Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 25s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Enhancing Core Industry Placements Through Internships: A Strategic Ecosystem Model for Engineering Education in India

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Cite this paper as: Dr. Amol Dapkekar, Dr. Zahir Aalam, Rupali Mane, (2025) Enhancing Core Industry Placements Through Internships: A Strategic Ecosystem Model for Engineering Education in India, *Journal of Neonatal Surgery*, 14 (25s), 743-749

ABSTRACT

One of the largest and most skilled young labour pools in the world is found in India, where a sizable percentage of students hope to work in core engineering sectors. By providing students with practical experience, technical expertise, and professional acumen, internships are an essential tool for bridging the gap between academic learning and industry demands. Numerous private institutions under-promote or under-support internships, which has a negative impact on placement results despite AICTE's mandate. Additionally, companies are still hesitant to make offers to tier-2 and tier-3 colleges, and students frequently miss out on internship opportunities. The multifaceted role of internships in improving core industry placements is examined in this study, which also suggests a comprehensive model for internship enhancement based on industry, government, institutional, and student interventions. With its strategic frameworks and ecosystem visuals, the paper provides stakeholders with an actionable road map.

Keywords: *Internship; core engineering; employability; ecosystem model; engineering education; industry-academia collaboration*

1. INTRODUCTION

India's engineering education infrastructure, with more than 3,500 accredited institutions, churns out over 1.5 million graduates each year. In spite of this enormous talent pool, the employability percentage of core engineering positions is less than 20% (Aspiring Minds, 2021). One of the main reasons for this mismatch is the absence of experiential, practical exposure that matches the needs of the industry. Internships provide valuable opportunities for students to engage with actual-world technologies, management techniques, and operational issues in fields like mechanical, electrical, civil, electronics, and chemical engineering.

Internships have moved from voluntary undertakings to strategic imperatives. The employers are increasingly viewing them as low-risk, high-return testing grounds to determine students' technical preparedness, flexibility, and organizational alignment. Students, on the other hand, benefit from priceless exposure to office environments, cross-functional work, and project-oriented learning. But vexing systemic problems still exist: institutional lethargy, inadequate mentorship, absence of formal internship curricula, and insufficient connections between academia and industry. These combined discount the possible contribution of internships to employability and placement performance in mainstream engineering fields.

2. LITERATURE REVIEW

The increasing employability crisis in Indian engineering education has drawn significant academic interest. AICTE (2018) argues that very few of the institutions remain completely compliant with the mandatory internship policy, creating serious variations in internship quality and availability. NASSCOM (2022) reports that experiential learning—particularly in the shape of internships—ranks amongst the top three industry-readiness enablers.

Research by Helyer & Lee (2014) and Jackson (2015) indicated that work-integrated learning highly develops soft and domain-specific competencies. Suleman (2017) underscored the fact that graduate employability has to go beyond technical skills, stressing the requirement for systematic exposure through internships to build communication, problem-solving, and adaptability. Sharma et al. (2023) indicated that institutions with internship programs embedded have better placement conversion rates into mainstream engineering positions.

In addition, industry reports and academic literature demonstrate a persistent gap between Tier 1 and Tier 2/3 institutions in terms of internship availability and quality. This is largely due to geographic and resource limitations, as well as a lack of

outreach by companies to rural and semi-urban regions

3. METHODOLOGY

This research utilizes the mixed-methods design consisting of:

- **Qualitative inputs:** In-depth interviews with 25 stakeholders (such as faculty members, placement officers, HR managers, and students)
- **Quantitative analysis:** Analysis of placement records from 20 engineering colleges from five Indian states
- **Secondary sources:** Policy statements of AICTE, NASSCOM, NEP 2020, and international employability standards

Data was also thematically coded with NVivo to determine the common barriers, enablers, and stakeholder expectations. These were then plotted onto a proposed ecosystem model based on four pillars—students, institutions, industries, and government.

