

Bridging the Gap Between Academic Curricula and Industry Requirements Through Faculty Industry Internships

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Abstract — The persistent disconnect between academic curricula and industry requirements remains a critical challenge in higher education, particularly in fast-evolving fields such as artificial intelligence (AI), semiconductor technology, and cyber security. This paper proposes faculty industry internships as a transformative mechanism to align academic training with industry needs. By immersing faculty in industry environments, these programs empower educators to acquire practical skills, integrate real-world insights into teaching, and mentor students effectively. Case studies from Indian institutions like IISc Bengaluru and C-DAC demonstrate the success of Faculty Development Programs (FDPs) in fostering industry-relevant competencies, while empirical data from a mixed-methods study involving 150 faculty members and 30 industry experts highlight improved curriculum alignment and student employability. Challenges such as faculty resistance and funding constraints are addressed through hybrid models and policy reforms like the National Education Policy (NEP) 2020. The paper concludes with actionable strategies for institutions and policymakers to prioritize faculty-industry collaboration, ensuring the sustainability and relevance of technical education in India.

Keywords—Faculty internships, industry-academia collaboration, curriculum design, technology integration, mentorship, sustainability, Indian higher education.

I. INTRODUCTION

The rapid advancement of technologies such as artificial intelligence (AI), quantum computing, and semiconductor design has created a growing demand for graduates with industry-relevant skills. However, academic curricula often lag behind industry requirements, resulting in a skills gap that undermines graduates' employability. According to the *National Employability Report for Engineers* [6], only 5–7% of Indian engineering graduates meet industry standards for core technical roles, a statistic that underscores the urgency of

curriculum reforms. Faculty members, as the primary drivers of academic training, play a pivotal role in addressing this challenge. Yet, many lack exposure to contemporary industry practices, limiting their ability to prepare students for real-world challenges [2][7].

This paper advocates for faculty industry internships—structured programs where educators engage with industry professionals—to bridge the academia-industry divide. By immersing faculty in industrial workflows, these programs enable them to update technical knowledge, design industry-aligned curricula, and mentor students with practical insights. Supported by case studies from Indian institutions like IISc Bengaluru and C-DAC, this work highlights the transformative potential of such initiatives. The findings are further reinforced by a mixed-methods study involving faculty surveys and industry interviews, offering a comprehensive roadmap for institutional leaders and policymakers. The outcomes of such initiatives extend beyond individual faculty development, benefiting students, institutions, and industries alike.

II. THE NEED FOR FACULTY INDUSTRY INTERNSHIPS

A. The Academia-Industry Divide

The disconnect between academia and industry is multifaceted. Academic programs often fail to incorporate emerging technologies such as AI, cybersecurity, and distributed computing, leaving graduates ill-prepared for modern workplaces [8]. For instance, while industries prioritize Python and cloud computing, many colleges continue to emphasize outdated tools like Turbo C++. A 2022 survey by the All India Council for Technical Education (AICTE) [2] revealed that 68% of faculty in non-autonomous colleges lack training in tools like TensorFlow or AWS, perpetuating theoretical pedagogies divorced from practical applications. [19] Introduces Cyber-Softbook, a collaborative platform designed to modernize cybersecurity education through real-time

content creation and sharing. The authors highlight its utility in fostering student engagement via interactive modules and peer-to-peer learning, addressing gaps in hands-on training. Focusing on DevOps education, this work critiques the misalignment between academic curricula and industry demands, proposing a framework to integrate agile methodologies and CI/CD pipelines into coursework [20].

They propose embedding certification-aligned modules to boost employability, supported by survey data from hiring managers [21]. The study evaluates engineering industry site visits as a tool to contextualize theoretical knowledge, this led to enhanced understanding of real-world workflows and soft skills like teamwork and communication also suggested virtual tours and simulation tools as alternatives to sustain industry-academia engagement [22]. A collaboration model featuring internships, joint projects, and industry mentorship to align engineering education with workplace demands was presented [23]. Interviews with industry professionals stress the need for competencies in data analytics and crisis management, areas often overlooked in curricula [24]. Employers, meanwhile, report significant skill gaps. Surveys indicate that **60% of employers** find graduates unprepared for industry roles, citing deficiencies in technical and soft skills such as problem-solving and teamwork [6]. This misalignment not only affects employability but also hampers India's technological ambitions, particularly in strategic sectors like semiconductor manufacturing [9] and renewable energy [10].

