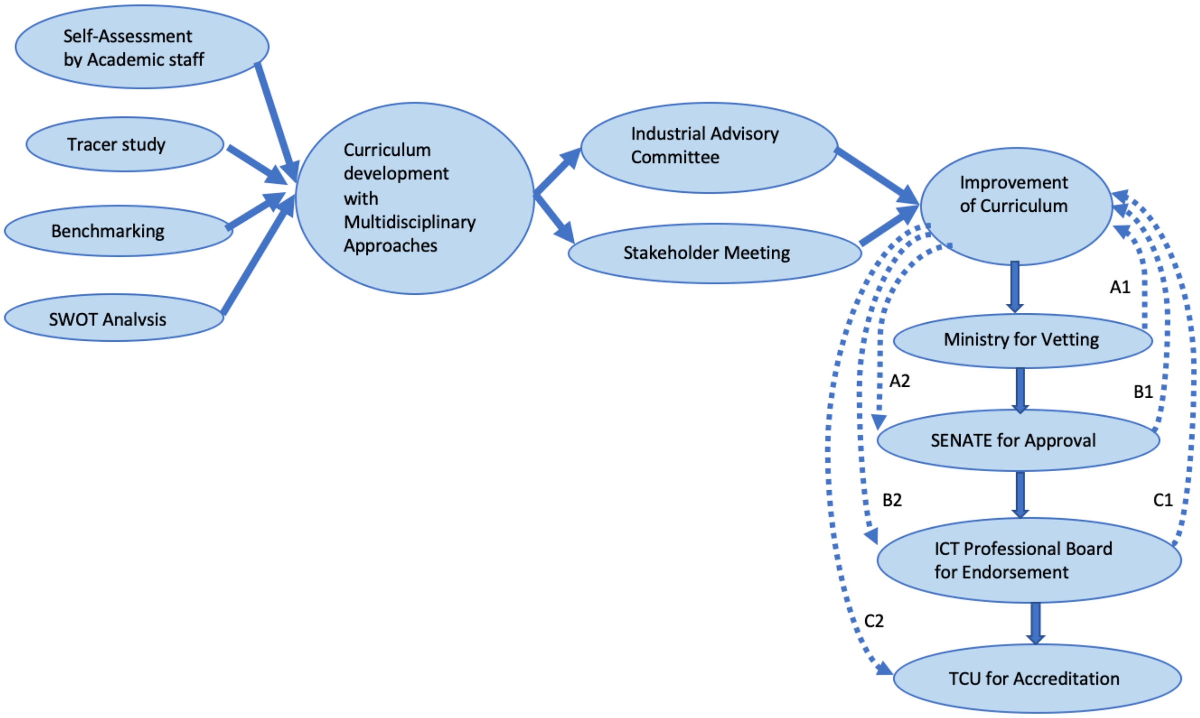

Figure 1: Computer Science Curriculum Review Processes

Stakeholder Meeting Processes: Stakeholder engagement played a key role in ensuring the BSc Computer Science curriculum met diverse needs. Key stakeholders, including academic staff, graduates, employers, and an Industrial Advisory Committee, were involved in the review process. Initial meetings focused on curriculum quality and workforce competencies. A multistakeholder workshop followed, bringing all groups together to examine findings through thematic sessions on content, teaching methods, and interdisciplinary integration. With 35 participants, the feedback was analyzed and organized into a thematic matrix, ensuring the curriculum remains relevant, competitive, and aligned with evolving industry demands. Key issues, including industry relevance and emerging technologies, were identified. The insights were transformed into actionable recommendations, forming the basis for curriculum redesign and final validation before approval, as presented in detail in Figure 1.

Approval and Implementation: Following stakeholder validation, the curriculum was submitted for institutional and regulatory approval. It underwent review by Tanzania's Ministry of Education, Science, and Technology to ensure alignment with national and HEET project standards, then revised accordingly. The curriculum was approved by the University Senate, endorsed by the ICT Professional Board, and finally accredited by the Tanzania Commission for Universities. Feedback loops (A1, B1, C1) informed improvements, while progression stages (A2, B2, C2) guided approval flow. This rigorous process ensured the curriculum met academic and industry standards before implementation.

