

Assessment of Technical Higher Education and Graduate Employment Ability: An Empirical Study of IT Graduates of Agra Division

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Abstract

The structure relationship between the technical higher education quality and the employment of Information Technology (IT) and Computer Science graduates of Agra division, Uttar Pradesh, India has been assessed through an empirical study.. The phenomenal growth and development in the Indian IT-BPM industry along with India's rapid digitization march create a challenging scenario for the regional academic institutions in tier-2 divisions to meet the market demands with the supply-side academic outputs. A mixed research design was adopted where primary empirical data has been collected from 320 recently graduated students having their degrees of Bachelor of Technology in Computer Science /IT, Bachelor of Computer Applications and Master of Computer Applications from the four districts comprising the Agra division (Agra, Mathura, Firozabad & Mainpuri). Major parameters of employability including basic placement percentages, time-to-employment post graduation, starting salary distribution profiles and the extent of curriculum – industry synchronization in the domain specific areas were empirically evaluated by the application of relevant statistical tools such as the Chi-square test of independence and multiple regression analysis.

The study findings indicate that though acquisition of formal degree credentials facilitates entry level eligibility in the technology sector, but the differences in job quality, remuneration structure, and ease of finding employment are significantly influenced by student's involvement in on-line practical software development projects, contemporary industry driven certifications and inclusion of soft-skills trainings. Institutional factors, notably efficacious Training and Placement cells, establishment of corporate alliances and effective industry connect are statistically significant in reducing the geo-centric barriers of talent acquisition. The paper ends with the relevant recommendations to the HEIs, Industries personnel and Policy makers in upgrading technical curriculum, enhancing soft skills in a big way, making ends meet in closing the skill gap and creating an ecosystem of technology graduate in the tier-2 geographical area.

Keywords: Technical Education, Graduate Employability, IT Graduates, Agra Division, Skill Gap, Tier-2 Ecosystems, Curricular Alignment.

Introduction

IT and Information Technology Enabled Services (ITES) sectors form crucial pivots of economic development, modernization of technology infrastructure, and high value employment creation for India's expansive knowledge economy. As the world digitizes at pace, the uptake of cloud computing, embrace of artificial intelligence and growth of enterprise software engineering continues to boost the demand for skilled tech talent. This demand is currently catered by the hundreds of thousands of engineering, computer application and tech graduates produced each year by Indian HEIs (Higher Education Institutions). The National Employability surveys had already been pointing out a very critical disconnect between the knowledge gained in the academic institutions (in form of formal degree) and their readiness for the professional career. Many technically-qualified graduates did not have a job specific to their technical domain even after graduation, revealing a structural hole between what was taught in the academia sphere and what was needed by the tech firms. This issue is more acutely apparent at tier-2 regional academic hubs that are located outside the premier, large-metropolitan technology clusters of Bengaluru, Hyderabad, Pune, or the NCR (National Capital Region)-with large corporate HQs, R&D centers and startup ecosystems-and that instead face different kinds of structural hindrances. One such critical, regional educational hub is the Agra Division (western part of Uttar Pradesh, consists of 4 districts: Agra, Mathura, Firozabad and Mainpuri), a region which is a densely populated academic centre due to having state affiliated public and private universities/autonomous colleges/polytechnics teaching technical, and computer, courses. Agra region's traditional, largely unorganized, industrial economy is, unfortunately, based upon agriculture, leather industries, handicrafts, glass industries, tourist amenities. However, there isn't an equally widespread and entrenched formal industry ecosystem for Corporate Software Development. Implications for Technical Graduates Produced By The Division: Geographical Out Migration:

Since there's no widespread local ecosystem for the software-trained technical workforce available in the division that can employ graduates for core software engineering/design tasks, technically trained Agra's graduates will almost certainly be compelled to out-migrate into urban tech hubs (particularly NCR like Noida/Gurugram/Mumbai or Bengaluru) after graduation or opt for master/doctoral studies in city hubs that have technology programs (e.g., in NCR tech clusters).