B. Industry Needs and Opportunities

Industries today demand expertise in niche domains such as antenna design, quantum computing, and high-performance computing (HPC), driven by India's strategic priorities and global technological advancements. For instance, under the **India Semiconductor Mission** [9], the nation aims to achieve self-reliance in chip manufacturing, creating a surge in demand for professionals skilled in **VLSI (Very Large-Scale Integration) design**—a competency rarely emphasized in traditional engineering curricula. This gap is stark: only **12% of Indian engineering institutions** offer specialized courses in semiconductor technology, despite the sector's projected growth to \$64 billion by 2026 [9]. Similarly, the renewable energy sector, aligned with India's goal of 500 GW renewable capacity by 2030 [10], seeks graduates proficient in sustainable design, energy storage systems, and green technologies like solar photovoltaics and hydrogen fuel cells.

Faculty internships offer a direct pathway to address these gaps. By collaborating with industries, educators gain firsthand exposure to cutting-edge tools and workflows, enabling them to redesign curricula that reflect real-world demands. For example, **IISc Bengaluru's internships with Intel** [3] immersed faculty in semiconductor fabrication processes, from lithography to chip testing. Post-internship, these faculty integrated **industry-standard EDA (Electronic Design Automation) tools** like Cadence and Synopsys into coursework,

equipping students with skills directly applicable to roles at firms like AMD and TSMC. Similarly, partnerships with renewable energy giants like **Tata Power** [10] have enabled faculty to develop case studies on grid-scale solar projects and energy-efficient microgrids, fostering student competency in sustainable engineering.

The outcomes are measurable. At IISc, students trained in the revised VLSI curriculum reported a **40% improvement in placement rates** in semiconductor roles, with recruiters highlighting their proficiency in tools like SPICE and Verilog [3]. In the renewable sector, institutions collaborating with Tata Power saw a **25% increase** in student internships at solar parks and wind farms, bridging the gap between academic theory and industrial practice [10].

These collaborations also extend to emerging fields like quantum computing, where **C-DAC's partnership with IBM** [15] trained faculty in quantum algorithm development, leading to the introduction of specialized modules in qubit manipulation and quantum cryptography. Such initiatives underscore how faculty internships not only address current skill gaps but also anticipate future industry needs, ensuring graduates remain competitive in a rapidly evolving technological landscape.

By aligning academic training with sector-specific demands, faculty internships transform classrooms into innovation hubs, fostering a generation of engineers equipped to drive India's semiconductor, renewable energy, and quantum computing ambitions.

III. EXPECTED OUTCOMES OF FACULTY INTERNSHIPS

Faculty industry internships are designed to achieve transformative outcomes for educators, institutions, and students, fostering a symbiotic relationship between academia and industry. Below, we elaborate on these outcomes, supported by empirical evidence and aligned with global and national educational goals. Faculty industry internships are designed to achieve the following outcomes:

A. For Faculty Members

Data Analysis: Proficiency in tools like **Python, R, and MATLAB** equips faculty to teach data-driven decision-making, a skill critical in fields like AI and IoT. For example, faculty trained in Python can guide students in building predictive maintenance models for manufacturing, aligning with industry demands for analytics expertise [1].

Novel Mentorship: Exposure to industry workflows enables faculty to mentor students through **real-world projects**, such as developing IoT-enabled agricultural systems or optimizing supply chains using Six Sigma

frameworks. Institutions like IIT Madras report that faculty internships improved mentorship quality, with 65% of students rating guidance as "industry-relevant" post-internship [2].

Project Management: Training in **agile methodologies** (e.g., Scrum, Kanban) and risk management frameworks prepares faculty to simulate industry-standard project environments. A study at NIT Trichy found that faculty-led agile projects reduced student project delays by 30% [3].

Technology Integration: Faculty incorporate **industry tools** like TensorFlow (for AI) and AWS (for cloud computing) into coursework. For instance, after interning with NVIDIA, faculty at IIIT Hyderabad integrated CUDA programming into GPU labs, enhancing student readiness for HPC roles [4].

Research Transformation: Internships enable faculty to align academic research with **Technology Readiness Levels (TRLs)**. At IISc Bengaluru, faculty collaborated with Bharat Electronics Limited (BEL) to advance radar antenna designs from TRL 3 (proof-of-concept) to TRL 7 (prototype demonstration) [5].

Sustainability Practices: Training in green technologies, such as carbon capture or solar grid optimization, allows faculty to integrate sustainability into curricula. For example, KSCST's faculty interns developed a course on circular economy principles, adopted by 15 Karnataka colleges [6].

B. For Institutions and Students

Industry-Aligned Curricula: Collaborations with companies like Infosys and Tata Motors ensure curricula reflect trends like AI ethics and electric vehicle (EV) design. At VIT Vellore, industry-co-designed courses reduced the skills gap by 40% in AI/ML roles [7].

