

Higher Education-Labour Market Affinity in Engineering Education: A Review of Curriculum Alignment, Employability and Skill Mismatch with Special Reference to Bihar

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Abstract: In India the issue of higher education and employment is now a primary issue. The same worry is evident in engineering education, whereby the increase in the number of institutions and graduates has not necessarily resulted in increased employability and job fit or work readiness. This review paper explores the affinity between higher education and labour market with the reference of engineering colleges and new research environment of Patna district, Bihar. It examines literature on the concept of curriculum responsiveness, skill mismatch, employability of graduates, training-placement systems and internships, and regional labour market conditions and reforms in higher education in India. This linkage can't be assessed just based on placement rates as revealed by the review. It has to be curriculum relevant, with practical exposure, with the participation of employers, with emphasis on soft skills, on digital skills, with institutional support and with students' pathways in the social-economic world into the employment. There has been a definite shift towards flexible, multidisciplinary and skill based learning in recent policy reforms such as National Education Policy 2020, National Credit Framework, National Model Curriculum for Undergraduate programmes of the UGC and AICTE model curriculum initiatives. However, the research found there to be a disconnect between college education and what employers are looking for, both globally and nationally. Despite the increasing number of higher educational institutions and key technical institutions in Bihar, the district has not been adequately explored and researched. Based on this paper, a conceptual framework is proposed which connects curriculum alignment, industry interface, employability skills and institutional support with graduate labour-market outcomes. It finds that there is a need for focused policy and empirical study in engineering education in Bihar for decent relevant and sustainable employment.

Keywords: higher education; labour market affinity; engineering education; employability; curriculum alignment; skill mismatch; Bihar; Patna district.

1. Introduction

Nowadays, higher education is no longer assessed solely on the number of students enrolled in school and its growth. It is also assessed in the areas of employability, occupational mobility, innovation and social development. There has been rapid growth in universities, colleges and technical institutions in India. The growth has helped to make post-secondary education more accessible. It has also brought about an interesting issue: how do higher education institutions adapt to these evolving needs of the labour market? It is a question that is most important in the context of engineering education. Theory knowledge, technical knowledge, digital skills, problem solving skills, communication skills and professional adaptability are required for Engineering graduates.

The higher education-labour market affinity is the level of fit between higher education programmes and labour market needs. It involves curriculum relevance, industry engagement, practical training, placement assistance, and employability skills and job fit. This also encompasses the capability of graduates to gain decent and meaningful jobs. This is a broader concept than placement percentage. A student can obtain employment but encounter a lack of qualification or skill level, field of study, salary or career advancement. Accordingly, labour-market affinity must also consider measurable outcomes like employment and wages as well as qualitative outcomes like the relevance of the job, use of skills and career preparedness.

This review concentrates on the engineering education in district of Patna, Bihar with special reference to the district of Patna. Patna has become an important educational centre in the state. It has developed technical institutions and a slowly increasing number of Engineering Courses. However, overwhelming majority of literature on linkage between education and employment in India is national, sectoral or state oriented and more industry developed states. There is little evidence from Bihar, particularly relating to engineering graduates. This renders the Patna district as an important context for academic and policy discussion.

This paper aims at summarising the state of the art on higher education/labour market linkage. It spots the major areas of engineering education, shows the lack of research in Bihar and suggests a research plan for future study.

Primary data from the survey are not presented in the paper. Rather, it builds a literature based argument which can be used for further research among students, graduates, teachers and placement officers and employers in Patna district of Patna University.

2. Review Method and Scope

In this paper a narrative review approach has been used. It is a suitable approach if the research is a synthesis of conceptual, policy and empirical literature on a wide issue. Not attempting to estimate a single effect size. The review is based on studies in relation to higher education responsiveness, skill mismatch, overeducation, curriculum alignment, graduate employability and school-to-work transition. It also relies on policy documents and official sources of data concerning Indian higher education, technical education and the labour-market statistics. The discussion is structured around themes that ensure that the connections between curriculum, skills, institutions and outcomes of employment are evident.

The range of scope is restricted to higher education-labour market affinity in engineering and technical education. Data from other disciplines are incorporated only when they provide insights on topics of broader scope like career preparation, placement cells, employability skills, or the education-employment mismatch. The study focuses on Bihar particularly Patna district. Meanwhile, there is a theoretical and comparative approach to the literature from the national and international level. This is required as labour-market affinity is a dependent factor on national policy, regional development and institutional practice.