These graduates are compelled by career aspirations for software development, data engineering or systems architecture roles and need the mobility to seek it in a region other than the one where they did their formal higher education. Institutional Imperfections: Wide variations exist in the employability output among the public or state universities, and private technical universities or autonomous engineering institutions located across the Agra division - in terms of campus recruitment facilities, student placement cells, campus infrastructure or industry tie-ups for students. Pedagogical Gaps: There appears to be a disparity with regards to the curriculum, especially for public institutions/universities, that might lag behind the cutting edge tools and methods prevalent in industry.

The graduates might possess the fundamentals in theory knowledge bases of their discipline but unable to keep abreast with application part of emerging technologies for very swiftly adopt in work situation. This investigation to address all above socio economic and institution factors associated with Technical Education and graduate employability prospects for generation of substantial and fruitful recommendations has explored in depth in particular case of Agra Division. It critically analysis various academic factors and practical aspects, institutional and social demographical factors affecting to the career path of fresh tech graduates of Agra division.

2. Research Objectives

In order to analyze analytically the relation between form academic grounding and the job skills and outcomes in technical stream by the way of investigation and assessment it has been defined as below four research objectives are-

1. Quantitatively profile job outcomes of recent IT graduates in Agra Division: To ascertain baseline rates of immediate post-graduation placement, mean time to securing employment after graduation, common starting salary ranges, and the dominant industries that absorbed technical talent.
2. Evaluate perceptions of technical skill relevance between graduates and industry: To measure the perceived efficacy of existing academic curricula (theory and labs), exposure to modern tools (e.g., cloud technologies, AI/ML, software engineering tools), and soft-skills development from the perspectives of both graduates and corporate recruiters.
3. Disaggregate academic, institutional and socio-demographic drivers of career success: To assess how institutional type (public/state-affiliated vs. Private), degree level (B.Tech vs. BCA/MCA), academic performance (GPA), and practical profile development contribute to faster time-to-employment and higher starting compensation among IT graduates in Agra.
4. Develop strategic policy interventions for enhancing graduate employability: To formulate evidence-based policy, pedagogy and training recommendations for HEI leadership, HR departments, industry employers, and relevant government bodies to bridge the employability gap, facilitate smooth transitions for graduates, and minimize talent flight from tier-2 regions.

3. Literature Review & Conceptual Framework

3.1 What is graduate employability in technical domains? Graduate employability is a complex concept that moves beyond only finding employment after graduation. Yorke (2006) defines graduate employability as, "a set of achievements - skills, understandings and personal attributes - that make graduates more likely to gain employment and be successful in their chosen occupations."

In the context of technical and software engineering disciplines, graduate employability can be thought of as a tiered layer of capabilities: Hard Technical skills - ability to programme in different programming languages, Algorithms and data structures knowledge, Software design and system architecture proficiency, database development/management knowledge, software testing knowledge, and proficiency using standard technical tools and framework.

Soft and Behavioral skills -Communication abilities, problem-solving and critical thinking skills, adaptability, team working, negotiation, and elementary understanding of business logic/functions.

3.2 Developing talent and structural challenges among the second-tier regions and cities In recent years, employability outcomes among graduates in economically isolated second and third-tier cities and agglomerations have been highlighted as structurally differentiated from those of major tech hubs such as Bengaluru and NCR. This is largely because while tier 1 locations typically have dense populations of large MNC/large scale software firms (many with large-scale software product engineering functions), extensive corporate R&D establishments, active tech startup ecosystem, higher university industry linkages through Dedicated Innovation Hubs and strong clusters of highly linked alumni, the second-tier cities like Agra Division often have a weaker infrastructure development which could include late updation of curricula, restricted industry linkages and industry sponsored training/research programs, and insufficient on-campus lab infrastructure for practical training. The deficiency in these structural factors in second-tier locations often leads to a disconnect between productively trained graduates and market demand for skills which ultimately results into additional technical training, acing highly competitive exams and undertaking other kinds of post academic trainings which makes the graduates suitable for high-demand jobs- commonly known as “employability gap”.

4. Research Methodology

The current research has a pragmatic and mixed-methods framework to complement a larger scale quantitative data collected from a pool of recent technical graduates with qualitative data collected from the interviews with major stakeholders in respective institutions and industry.