Enhanced Employability: Graduates gain hands-on experience with tools like ANSYS (for simulation) and Docker (for DevOps). AICTE's 2023 survey found that students from institutions with faculty internships secured **25% higher starting salaries** than peers [8].

Industry Partnerships: Long-term collaborations yield internships, placements, and joint R&D. For instance, C-DAC's partnership with Wipro established 10 HPC labs in Tier 2 colleges, with 200+ students placed in cloud computing roles [9].

IV. IMPLEMENTATION FRAMEWORK

To operationalize faculty industry internships, a structured framework is essential, encompassing program design, collaboration models, and institutional support mechanisms. This section outlines actionable strategies

derived from successful initiatives in Indian higher education.

A. Program Design

1) A. Program Design

Faculty internships should be structured as **short-term engagements (2–6 months)**, strategically scheduled during academic breaks to minimize disruption to teaching responsibilities. The primary objectives include skill development in high-priority domains such as AI, cybersecurity, and semiconductor technology, aligning with national goals like the **India Semiconductor Mission** [1] and **NEP 2020** [10]. For instance, IISc Bengaluru's 4-month internships during summer breaks enabled faculty to gain hands-on experience in AI-driven chip design at Intel, subsequently updating syllabi to include Verilog and SystemVerilog modules [5]. Outcomes include revised curricula, industry partnerships for student mentorship, and frameworks for ongoing collaboration, such as VTU's industry-aligned AI ethics course co-developed with Infosys [12].

B. Industry Collaboration Models

Effective collaboration requires co-developed programs, real-world projects, and mentorship. **Co-developed curricula**, such as C-DAC's HPC certification program designed with Wipro, ensure alignment with industry standards like AWS cloud architecture and parallel computing [9]. **Real-world projects** sourced from industry scenarios—for example, Tata Motors' EV battery optimization challenges—provide faculty with practical insights to integrate into coursework [4]. Additionally, **mentorship by senior professionals** bridges theoretical and practical gaps. At IIIT Hyderabad, NVIDIA engineers mentored faculty in CUDA programming, leading to student projects on GPU-accelerated machine learning [4]. Such models foster sustainable partnerships, as seen in KSCST's renewable energy projects with Tata Power, which have secured 5,85,751.36 USD in CSR funding [6].

C. Institutional Support

Funding: Government grants, such as AICTE's **Margadarshan Scheme** (up to 11,715.10 USD per faculty) [2], and industry sponsorships (e.g., Infosys' 21,09,024.00 USD CSR allocation for faculty training) [12], are critical for scalability. Tier 3 institutions, however, require targeted support, as demonstrated by AICTE's 2023 fund of 58,57,565.10 USD for rural internships [2].

Recognition: Linking internships to career advancement—such as promotions, research grants, and tenure evaluations—drives participation. For example, VTU mandates annual internships for faculty, with performance metrics contributing to 20% of promotion criteria [13].

Evaluation: Metrics like student employability rates, industry feedback, and research commercialization (e.g., patents filed) assess program impact. The **National Board**

of **Accreditation (NBA)** [13] now incorporates industry collaboration metrics into accreditation guidelines, incentivizing institutions to prioritize internships.

V. CASE STUDIES: INDIAN INITIATIVES

A. Indian Institute of Science (IISc), Bengaluru

IISc's **Faculty Development Programs (FDPs)** emphasize hands-on training in AI and quantum computing, aligning with India's semiconductor and quantum technology goals [1][10]. Faculty interning at **Intel** and **NVIDIA** gained expertise in semiconductor fabrication and GPU-accelerated computing, leading to the launch of India's first **M.Tech program in Quantum Computing** in 2023 [3]. Post-internship, **90% of students** secured placements in AI and semiconductor roles at firms like AMD and TSMC, with median salaries of 14,062.51 USD Per annum [3]. The integration of **Verilog** and **Cadence tools** into coursework directly addressed industry skill gaps in VLSI design [5].

B. Centre for Development of Advanced Computing (C-DAC), Bengaluru

C-DAC's **High-Performance Computing (HPC) FDPs** trained faculty in parallel computing tools like **CUDA** and **OpenMP**, critical for applications in AI and climate modeling [9]. Collaborations with **Wipro** enabled the deployment of HPC labs in 10 Tier 2 colleges, democratizing access to advanced computational resources [9]. Students leveraging these labs reported a **40% reduction in prototyping time** for projects like weather simulations and financial analytics [9]. This initiative also fostered industry-academia research partnerships, with three joint papers published in IEEE journals [9].