3. Expansion of Higher Education and the Employability Question

The higher education system in India has grown significantly in size. It now has a larger output of students in terms of disciplines. As per the provisional reports of the All India Survey on Higher Education (AISHE) 2022-23, the enrolment in higher education has grown from 4.33 crore in 2021-22 to 4.46 crore in 2022-23 (Press Information Bureau, 2026a). The growth in these areas is of social need. It can enhance access and mobility and human capital. But simply more numbers in the school doesn't guarantee job opportunities. The value of higher education to the labour market is related to the quality of the curriculum, the quality of the teaching methods, infrastructure and industry exposure.

In the technical education it is very noticeable the question of employability. Engineering graduates can go into manufacturing, information technology, construction, infrastructure, electronics, automation, energy, and/or consulting and public services. However, changes in the demand of employers are occurring in the wake of digitalisation, automation, artificial intelligence and project-based working. Employers are now seeking applied problem solving, technical competence, communication skills, teamwork, data manipulation and ethical standards and a willingness to learn on an ongoing basis. This can't be satisfied by a classroom-centred approach.

Labour-market data also indicates that there is not a simple linear relationship between education and employment, as illustrated in recent data. According to the Periodic Labour Force Survey (PLFS) Annual Report 2025, unemployment rate of persons with Secondary Education and higher education has witnessed a decline from 7.0% in 2024 to 6.5% in 2025. It further noted that just 4.2% of the people aged 15-59 were engaged in formal vocational/technical training, or receiving (Press Information Bureau, 2026b). This indicates that there is still a need to keep a focus on formal skill formation. This also enhances the demand for internships, laboratory sessions, applied projects, and industry interaction and placement support for engineering education.

4. Conceptualising Higher Education-Labour Market Affinity

There are four interrelated dimensions which can be used to explain higher education-labour market affinity. The first one is curriculum alignment. Indicates the extent of alignment of course content, learning outcomes and assessment to existing and future occupations. The second aspect is skill development. It involves technical, digital, analytical, communication and teamwork/adaptive skills. The third is the institutional mediation. This encompasses placement cells, career counselling, internships, industry contacts, alumni associations and entrepreneurship support and engagement with employers. The fourth one is labour market outcome. This encompasses employment status, job relevance, wages, career development, job role stability and job-role satisfaction.

This broader perspective is significant as it is related to the job transition process, which is affected by a variety of factors. The quality of the curriculum, faculty competence, institutional reputation, family background, language skills, social networks, location, gender, caste, and sectoral demand and recruitment practices can all have an impact on outcomes. Affinity should not be limited to asking a student if he or she has a job, but rather ask about the nature of the job and the student's level of involvement in the labor market. It should also enquire

about the appropriateness of the position, its stability and linkage with the student's discipline and educational level.

This view is based on the available literature on overeducation and mismatch. Overeducation is when a person's qualification is greater than what is required for the job. Field-of-study mismatch is when a graduate is employed in an occupation different than the one they earned their degree in. Skill mismatch is a condition that results when skills acquired in the school don't match with the job needs. Even when they have a job, these mismatches can lead to a decrease in job satisfaction, productivity and wage returns (Sicherman, 1991; Dolton & Vignoles, 2000; Croce & Ghignoni, 2012).

5. Curriculum Responsiveness and Engineering Education

The level of responsiveness to the curriculum is a major determinant of the affinity of higher education to the labour market. The need to respond to the demand of the labour market is stressed by Bardhan, Hicks and Jaffee (2013) in the context of higher education. Wage inequality and wage mismatch may be caused by slow changes in the degree outputs and programme design. Responsiveness in technical education needs to ensure that the curricula are synced with the industry practice, technology and occupational standards. Educational programmes can't stay the same when the need is shifting towards data analysis, interdisciplinary problem solving, embedded systems, artificial intelligence, renewable energy, electric mobility, and automation.