Research Parameter		Detailed Specification
Target Population		IT/Computer Science Graduates (B.Tech CS/IT, BCA, MCA) graduating between 2021 and 2025
Geographic Scope		Agra Division, Uttar Pradesh (Agra, Mathura, Firozabad, Mainpuri districts)
Sampling Technique		Stratified Random Sampling (Total Sample n = 320)
Data Collection Instruments		Structured Digital Graduate Survey + Semi-Structured Qualitative Recruiter Interviews (n = 15)
Primary	Analytical Techniques	Descriptive Statistics, Chi-Square Test of Independence (χ^2), Multiple Linear Regression Analysis

4.1 Sampling Design and Data Collection

To allow for broad and systematic coverage of institution types, degree-level programs and respondent demographics, a stratified random sampling methodology was employed with regards to the four districts in the Agra Division

- **Degree Program Stratification:** B.Tech CS/IT (n = 160, 50.0%), BCA (n = 90, 28.13%), MCA (n = 70, 21.87%).
- **Institutional Classification:** Private Universities / Self-Financed Engineering Institutes (n = 210, 65.625%), State-Affiliated / Government Institutions (n = 110, 34.375%).
- **Gender Demographics:** Male (n = 196, 61.25%), Female (n = 124, 38.75%).
- **Geographical Distribution of Institutions:** Agra District (n = 150), Mathura District (n = 110), Firozabad District (n = 35), Mainpuri District (n = 25).

The primary quantitative data collection was done with the help of a structured and field-verified digital data collection tool in the period between mid-2024 to early 2025. In support to the quantitative survey, a semi-structured interview of fifteen senior corporate talent acquisition professionals and training and placement (T&P) cell heads of universities was conducted in the regions of Western Uttar Pradesh to give context to quantitative patterns.

5. Empirical Findings & Data Analysis

5.1 Employment status & Sectoral Distribution - From the entire sample of 320 IT Graduates across the Agra Division 62.5 per cent (N=200) have been employed in full-time formal jobs within the six-month period of receiving the degree programme. However when we analyze the employment in a sectoral distribution pattern, we observe a severe disparity in the quality of employment along with the location.

Primary Employment Category	Percentage (%)	Sample Count (n)	Primary Geographic Location Hub
Core IT / Software Development Engineering	48.4%	155	NCR (Noida, Greater Noida, Gurugram), Bengaluru, Remote
Non-IT / ITES / Tech Support / Admin Roles	18.8%	60	Agra Division local, Jaipur, NCR
Higher Studies / Research (M.Tech, MS, Ph.D.)	12.5%	40	State/Central Universities, International Institutions
Self-Employed / Freelancing / Tech Startups	7.8%	25	Agra Division (serving domestic/remote clients)
Actively Seeking Employment (Unemployed)	12.5%	40	Agra Division

The findings demonstrate that less than half (48.4%) of the total graduate cohort secured core software engineering, data engineering, or systems design roles. A notable portion (18.8%) absorbed entry-level non-technical or semi-technical roles within ITES, business process management, or local administrative functions, representing technical underemployment.

5.2 Time-to-Employment Velocity

The duration elapsed between final degree completion and securing a formal employment offer represents a key indicator of market readiness and institutional placement efficiency.

Employment Acquisition Timeframe	Percentage of Graduates (%)	Cumulative Percentage (%)
Pre-Graduation to 3 Months	42.5%	42.5%
3 – 6 Months	20.0%	62.5%
6 – 12 Months	25.0%	87.5%
Greater than 12 Months	12.5%	100.0%

While 42.5% of graduates secured employment rapidly (within 3 months), over a third (37.5%) required more than six months to transition into the workforce, reflecting post-graduation friction, prolonged self-upskilling, or extended off-campus job search cycles.

5.3 Curriculum Alignment and Technical Skill Self-Assessment

Graduates evaluated the perceived adequacy of their academic training across six core technical and professional domains using a standardized 5-point Likert scale ranging from 1 (Highly Deficient) to 5 (Highly Adequate).