Data Collections

Data were collected through self-assessment, a tracer study, and stakeholder consultations. The self-assessment involved 25 lecturers from the SUZA. The tracer study included 50 graduates and 15 employers, while stakeholder meetings engaged 35 participants from academia and industry to provide insights on graduate skills and program improvement.

Ethical Consideration

The research was conducted in accordance with established social science research standards and ethical guidelines. Participation in the study was entirely voluntary, and all participants were informed about the research purpose. The confidentiality and privacy of personal information were strictly protected throughout the data collection, analysis, and reporting processes to ensure ethical research practice.

Data Analysis

Data analysis combined quantitative and qualitative methods to evaluate the CS program at SUZA. Descriptive statistics were used to analyse self-assessment and tracer study data, focusing on curriculum content, teaching effectiveness, employability, and job outcomes. Qualitative responses were thematically coded to identify key issues such as limited interdisciplinary teaching and skills gaps. Benchmarking data were analysed through comparative evaluation with peer institutions, highlighting best practices like integrated modules and experiential learning. Triangulation across all data sources ensured reliability and consistency. Overall, the analysis provided comprehensive insights into strengths and gaps, informing curriculum improvement and enhancing graduate employability.

Results and Discussion

This section presents the study’s findings, highlighting key results and insights derived from the research. The findings are categorized according to the main areas of investigation, providing a clear understanding of the study's outcomes and their relevance to the research objectives.

Self-Assessment by Academic Staff

The self-assessment involved 25 academic staff, with 28% female and 72% male, mostly from the Computer Science department (76%). Findings showed strong agreement on the need to revise the curriculum by updating content and introducing emerging areas such as machine learning, cloud computing, data science, IoT, cybersecurity, and entrepreneurship. Participants emphasized practical-oriented learning, recommending a 60:40 coursework-to-exam ratio. They also suggested improved reading materials, real-world applications, coding exercises, and collaborative projects. Overall, staff highlighted the importance of balancing theory and practice, strengthening industry collaboration, and aligning the curriculum with current technologies. These insights informed the revised curriculum and improvements in teaching and assessment strategies, as presented in Figure 2.