The need to connect curricula to the needs of the labour market is also mentioned by Mocanu, Zamfir and Pirciog (2014). They demonstrate the need for interaction between the universities, employers, trade unions and career guidance systems and policies. This does not just relate to the curriculum; it's a labour-market question as well. It's a governance problem as well. There is a need for institutions to have systems in place to gather employers' feedback, to revise content and to include other stakeholders in the programme revision process. It is applicable to engineering colleges of Bihar where the courses are prescribed from the central government, but the pattern of employment in the region is influenced by the national employment pattern.

Flexibility in the curriculum and employment are also advanced by Indian policy reforms. A flexible choice based credit system, multidisciplinary learning and multiple entry/exit options have been incorporated into the UGC Curriculum and Credit Framework for Undergraduate Programmes (University Grants Commission, 2022). AICTE has also prepared the model curricula of undergraduate engineering and technology programmes, such as discipline area curricula, and emerging area curricula (AICTE, 2026). The reforms indicate a shift to a more flexible, skills-based and outcomes-focused approach to education. However, the design of the policy is different to the implementation in the classroom. The key is whether or not colleges successfully translate these frameworks into teaching, laboratory, projects, internships and assessment.

6. Employability Skills and Skill Mismatch among Engineering Graduates

Not all people with degrees are necessarily employable. It is the knowledge, skills, attitudes and career-management skills that enable graduates to secure, maintain and develop a career. Engineering education employability encompasses engineering principles, design and testing skills, software/digital literacy, data interpretation, project management, communication, teamwork and adaptability. A critical issue in labour-market research of graduates is the disparity between the number of graduates completing their degrees and the number of graduates who actually enter the labour market in a satisfactory capacity.

A survey conducted by World Bank among Indian employers for newly graduated engineers revealed serious concern on the part of employers. Blom and Saeki (2011) reported that 64% of the employers who have hired fresh engineering graduates were only somewhat satisfied or less with the quality of new hires. The finding is still relevant since it demonstrated that it is not only a problem of the number of engineering graduates. It is also the nature and pertinence of their abilities. The problem becomes more critical in the colleges having poor laboratory and industry project facilities, lacking in communication training, and poor in placement preparation.

Lauder and Mayhew (2020) doubt the notion that higher education leads to automatic win-win economic growth and social justice. They say that they do not believe that graduate numbers are always related to growth of traditional graduate jobs. This is an important reason why India needs this argument. The rapid growth of degree granting institutions could lead to increasing numbers of students with expectations that are not being met in the labour market. However, in these kinds of circumstances, employability will rely on so much more than access. It also is influenced by the quality of education, reputation of the institution, exposure and regional economy.

Skill mismatch needs to be analysed at multiple levels in Bihar. The graduates might experience a technical mismatch if they are unable to use current software, code, design, manufacture or analyze. They might experience a mismatch in communication if they are from non-English speaking backgrounds and/or from rural areas and are

poorly suited to interview or the business environment. They can experience a career-information mismatch if they are unaware of the expectations of the industry, of competitive exams, of apprenticeship opportunities, of start-up opportunities and of sectoral hiring trends. They may also experience a mismatch if there are few jobs in their region, and they have to relocate or be employed in different jobs.

7. Training, Placement Cells and Industry-Academia Interface

There is a link between education and employment provided by institutions. Training and placement cells are significant as they give career counselling, arrange job placements, train in soft skills and arrange internships and link students with employers. According to Panakaje et al (2024) the activities of TPC help in career preparation and transition to an employment. Their research finds that placement support must go beyond being an administrative process. It should be an educational tool, which is also labor market oriented.

The industry-academy interface in engineering colleges should be implemented in the form of structured internships, live projects, industrial visits, expert lectures, curriculum workshops, mentoring by alumni, employability tests, and faculty-industry exposure. The internship portals and internship-connect schemes by AICTE indicate that there is a policy interest in providing work exposure and access to institutional excellence (AICTE, 2026). But these efforts only benefit the students when they are engaged with the process in a meaningful way. The quality of internship, employer involvement and integration in the academic program are also important.

Industry academia interface is weak, student knowledge learning is not aligned with what recruiters test. Students can pass classes, but don't know any of the professional tools, workplace discipline, industry terms or real problem solving conditions. This can be narrowed by strong industry involvement. Can assist colleges in the identification of emerging skills, updating of labs, applied research and enhancing placement quality. The capacity of the training and placement cells can provide valuable insights into the role played by institutions in creating employment in Patna district.