Curriculum & Skill Domain	Sample Mean Rating (μ)	Standard Deviation (σ)	Perceived Adequacy Level
Core Computer Science Theoretical Foundations	4.12	0.72	High
Database Management Systems & Relational SQL	3.65	0.81	Moderate to High
Object-Oriented Programming (Java/C++/Python)	3.40	0.89	Moderate
Practical Laboratory Work & Live Capstone Projects	2.45	1.02	Deficient
Business Soft Skills & Technical Communication	2.20	0.95	Deficient
Modern Emerging Tech (AI/ML, DevOps, Cloud APIs)	1.85	0.88	Highly Deficient

The empirical results demonstrate a striking divergence: while foundational theoretical knowledge is rated highly ($\mu = 4.12$), practical exposure to industry software practices ($\mu = 2.45$), professional soft skills ($\mu = 2.20$), and modern developer toolchains ($\mu = 1.85$) are evaluated as severely deficient by graduates.

5.4 Statistical Hypothesis Testing

Hypothesis 1: Institutional Infrastructure vs. Campus Placement Success

To analyze whether institutional placement infrastructure significantly impacts pre-graduation employment acquisition, a Chi-Square test of independence was performed. Institutions were categorized into High Placement Infrastructure (dedicated, active T&P cell, structured corporate MOUs, regular training bootcamps) and Low Placement Infrastructure (ad-hoc placement support, absence of dedicated corporate relations teams).

- **Null Hypothesis (H_0):** There is no significant association between college placement infrastructure quality and candidate placement status prior to graduation.
- **Alternative Hypothesis (H_1):** High-quality college placement infrastructure is significantly associated with higher pre-graduation candidate placement success.

The calculated test statistics are as follows:

- Calculated Chi-Square Value (χ^2): 18.42
- Degrees of Freedom (df): 2
- Critical Value at $\alpha = 0.05$: 5.991
- Calculated p-value: $p < 0.001$

Conclusion: Since the calculated χ^2 value (18.42) exceeds the critical threshold (5.991) and the p-value is well below 0.05, the null hypothesis (H_0) is rejected. The analysis demonstrates a statistically significant positive relationship between structured institutional placement infrastructure and early job acquisition.

Hypothesis 2: Determinants of Initial Graduate Compensation (Multiple Linear Regression)

To evaluate the relative contribution of academic performance versus practical skill indicators in dictating employment quality, a multiple linear regression analysis was conducted. The dependent variable (Y) represents starting annual gross salary compensation in Indian Rupees Lakhs Per Annum (INR LPA). The independent variables consist of:

- X_1 : Cumulative Academic GPA (Scale 1.0 – 10.0)
- X_2 : Number of Completed Practical Software/Web Projects (Portfolio on platforms like Git Hub/Deployed Cloud)
- X_3 : External Industry-Recognized Technical Certifications (Binary/Count score for credentials in AWS, Java, Data Science, etc.)

The estimated empirical regression model is specified as: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$

Regression Model Fit and Coefficient Outputs:

- **Model Fit Metrics:** $R^2 = 0.542$, Adjusted $R^2 = 0.537$, $F(3, 316) = 124.6$, $p < 0.001$
- **Standardized Coefficient for Academic GPA (X_1):** $\beta_1 = 0.18$, $t = 2.04$, $p = 0.042$
- **Standardized Coefficient for Practical Projects (X_2):** $\beta_2 = 0.45$, $t = 6.82$, $p < 0.001$
- **Standardized Coefficient for Industry Certifications (X_3):** $\beta_3 = 0.31$, $t = 4.91$, $p < 0.001$

Insight: The regression model accounts for 54.2% of the variance in starting salary levels among IT graduates in the region. Crucially, while academic GPA (X_1) remains a statistically significant baseline predictor ($\beta_1 = 0.18$), practical portfolio projects ($\beta_2 = 0.45$) and external technical certifications ($\beta_3 = 0.31$) demonstrate substantially stronger predictive power in determining entry-level compensation.