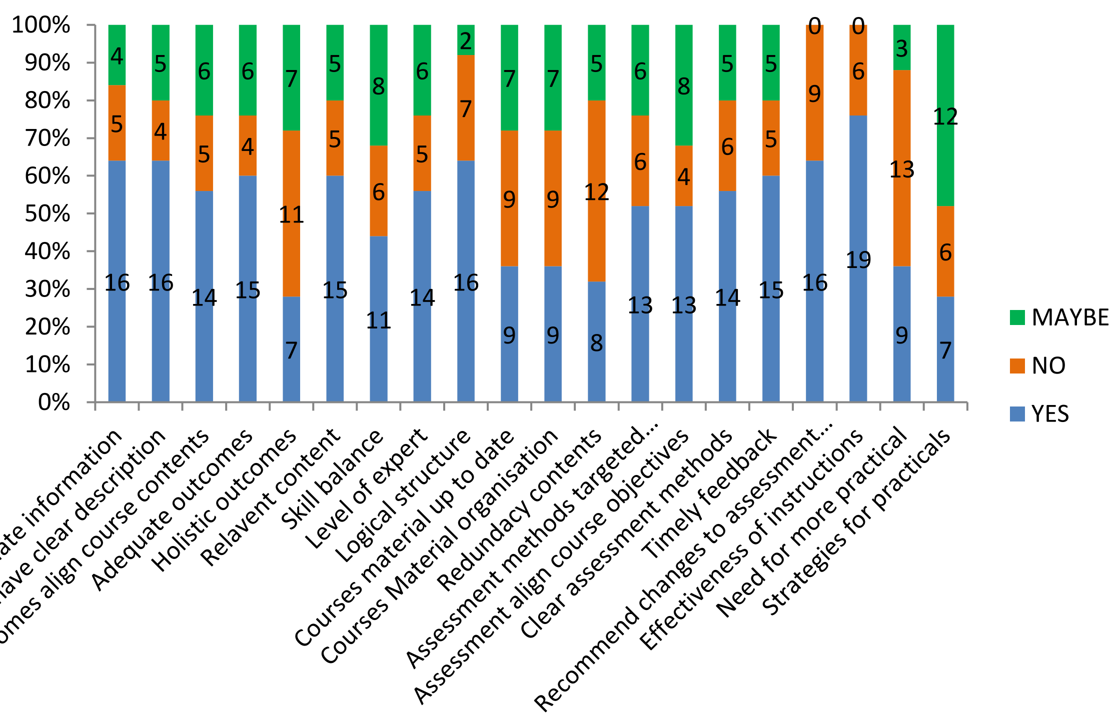

Figure 2: Computer Science programs self-assessment by academic staff

Academic staff emphasized the need for major curriculum revisions, including adding emerging areas such as machine learning, cloud computing, data science, IoT, cybersecurity, and entrepreneurship. These recommendations reflect global trends, as highlighted in the CS2023 curricula guidelines by ACM, IEEE, and AAAI, and studies emphasizing practical, industry-relevant competencies for enhancing graduate employability (Oudshoorn, 2024; Peracaula-Bosch and González-Martínez, 2024; Adeyemi et al., 2023).

Practical learning was strongly advocated, with suggestions for collaborative projects, coding exercises, case studies, and a shift toward coursework-focused assessment (60%) over final exams (40%). This mirrors international trends favoring formative, project-based evaluation to enhance skill acquisition (Alabi, 2024). Challenges such as inadequate laboratories, limited internet access, and insufficient infrastructure were reported, consistent with literature from developing contexts (Micheni, 2021; Musonda, 2025), highlighting systemic barriers to integrating modern, technology-driven content.

Tracer Study of Graduates and Employers

The findings indicated that there are 15 employers and 50 graduates participated in the study. Among 50 graduates, 82% are employed in both government and private organisations, of them 24% are female. Most of graduates were employed in IT related organisations, education, healthcare, tourism and agriculture. All participants responded that the BSs in CS are potential though it needs review to cater the market needs. Most of them responded that the reviewed program should consider the system analyst, software development expert, network administrator, data scientist and IT support specialist. Furthermore, participants responded about the need of the program to meet the market needs and willingness of private companies to hire SUZA graduates, as shown in Figure 3.