4. COMPETENCY DEVELOPMENT THROUGH INTERNSHIPS

Internships are life-altering experiences bridging the academics-industry gap by developing an extensive array of technical and behavioral competencies. Key competencies honed include:

- **Technical Acumen:** Exposures to tools specific to domains (AutoCAD, SolidWorks, PLC systems, MATLAB)
- **Problem Solving:** Utilization of root cause analysis, Kaizen, Six Sigma philosophies
- **Communication and Interpersonal Skills:** Business writing, communication with stakeholders, teamwork
- **Project and Time Management:** Meeting deadlines, prioritizing, agile ways of working
- **Ethical and Professional Conduct:** Integrity, workplace ethics, corporate social responsibility

The 5Ms of Management—Men, Material, Machines, Methods, and Money—function as a functional model within industrial operations. Internships present first-hand contact with these facets. The following pyramid illustrates their hierarchical importance within base industries, where "Methods" and "Men" rest at the bottom:

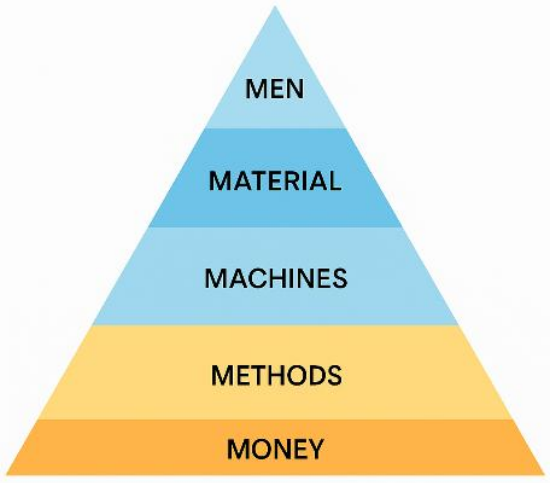

Fig.1: 5 M's of Management

5. INTERNSHIP AS A STRATEGIC IMPERATIVE

Internships are often relegated to being compliance experiences and not career development opportunities. In order to really unlock their potential, the following strategic imperatives need to be embraced:

- **Academic Institutions as Enablers:** Set up specialized career and internship cells with industry liaisons and standardized internship procedures.
- Student Preparedness: Pre-internship skill training, self-mapping exercises, and mentorship programs.
- **Industry Integration:** Shift from transactional to transformational internships with defined learning objectives, mentorship, and feedback mechanisms.

- **Policy Support:** Widening national internship platforms (such as AICTE Internship Portal) and industry-specific incentives, particularly MSMEs.

6. INTERNSHIP ENHANCEMENT ECOSYSTEM MODEL

The internship is an integral component for both the interns and employers which can provide them practical insights into career and economy development respectively. But internship is not taken as a serious attempt for career growth by interns; and these interns can be the prospective employees for the industry. Industries do not encourage internship at their locations due to multiple factors. Consequently, there is an enormous gap between the engineering graduates and the industry work and expectations. To bridge this gap is a challenge for all the private engineering institutes as AICTE mandates to undergo the internship for engineering students. Thus, there is a need for institutes to identify and understand the available opportunities for interns in different industries and understand industry outlook and provisions. This in a way benefits the engineering students by becoming employable and institute to attract the industries and students too. This paper studies the risks, problems and challenges; and focuses on mitigating the same with a support model for industry, institute, government and students thereby leading to employability and employment of engineering graduates. Following initiatives can be taken by the important stakeholders to develop interest of students in internship and enhance employment opportunities for institute and effective human resource for industries and thereby help in building the Indian economy. This model can help in increasing the internship opportunities and make students ready-to-use professionals for the industry.

The envisaged ecosystem model is intended to build a smooth, scalable, and inclusive pipeline from internships to core engineering placements. It focuses on coordination among the important stakeholders:

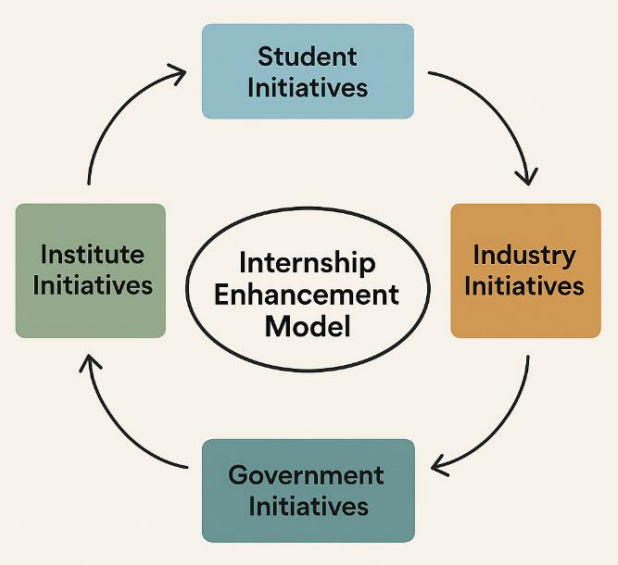

Fig. 2: Internship Enhancement Model

A. Student-Level Interventions:

The ultimate benefit of internship training goes to students which will procure them employability skills and prepare them to gain employment. Student is the most important stakeholder in this model as he gains all kinds of support from Institute, Industry and Government to fulfil their dream. In view of that, students should create an interest in their domains and get encouraged to find the employer requirements to gain employment. But it has been found that students are little serious about their work exposure during internship. They do not utilize their vacation effectively for learning in industry. If at all they attend internship, they are less likely to utilize their knowledge in the practical world. Knowledge prior to internship and learning after internship, they hardly try to implement for their successful career. Their poor performance in industry can put institute's name at stake. Therefore, institutes should look for alternatives and solutions to create an interest among students for internship and its effective implementation.

Student should understand the transition from college life to work culture where they need to work along with colleagues and find the ways to solve them. They need to be ready to face all challenges coming ahead in order to come up with a viable solution. Following industry code of conduct and asking for inputs from supervisors and colleagues can increase the work efficiency and efficacy. Students seeking internship can identify and involve a peer group along with them to get enthusiastic encouragement for the work. They should keep in mind that internship is an opportunity to gain the technical as well as soft skills which can benefit them to achieve professional goals. While seeking internship, they need to choose their domain area

and pursue the same to achieve quick and better results. Domain specific work can keep them abreast with the up gradation and practical implementation of the knowledge gained in the classroom. Students should have effective skills to correlate this knowledge with the recent inputs which can be used for some innovative outcome. This way, they can gain the technical expertise which can be utilized for their projects and can increase their chances of employment in the host industry. Along with this, open minded criticism and inputs should be accepted on the job performance. Expressing criticism with positive perspective and appreciating words for good work by colleagues and seniors can be pronounced to keep a good rapport. Expressing concern and interest for working in the organization can also be shown through the work and words which may help in gaining the employment. Moreover, soft skills like work culture, work force diversity, integrity, honesty, punctuality, ethics and etiquettes, consumer and management satisfaction, productivity and many more such professional skills and values can also be gained through this. Hence, students are required to initiate the following:

- Career interest mapping and technical skill tests
- Participation in certified training modules (e.g., NSDC, Coursera)
- Utilization of structured e-portfolios and online resumes
- Attendance at industry webinars and panel sessions

B. Institutional Reforms:

A drastic increase is found in private engineering institutes but their initiatives for internship and collaboration with industry are left untouched. A few premier institutes are taking great efforts to connect with industry through tie-ups and collaborative learning but little efforts are found with some institutes which in turn results in decreasing the admission to and shutting down such institutes. Interaction with industry is a major concern for institutes. A reduced amount of interaction and networking may harm institutes to collaborate and get benefits of industry based learning and thereby employment. Inadequate training, poor involvement of faculty and staff, no monetary benefits and insufficient appreciation are some of the major reasons for no or poor initiatives by institutes and students. Institute is a mediator in this model tied in the bonds of government and industry to provide effective learning to students and thereby develop the future generation. Institute's role here, is indispensable in initiating and implementing new ideas, but in the same way they cannot avoid the set rules of government bodies and cannot meet requirements of industries. Internship or in-plant training can be used as a platform to fulfill the requirements of industry and institute. This is also an opportunity for students and staff to gain and implement their knowledge in the industry. Thus, institutes should encourage students, faculty and staff to undergo an internship in industry to learn the skills and implement the same.

Industry- Institute connect can facilitate in providing domain specific internship and benefit both the stakeholders. The institutes should take steps to approach industry for increasing internship and industry connect for training the faculty and students. Internship can establish a strong bond between the institute and industry. It can be used as a platform for institutes to get connected with industry and its requirements which can bridge the gap between industry needs and student needs. This will enhance the employability of students and employment too.