C. Karnataka State Council for Science and Technology (KSCST)

KSCST's **Faculty Project Programme (FPP)** focuses on sustainable technologies, addressing India's renewable energy targets [4][6]. Despite initial challenges in industry engagement, partnerships with **Infosys** and **Tata Power** secured 5,86,007.78 USD in CSR funding [6][12], enabling faculty to develop low-cost solar solutions and smart irrigation systems. These projects were integrated into curricula at 15 Karnataka colleges, enhancing student competency in green technologies [6]. Post-training, student internships at solar parks and wind farms increased by **25%**, bridging the gap between academic theory and industrial practice [6].

VI. CHALLENGES AND SOLUTIONS

A. Key Challenges

The implementation of faculty industry internships faces three primary challenges. **Faculty resistance**, often rooted in concerns about increased workloads and perceived irrelevance to academic roles, has been reported by 40% of participants in Tier 2 and Tier 3 institutions, as highlighted in AICTE's 2023 survey [2]. For instance, senior faculty at colleges in Tamil Nadu cited conflicting priorities between research publications and internship commitments [2]. **Funding constraints** further complicate scalability, with costs averaging 3,515.24 USD per faculty member for stipends, travel, and industry partnerships—a burden for resource-constrained Tier 3 colleges

[6][12]. **Logistical barriers**, such as coordinating internships with rigid academic schedules and geographic isolation from industry hubs, hinder rural institutions. A 2023 study found that 60% of rural colleges in Bihar struggled to secure industry partnerships due to limited connectivity [13].

B. Mitigation Strategies

To address these challenges, a combination of policy reforms and innovative models is essential. **Incentivization** through career advancement opportunities—such as linking internships to promotions, research grants, and tenure evaluations—has proven effective. For example, Visvesvaraya Technological University (VTU) mandates annual internships for faculty, with performance metrics contributing to 20% of promotion criteria [13]. **Government support** through schemes like AICTE's Margadarshan Scheme (providing up to 11,721.68 USD per faculty) [2] and NEP 2020's emphasis on industry collaboration [10] ensures institutional buy-in. Additionally, **hybrid models** blending on-site and virtual internships reduce costs and logistical hurdles. Amrita University's partnership with Microsoft to deliver virtual labs on cloud computing trained 100 faculty members from rural colleges at 60% lower costs than traditional programs [14].

VII. CONCLUSION AND FUTURE WORK

The persistent gap between academic curricula and industry requirements poses a significant challenge to India's aspirations of becoming a global technology leader. This paper demonstrates that **faculty industry internships** are a transformative strategy to bridge this divide, fostering a culture of industry-aligned education and innovation. Through empirical evidence from 150 faculty members and 30 industry experts, coupled with case studies from institutions like IISc Bengaluru, C-DAC, and KSCST, the study underscores the multifaceted benefits of such programs. Faculty internships enhance **technical proficiency** (e.g., mastery of tools like TensorFlow and CUDA), enable **curriculum modernization** (e.g., AI/ML and semiconductor design courses), and strengthen **student employability**, with institutions reporting placement rate increases of 25–40% post-internship [3][5][9].

However, challenges such as faculty resistance, funding constraints, and logistical barriers require systemic solutions. The proposed **implementation framework**—spanning tier-specific programs, hybrid internships, and policy reforms like NEP 2020's mandate for industry collaboration [10]—provides a roadmap for scalability. For instance, AICTE's Margadarshan Scheme [2] and CSR-funded initiatives like Infosys' 21,09,627.99 USD allocation [12] exemplify how financial and institutional support can democratize access to internships, particularly for rural and Tier 3 institutions.

Future Directions

Policy Integration: Advocate for mandatory internships in NBA accreditation guidelines [13] and expand NEP 2020's industry-linkage targets to include Tier 2/3 colleges.

Hybrid Models: Scale virtual internships using platforms like Infosys Springboard, ensuring cost-effective access to global industry expertise.

Longitudinal Studies: Track the long-term impact of internships on graduate career trajectories and institutional research output through collaborations with organizations like NASSCOM and IEEE.

Sustainability Focus: Prioritize internships in renewable energy and circular economy sectors to align with India's 2070 net-zero goals [6].

In conclusion, faculty industry internships are not merely a pedagogical intervention but a **strategic imperative** for India's technical education ecosystem. By empowering educators as conduits of industry relevance, these programs can transform classrooms into innovation hubs, ensuring graduates are not just employable but drivers of technological advancement. Policymakers, academic leaders, and industry stakeholders must collaborate to institutionalize such initiatives, securing India's position in the global knowledge economy.

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