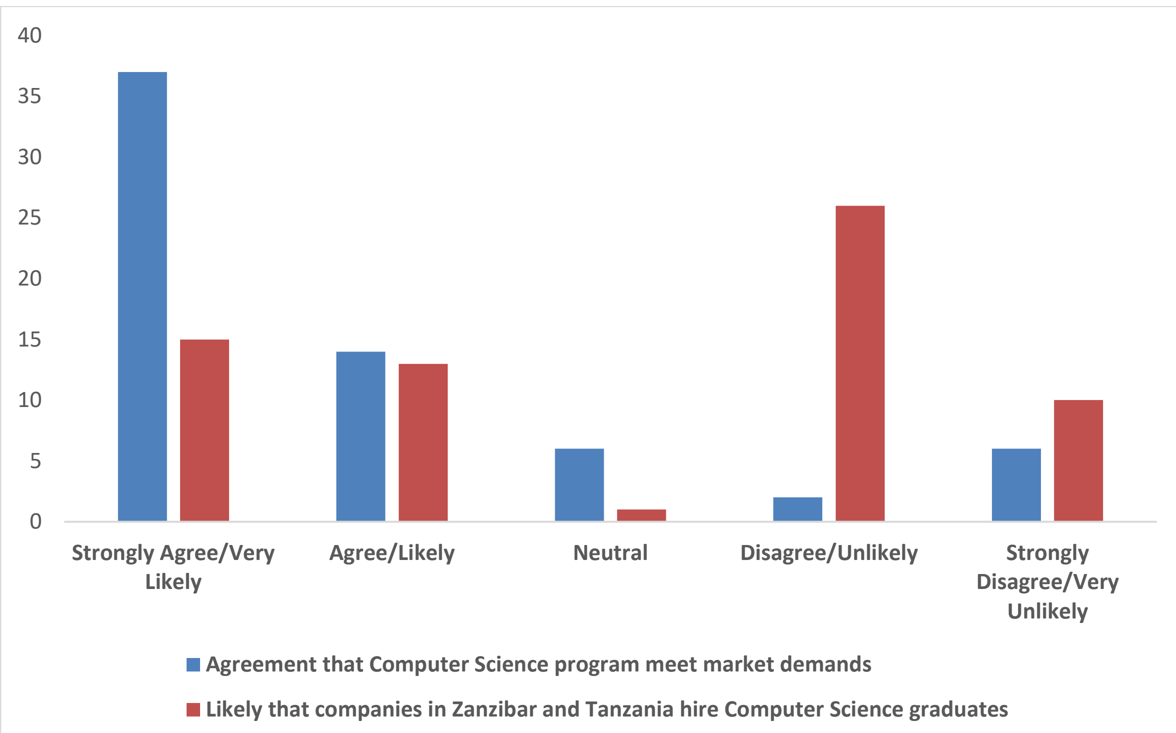

Figure 3: Acceptance of Computer Science program

Participants further identified key skills for inclusion in the revised BSc CS program, emphasizing practical and industry-relevant competencies (Singh, 2023). Priority areas included such as software development, cybersecurity, web and mobile application development, and computer systems such as networking and system administration. These were seen as essential for meeting modern ICT workforce demands. Less emphasis was placed on specialized fields like GIS and image processing, as detailed in Figure 4.