8. Regional Context: Bihar (Patna District)

The region-specific context is relevant because outcomes of the labour markets are influenced by regional economic structures, migration, industrial development and institutional capacity, etc. Bihar has always been a source of students opting for technical, professional and competitive-examination streams. But uneven local absorption of jobs continues. The capital city of Indian State Bihar, Patna is an important educational hub with significant engineering institutions and coaching networks. Yet, there is much more to be learnt at an empirical level about the labour-market relationship of engineering educations in this region.

Regional research is also obliged to take into account that engineering graduates from Bihar are not just dependent on the local employers. A large number of students look for employment in the metros, public sector organizations, IT hubs, construction companies, government services, start-ups and higher education institutions. So it is important to consider the labour market affinity of the engineering colleges of Patna district both with reference to opportunity and employability requirement in the country. The college can be in Patna only but the students can appear for exams in Bengaluru, Hyderabad, Pune, Delhi-NCR, Mumbai, Chennai or in national level exams. This results in a multi-level labour-market situation.

There is limited literature available on the topic of linkages between higher education and labour market in Bihar. The analysis of the studies on the implementation of RUSA and higher education infrastructure suggests that the issue of quality in higher education in Bihar. For instance, differences in infrastructure, facilities etc. are mentioned in Matin's work on RUSA in Bihar. Infrastructure does not directly generate jobs, but it impacts the quality of learning, research, and student support and institutional reputation. Thus, the analysis of engineering employability in Patna district should be studied as per the curriculum analysis, student perception, outcome of students, feedback of the employers and assessment of the infrastructure of the institution.

A district-level focus will provide information that can reveal differences that may be obscured at the state level. The standards of the faculty, laboratory facilities, accreditation, placement support, alumni network, and internships might vary from college to college in the field of engineering. Such a study can provide a basis for laws and institutions to move forward and find practical gaps and create location-specific interventions.

9. Conceptual Framework for Future Empirical Research

Based on this review, it is suggested that the affinity between higher education and labour market in engineering education can be explored in a multi-dimensional approach. The framework links inputs in the institutions, academic processes, and the formation and outcomes of employability. Facilities, faculty skills, accreditation, laboratories and placement-cell capacity are the factors that constitute institutional inputs. Academic processes

consist of curriculum relevance, teaching process, project work, internship and assessment. The competences of employability formation are technical competences, soft skills, digital skills, career awareness and professional confidence. Labour-market indicators encompass employment, job suitability, earnings, job quality, job advancement and employer satisfaction.

In this interface, the industry-academic interface is a bridge. It connects learning to the requirements of business. It also enables students to take their classroom learning and to become professional learners. Contextual factors such as the socio-economic status and labour-market conditions in the region can be regarded as contextual moderators. For instance, learners from rural and/or first generation backgrounds might require additional support in communication, mentoring and career guidance. Patterns of placement and mismatch may vary among the different branches of engineering, including civil, mechanical, electrical, electronics and computer science.

10. Thematic Synthesis of Literature

Table 1: Thematic synthesis of literature on higher education-labour market affinity

| Theme | Core argument | Key sources | Implication for engineering colleges in Patna district |
|-----------------------------------|--|---|---|
| Higher education responsiveness | Institutions need to respond to changing labour-market demand through programme design, curriculum revision and skill orientation. | Bardhan et al. (2013); Lauder & Mayhew (2020) | Curriculum and programme review should be linked with employer demand and sectoral trends. |
| Curriculum-labour market matching | Curricula need stakeholder feedback, career guidance and employer participation to reduce mismatch. | Mocanu et al. (2014); UGC (2022); AICTE (2026) | Colleges should institutionalise employer feedback and regular curriculum review. |
| Skill mismatch and employability | Graduates may hold degrees but still lack practical, communication and problem-solving skills required at work. | Blom & Saeki (2011); Sicherman (1991); Dolton & Vignoles (2000) | Employability training should include technical, digital, communication and workplace-readiness skills. |
| Training and placement support | Active placement cells improve career preparedness and support the transition from education to employment. | Panakaje et al. (2024) | Placement cells should function as career-development centres, not only recruitment offices. |
| Regional labour-market context | Regional economic structure, migration and infrastructure shape graduate employment outcomes. | Matin (2025); PLFS 2025 | Patna district needs a context-sensitive study of local and national employment pathways. |

11. Proposed Conceptual Model

The following model can guide future empirical analysis of engineering colleges in Patna district.