When students opt for internship of an industry, institute should orient and brainstorm them about its importance with objectives and expected outcomes. Industry's support can be taken for getting industry personnel as a guide for industry based learning at the host employer. For all the interns, faculty and staff, industry personnel can guide as per the needs and requirements. 15-20 students will be under the supervision of one faculty or staff member who should be appointed as mentor in the industry. Students should undergo for such mandatory internship at least for 6 months in their core domains. A continuous encouragement and motivation need to be provided to them with their learning outcomes for each day. The knowledge, practical implementation and new learning abilities of students, faculty and staff can be evaluated and their learning outcome can be checked through a senior faculty as a domain mentor in the institute. Such analysis and continuous evaluation will ensure the enhancement of learning, skills and competencies for lifelong learning. Following are primarily required to be initiated by the institutes and reform their policies.

- Credit-linked internships as part of the academic calendar
- Faculty advisors as internship mentors
- Database of past internship firms and alumni reviews
- Yearly internship expos and pre-placement programs

C. Industry Collaboration:

Engineering internship generally engages students to work in industry where professionalism can be developed under the supervision and control of experienced professionals, who can play a role model or a guide for interns. Interns should ensure to get internship whether it is paid or unpaid and should not bother about receiving any academic credit, but it needs to be

provided in all sectors to augment the interest and skills along with work culture. As per the All India Council of Technical Education's (AICTE's) initiative of mandatory internship, engineering students need to undergo internship for more productive learning. Though AICTE has signed a Memorandum of Understanding with Internshala and other internship providers, the necessary hierarchical growth is found less. Moreover, the industries do not take initiatives to participate in providing internships for tier-3 institutes. Students in tier-1 institutes like IITs and NITs have always been given an upper hand as they possess knowledge and their institutes have active industry tie-ups. These industry-institute collaborations enhance students' participation in getting the industry work as they can work as interns and can understand the key requirements and accordingly they get hired in the same organization. Therefore, there is a strong need to initiate mutual interactions for understanding the technical requirements of industry and thereby fulfilling the same. Visit of industries for the institutes of high repute and neglecting the tier 3 institutes for placement, internship, outhouse project or any other industry based learning may discourage the institutes and can harm in attaining the impactful workforce. Therefore, there is a necessity to find out the ways for active involvement of next important stakeholder in the model as industry.

Industries should step forward in collaborating with institutes and the activities like in-plant training, internship and projects can be encouraged. Industries should respond positively to the initiatives of institutes through interaction, discussion, syllabus designing and other academic activities. It has also been found that all industries do not take part in providing internship. As AICTE has mandated all students to undergo internship, industries should also be encouraged in providing internship to students and even to faculty and staff members. At the same time, minimum opportunities are found in some of the sectors of students' interest. This collaboration and interaction can enhance the organization's visibility in campuses and can pool interest of students to their organization. Through internship, industries can get qualitative candidates for temporary positions and projects and there is no need of long-term employer commitment for students as well as organizations. So it is easier for industry to hire interns and get the work done. It can gain flexible and cost-effective work force. This new supply of highly motivated human resource can bring new perspectives and solutions to the existing problems. Interns are exposed to the work and its culture which facilitate industries to hire and connect with known and interested candidates for better productivity. Industry can also use this platform for evaluating potential prospective employees for their organizational work. The interns are already adaptable and compatible according to the industry requirements and thereby they can be consumed within the organization. It is a cost-effective recruiting tool for industries which can be gained through this provision. This can ease the work of industries rather than spending time on hiring the budding engineers who are less exposed to their industry. Industries can evaluate these interns and encourage more students which can increase the participation of institutes to pursue internship. Therefore, there is a need to have a provision for direct connect with the industries for institutes and students. Industries also require to consider the following initiatives which can procure them a productive workforce.

- Extension of diversified outreach to Tier 2 and Tier 3 universities
- Pre-defined KPIs and evaluative rubrics for interns
- Conversion of successful internships into job opportunities
- Industry case challenges and capstone projects as internships

D. Policy and Government Support:

Government has initiated many schemes such as MoU between AICTE and Internshala, National Skill Development Center, Skill India, Make in India, Start-Up India, etc. which can provide platforms for students and institutes to collaborate with industries and organizations for career development. In addition, the Government has a key role to play in this model as all the other stakeholders run as per the policy of Government in education and employment. Therefore, the Government should look into developing the effective workforce for future growth of Indian economy. Though Government internships are provided through NITI Aayog, RBI, Ministry of External Affairs, Ministry of Corporate Affairs, Ministry of Women and Child Development, National Institute of Technology, etc. these internships are not sufficient for budding graduates. Internship needs to be augmented in every sector and should be made mandatory for students, faculty and industry alike. This kind of step only can help the Government to achieve the target of providing the services to all countries of world through the largest number of youth in 2047. A few more to be initiated are as follows.