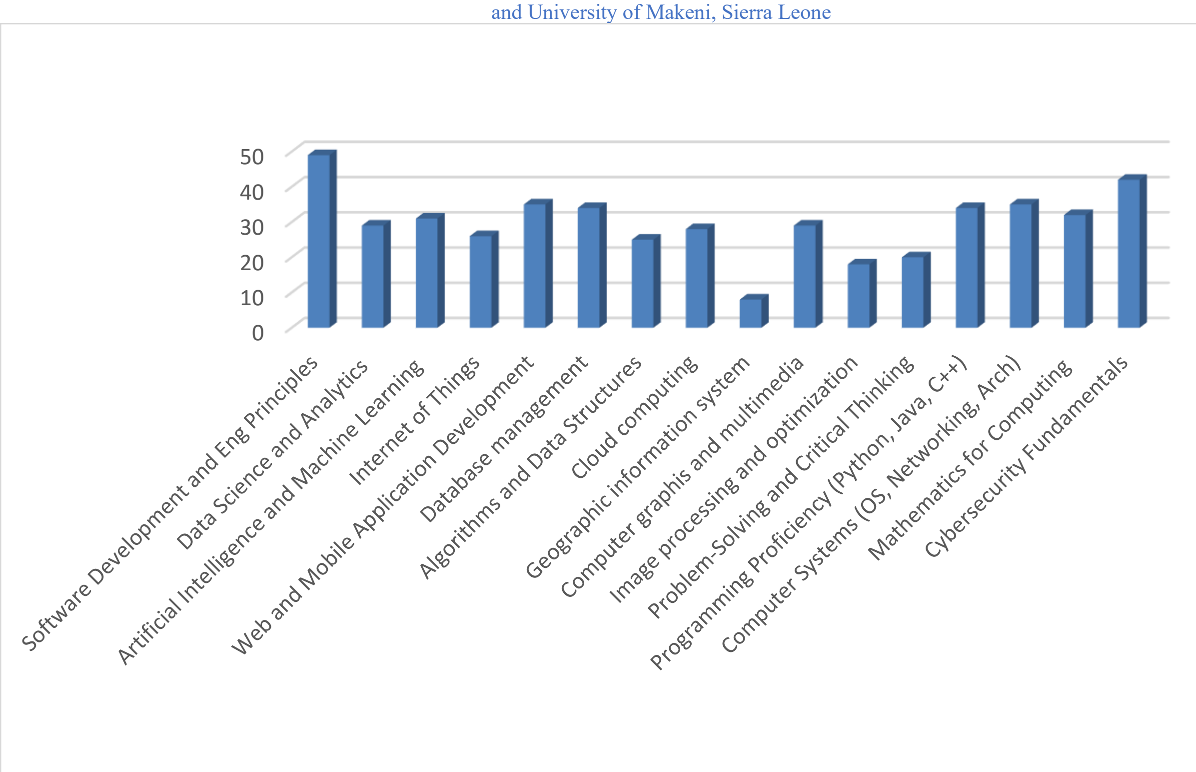

Figure 4: Core Skills priorities the Computer Science program

Furthermore, the findings from graduate survey reinforced the need for curriculum alignment with industry demands. High employment rates (82%) across sectors such as IT, education, healthcare, tourism, and agriculture indicate the program's contribution to workforce development. However, gaps remain in skills such as software development, cybersecurity, networking, mobile and web application development, reflecting global calls for applied, practical competencies (Musonda, 2025; Adeyemi et al., 2023). Specialized areas like GIS and image processing were deprioritized, reflecting a pragmatic focus on foundational competencies first (Alabi, 2024). Gender imbalance among graduates highlighted the need for inclusive curriculum design to address underrepresentation of women in ICT, aligning with global STEM equity goals.

Benchmarking processes

The benchmarking process analysed similar Computer Science programs from both national and international universities, as summarized in Table 1. The findings highlighted variations from some institutions in curriculum structure, industry linkages, and teaching methods, providing valuable insights and best practices to strengthen SUZA's program and align it with global academic and industry standards. Though, it was found that some institutions combined CS and engineering, and some CS and AI, and some have specialization including CS with digital forensics, and CS with cyber security such as APU and UPM. While institutions such as UDOM, ZU, and UDSM have similar environments to SUZA, differences exist in teaching approaches and practical time. International programs emphasized early project development, real prototypes, and industrial training. Despite similar course content, the reviewed program integrates lessons such as innovative pedagogy and blended learning. However, mini projects were not added, as existing courses already include project components.

Table 1: Institutions that Benchmarked to improve BSc Curriculum

Category	Institution	Method of Benchmark	Place
National	UDSM	Physical visit	Dar es Salaam, Tanzania
	ZU	Physical visit	Zanzibar, Tanzania
	UDOM	Physical visit	Dodoma, Tanzania
International	APU	Physical visit	Kuala Lumpur, Malaysia
	UPM	Physical visit	Kuala Lumpur, Malaysia
	IEEE	Online	New York, USA
	ACM	Online	New York, USA

Besides, benchmarking findings confirmed international practices emphasizing practical training, project-based learning, prototype development, and industrial placements (Adeyemi et al., 2023; Bawica, 2021). Institutions like APU and UPM allow early project engagement and extended industrial training, enhancing professional readiness. SUZA's decision not to adopt mini projects reflects adaptation to resource constraints, avoiding duplication while maintaining practical learning components. Stakeholder further recommends to include lab sessions, and merging overlapping topics, reflect global best practices in applied pedagogy, curriculum modernization, and alignment with industry needs (Micheni, 2021; Musonda, 2025; Bawica, 2021).

Stakeholder Meeting Processes

Stakeholders engaged to ensures the revised program reflects both academic and industry needs. A total of 35 participants took part, including graduates or alumni, lecturers, and employers from various sectors, as detailed in Figure 5.