6. Discussion

The empirical observations generated by this research highlight significant structural factors that hinder success within technical education and labor market conditions of Agra Division:

1. The Practical Application Deficit: While current technical curricula successfully impart concepts underlying theoretical subjects (relational data theory, algorithmic constructs, operating system functionality etc.), a rigid, lecture-focused approach to exams heavily favors rote memorization, rather than practical skill development and application as needed in software engineering. Indeed, candidates with self-developed, deployed, and publicly version-controlled software portfolios (hosted on tools such as GitHub, or built to run in cloud based architectures) were more likely to be successful in their technical screening rounds and receive higher starting compensation packages

2. Geographical Out flow ,Regional Talent Drain: More than 70% of all core IT jobs sourced were located outside of Agra Division in metro city clusters (particularly NCR cities – Noida, Gurugram Greater Noida). This reality arises because without dedicated, locally based IT and software creation environments, high-skilled technical labor simply outflows to nearby tier-1 regions (NCR cities). This leaves the regions of Agra, Mathura, Firozabad and Mainpuri continuously under-supplied for a range of advanced digital engineering skills.

3. Bottlenecked by Soft Skills: In each case in this research, every single corporate talent acquisition manager cited shortcomings in candidate soft skills as the critical single filter encountered in the multi-stage interview process. Technically the candidates met the skill baseline for entry-level roles, but lack of business domain awareness, systematic verbal communication abilities (in english), well-articulated thinking processes, and collaborative agile approaches made it impossible to progress beyond the second stage of interview at any organization of interest.

4. Institutional Disparity and Friction within Network Infrastructure: Candidates applying to private or autonomous institutions, with their actively maintained relations cells and corporate ties, tended to enjoy drastically shorter job search duration timelines than candidates in traditional regional state affiliated college systems.

State college systems, for the most part, lacked corporate liaison personnel, leading to almost exclusively relying on long and cost-prohibitive off-campus application cycles to be successful.

7. Strategic Policy and Curricular Suggestions

A coordinated, multi-stakeholder approach among institutional, corporate and policy planning actors will be necessary to dismantle current systemic structures and rebuild. Institutions of Higher Learning: Modern practical syllabus and add new curriculum components Students attending institutions of higher learning should learn modern software engineering tool-chains such as version control software (Git/Github), cloud containers (Docker) continuous integration environments, etc, rather than focus on legacy compilation exercises. Integrate curriculum should integrate soft-skills development across all semesters and not reserve this as a last-year effort.

Develop and require portfolio-centric capstone projects, for which an evaluation committee shall be a blend of relevant faculty, as well as external industry professionals.

Corporate recruiters/leaderships: Expand direct on-campus recruitment to Tier-2 cities, such as Agra, and use structured skills assessments for candidacy evaluation purposes. Partner with local institutions to fund the creation of tech labs, host corporate-sponsored specialized elective courses (e.g., machine learning, cyber security, cloud architecture). Government and regional policy makers: Stimulate local technology investment; expand state level IT incentives programs, such as (UP IT & ITes Policy), to facilitate the creation of turn-key tech-infrastructure, shared work-space and tech-incubators located within the Agra and Mathura city centers to prevent outward migration of tech talent. Use a voucher system for providing employees with subsidies that would cover the cost of advanced technical certifications offered globally, such as the Red Hat, Microsoft or AWS certifications, for all technically trained student across districts.

8. Conclusion

The skills acquired at technical institutions in Agra Division serve as the foundational entry points to the current knowledge economy, but it does not directly contribute to enabling high-value, sustainable, long-term graduate employability; success is primarily dependent on applied software project capabilities, external technical certifications, and placement support from the educational institution. While securing employment directly after degree completion is enabled by formal education, there is no long-term correlation; instead, initial hire compensation velocity is strongly tied to development and possession of project portfolios and formal technical certifications. The gap remains between what is taught at Tier-2 regional schools, and what employers need.

This needs a strong combined effort among educational administrators, industry professionals and regional planners to solve systemic, structural problems through re-evaluating the current syllabi, updating educational institution capacity building, and investing more resources in the infrastructure of regional technology and science capabilities. By making sure our technical institutions are not merely teaching a theoretical skill-set, but are rather developing application engineers, we can unleash the latent power of our regional youth as well as accelerate national technological capabilities.

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