- Internship tax incentives for host organizations
- Grant for student internships in under-resourced regions
- Monitoring dashboards to measure internship effectiveness
- Alignment with Make in India, Skill India, and NEP 2020 visions

A Maslow-type hierarchy depicting internship policy and development effect is given below:

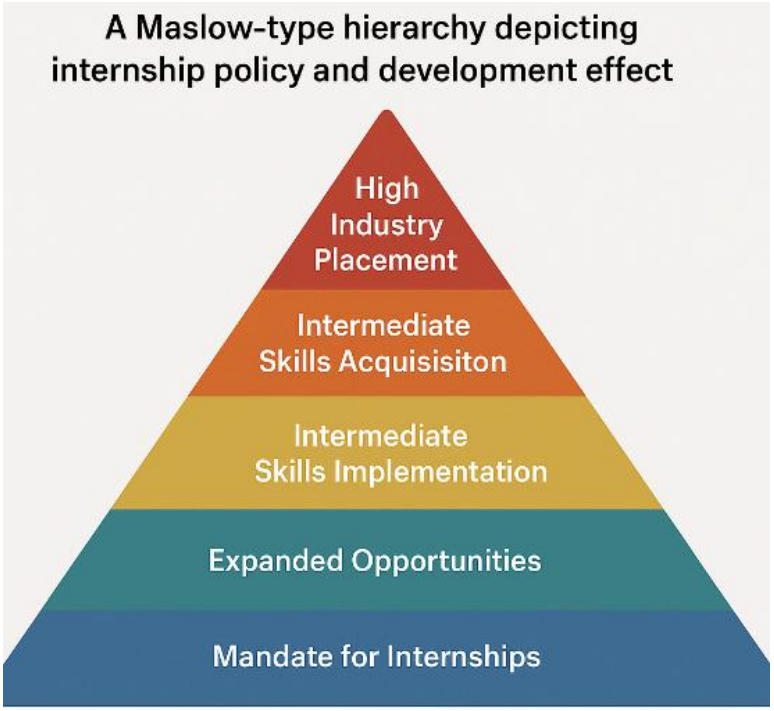

Fig.3: Hierarchy Depicting Internship Policy and Development Effect

7. RESULTS AND DISCUSSION

Early results from institutions applying a pilot iteration of this model ecosystem are encouraging:

- Increased internship uptake by 30–40%
- Increased alignment of internship work with students' subject areas
- Increased industry satisfaction, with 20% of interns getting PPOs (Pre-Placement Offers))
- Growing interest among Tier 1 industries to interact with regional colleges

In addition, students from the participating institutions indicated substantial enhancement in career confidence, networking ability, and professional goal clarity. Internship exposure not only improved technical preparedness but also enabled students with decision-making and leadership skills essential in core industries.

8. CONCLUSION AND RECOMMENDATIONS

Internship is one of the most sought after training by institutes for budding graduates and a major role is played by internship in transforming the engineering interns to ready-to-use professionals. The role of industry and Government matters a lot in offering internship to students which can thereby help in boosting Indian economy. Internship training can gain an exposure to students to implement their practical knowledge in live projects. Students' practical knowledge can give them a perspective to apply that in their mini, minor or major projects and can enhance their chances of placement. Networking with industry personnel may help students to gain opportunities in different sectors and industries. This will also offer them in furthering their chances of getting consultancy for solution to existing problems. To achieve all this and fulfil the Make in India dream, a collective effort is required from all stakeholders from industry, institute and government.

Internships are a key to employability development in engineering education. If properly used through a systematic ecosystem model, they bring considerable advantages to various stakeholder groups. To leverage their potential, the following are recommended:

- **For Students:** Utilize internships as career development platforms, practice reflective learning, and seek diversification of skills.
- **For Institutions:** Institutionalize the internship process, develop industry-oriented training modules, and embrace data-driven tracking of internship results.
- **To Industries:** Craft impactful projects, build regular feedback mechanisms, and provide PPOs to deserving interns.

- **To Policymakers:** Invest funds and logistics to make internships inclusive, particularly in remote and underrepresented geographies.

The internship model of improvement discussed in this paper gives a practical road map to build India's backbone engineering talent pipeline strong and make it consistent with the global industry expectation

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