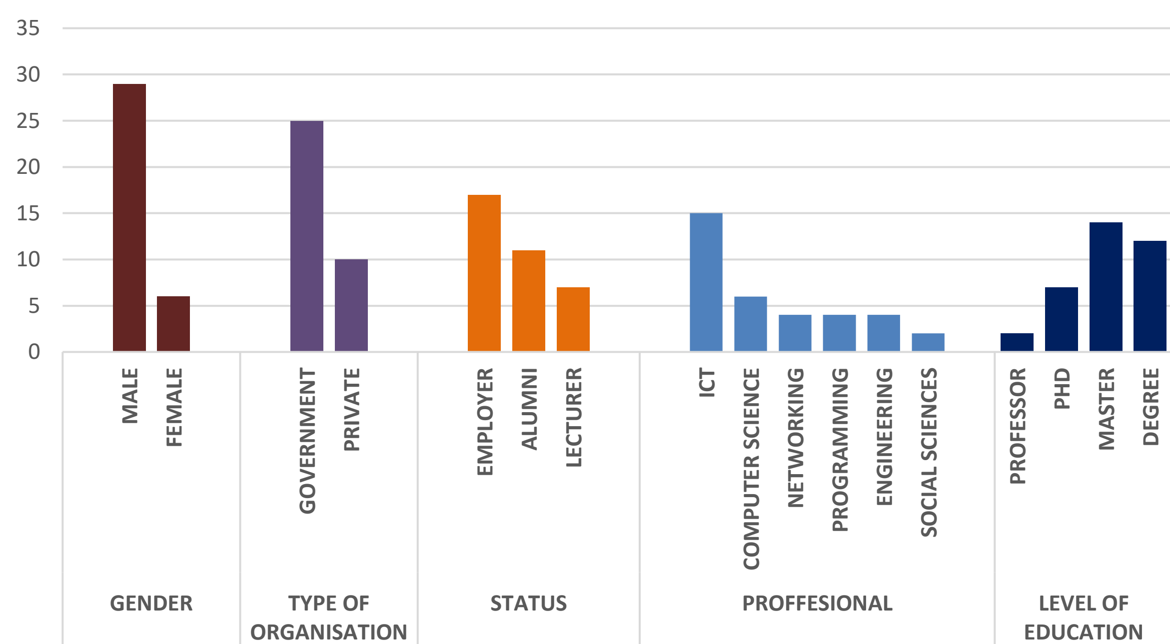

Figure 5: Stakeholders participated in improving Computer Science program

Participants provided suggestions to consider revising course titles for clarity, such as renaming Computer Forensics and Cyber Security to Computing and Digital Forensics. Duplicated topics were identified for removal, overlaps streamlined, and content reorganized for coherence. Gaps were addressed by integrating emerging areas like Edge Computing, the blue economy and native Android development. Stakeholders further proposed new courses to be included such as Ethics in Computing, Data Visualization, Cloud Computing, Information Systems Audit, Big Data Analytics, and Game Development. This finding is in line with the study by Roberts (2011), which also suggests the inclusion of more advanced computer science topics.

In addressing RQ1, which examines how self-assessment, tracer study, and benchmarking are effectively integrated to inform the review and improvement of a BSc CS program, self-assessment is used to identify internal program strengths and weaknesses, tracer study tracks graduate outcomes, and benchmarking through SWOT analysis compares the program against industry standards. Together, these methods provide a comprehensive foundation for informed curriculum improvements.

In addressing RQ2, the review of the BSc CS program highlighted opportunities to enhance the curriculum by integrating emerging fields such as AI, data science, cybersecurity, and mobile applications, thereby strengthening graduate employability. Industry collaboration through internships, training, and joint projects bridges theory and practice. Alignment with TCU guidelines and blended learning approaches further supports a flexible, student-centered education.

This study provided a strong foundation for multidisciplinary approaches to be considered during the review of BSc CS programs. Though, challenges remain, including inadequate laboratories, limited internet, outdated teaching resources, weak student mathematical foundations, and overcrowded classes, which may hinder practical training (Singh, 2023). Triangulation of internal evaluation, graduate tracking, and benchmarking identified curriculum gaps and best practices. Findings also emphasized multidisciplinary integration with sectors such as healthcare, agriculture, tourism, and business, enhancing problem-solving skills, practical orientation, and employability across diverse industries.