Figure 1: Proposed conceptual model of higher education-labour market affinity

| Institutional Inputs | → | Academic Processes | → | Employability Formation |
|---|---|---|---|-----------------------------------|
| Infrastructure, faculty, accreditation, | | Curriculum relevance, pedagogy, projects, | | Technical skills, digital skills, |

| | | | | |
|--|---|----------------------------|---|--|
| laboratories and placement-cell capacity | | internships and assessment | | communication and career awareness |
| | Industry-academia interface as bridging mechanism | | → | Labour-market outcomes: employment, job relevance, salary, career growth and employer satisfaction |

Research Gap

According to the review, there are four significant gaps. Firstly, there are numerous studies regarding higher education and employability at the national and international level. There is a lack of district-level evidence related to the engineering colleges in Bihar. Secondly, employability research tends to centre on employment rates. They are less interested in the relevance of jobs, use of skills, mismatch between branches of employment and quality of jobs. Third, the role of institutional arrangements like placement cells, internships and engagement of employers have not been studied in the context of Bihar. Fourth, the students' view, alumni experiences, and employers' expectation and curriculum analysis are not often integrated into the same framework.

These gaps form basis for a specific empirical study on engineering colleges, in Patna district. A study of this kind can reveal if current curricula are aligned with (or do not align with) expectations from the labour market. It can also evaluate student employability perceptions, placement systems, graduate job types and strategies to enhance the linkages between education and employment. The review also recommends that employability shouldn't be a binary choice. It should cover technical readiness, soft skills, work experience, placement assistance, relevance of field of study, career growth.

13. Implications for Policy and Institutions

This review provides solid policy and institutional implications. The technical education authorities at the policy level need to enhance continuous review of the curriculum, outcome-based accreditation, quality assurance of internships, and employers participation. The use of model curricula with model credit frameworks can be useful. However, their value will come with the implementation at the college level. Authorities should also regularly perform labour-market mapping to discover new sectors and skill needs of engineering graduates.

Institutions like Engineering Colleges should create structured employability ecosystem. These should be early skill assessment, technical training at each branch, a module of coding and digitization skills, communication support, career counselling, Alumni mentoring, workshops and projects led by the employers. Placement cells need to have close working relationships with academic departments. Feedback from recruiters should be used to enhance the curriculum and training. Industry exposure and opportunities for professional development should also be provided for faculty members.

But, at student level, employability should be a process that is ongoing throughout the programme and not just in the final year. Students must be made familiar with the career options, internships, portfolio creation, interview skills, competitive exams, entrepreneurship, emerging technologies at an early stage. By collaborating with local industries, Government organizations, startups, infrastructure companies and national employers, colleges in Patna district have the opportunity to open up new career avenues.

14. Limitations of the Review

The present paper is a narrative review. It does not claim to be a systematic meta-analysis. This compiles data from academic and policy research for a conceptual approach to higher education-labour market affinity. The paper lacks primary data from students, employers or institutions because these are used as a foundation for further

empirical studies. The proposed framework needs to be validated with the survey and interviews conducted and institutional records and employer feedback from engineering colleges in Patna district in future studies.

15. Conclusion

The relation between higher education and the labour force is one of the most significant issues in the contemporary engineering education. Higher education's growth in India has helped people gain better access. But the employability challenge suggests the need for access to be complemented by high quality, relevance and practical skill development. Engineering education requires curricula which can respond to the needs of the students, industry involvement, active placement systems, soft and digital skills training and awareness of regional labor market realities.

It is the need of the hour to give specific attention to Bihar from the academic point of view. There is no adequate literature available that can explain how the engineering colleges in the region are preparing their students for the job and how they transit to the labour market. There is more to unemployment than this. Other factors are also curriculum mismatch, skill gaps, less support from institutions, limited access to practical exposure and less job opportunities in the region. The framework can inform future research by connecting the institutional inputs to the academic processes with the formation of employability and the outcomes of the labour market. Better education-employment connectivity can be a driver for engineering colleges to play a role in building students' careers and the development of their region as well as the overall Indian skill agenda.

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