Conclusion and Recommendations

The review of the BSc CS at SUZA demonstrates a clear need for curriculum modernization to align with industry standards and emerging technologies. Findings indicate strong support from stakeholders, graduates, and faculty for enhancing practical, interdisciplinary, and industry-relevant components, including AI, data science, cybersecurity, and software development. Key approaches such as self-assessment, tracer study, SWOT analysis, and benchmarking provide evidence-based guidance for reform. While opportunities exist to strengthen employability and multidisciplinary skills, challenges such as limited infrastructure, resource constraints, and student preparedness must be addressed. This study recommends updating course syllabi, training faculty on interdisciplinary approaches, and integrating revised content into administrative systems for effective BSc CS implementation at SUZA. Continuous monitoring mechanisms should also be established to assess curriculum effectiveness. Overall, the review lays a foundation for a more relevant, practical, and competitive CS program.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

ACM & IEEE-CS. (2013). Computer Science Curricula 2013: Curriculum Guidelines for Undergraduate Degree Programs in Computer Science.

Adeyemi, O. O., Ndodo, N. D., Sulaiman, M. K., Ayansola, O. T., Buhari, O. I. N., Akanbi, O. A., ... & Fadeyi, A. (2023). SARS-CoV-2 variants-associated outbreaks of COVID-19 in a tertiary institution, North-Central Nigeria: Implications for epidemic control. Plos one, 18(1), e0280756.

Alabi, M. (2024). Experiential learning: Fostering deep learning through active engagement.

Andrade, H., & Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. Theory into practice, 48(1), 12-19.

Bawica, I. M. (2021). The university internship program and its effects on students' employability readiness. International Journal of Academe and Industry Research, 2(3), 86-101.

Christiansen, S. H., Juebei, C., & Xiangyun, D. (2023). Cross-institutional collaboration in engineering education – a systematic review study. European Journal of Engineering Education, 48(6), 1102–1129. https://doi.org/10.1080/03043797.2023.2228727

Gorlatova, M., Margolies, R., Sarik, J., Kinget, P., Kymissis, I., & Zussman, G. (2023). Project-based learning within a large-scale interdisciplinary research effort. Journal of Engineering Education, 112(1), 123–145. https://doi.org/10.1002/jee.20456

Guzdial, M., & Tew, A. E. (2010). Imagineering in computing education. Communications of the ACM, 53(8), 24–26.

Katcherovski, A. (2024). Managing cross-functional teams in organizations: Best practices. Birdview PSA. Retrieved from https://birdviewpsa.com/blog/managing-cross-functional-teams/

Laurillard, D. (2013). Teaching as a design science: Building pedagogical patterns for learning and technology. Routledge.

McKown, D. M. (2021). Instructional strategies in teacher preparation: Are we building efficacy in beginning teachers. St. Thomas University.

Micheni, B. M. (2021). Teacher perspectives on the implementation of the competency-based curriculum in Kenya (Doctoral dissertation, University of Oxford).

Musonda, R. (2025). ICT-integrated practices in Finnish schools: Examining institutional and individual influences–evicence from ICILS 2018.

Oudshoorn, M. (2024). Cs2023 curricula guidelines and computer science accreditation. In 2024 International Symposium on Accreditation of Engineering and Computing Education (ICACIT) (pp. 1-6). IEEE.

Pittarello, F., & Pellegrini, T. (2017). HCI and education: a blended design experience. Multimedia tools and applications, 76(4), 4895-4923.

Roberts, F. S. (2011). The challenges of multidisciplinary education in computer science. Journal of Computer Science and Technology, 26(4), 636-642.

Singh, A. (2023). Challenges of a multidisciplinary approach in higher education. International Journal of Advanced Academic Studies, 5(9), 30-32.