Placements, internal 'brain drain' and academic life of undergraduates at the Indian Institute of Technology, Bombay

*Namit Agrawal, Sailakshmi Sreenath, Shishir K. Jha and Anurag Mehra**

The nature of jobs that undergraduate students at IIT Bombay opt for is analysed in this study. We examine the factors that affect student choices, especially what makes them opt for core (related to branch of study) or non-core jobs. We factor in the effect of their branch of study (or department), the remuneration offered, extracurricular activities pursued and the dominant aspirational narratives. Except for Computer Science and Engineering, there is a preponderance of students taking up non-core jobs. This 'realization' amongst students often promotes a disconnect with academic studies, especially of core subjects. We conclude that placement data need to be recorded and analysed every year so that rational decisions about the number of seats on offer in a given branch, the nature and extent of curricular changes, establishing multidisciplinary 'branches' and improvements in the placement process can be made in a reasoned manner.

Keywords: Academic life, core versus non-core jobs, placements, technical education, undergraduate students.

THE Indian Institutes of Technology (IITs) were setup based on the recommendations made by the Sarkar Committee in 1948 (refs 1–3). The objective of establishing these institutions was to produce technology leaders who would build the industrial base of the country. The IITs were modelled after the Massachusetts Institute of Technology (MIT), USA. The unique aspects were that engineering, science, arts and humanities were brought together in the curriculum and a semester-based, flexible structure was adopted. Within a few years of their establishment, it was found that a significant number of the graduating students were going abroad for higher studies, mostly USA. This phenomenon was so significant that a popular saying[4] was, 'when a student enrolls at an IIT, his spirit is said to ascend to America. After graduation, his body follows'.

Most of these graduates settled abroad and did not return to India. Thus, the IITs became a springboard for taking up a career overseas, and this became known as the infamous brain-drain problem[5]. A few graduates returned after acquiring a Ph.D. and, sometimes, postdoctoral experience; many joined as faculty in the IITs.

After persisting for decades, over the years, this external brain drain has declined[6]. As of now, it has morphed into a broader internal brain drain, with engineering and science graduates taking up jobs in sectors like management, finance, software, analytics, etc. These trends are driven by a variety of factors like the state of the economy and of specific sectors, job availability, the 'quality' of the job (in terms of keeping people engaged, e.g. routine versus creative), salary differentials across sectors and aspirational narratives, including those around startups, etc. While there has been some awareness of the internal brain drain inside as well as outside the IITs, this aspect has not been studied in depth largely because almost all students get some job and a general justification that in some way they contribute to society (see Supplementary Information 1). This trend also raises the important question: why are we spending so much on engineering training that is 'misallocated' subsequently?

Here, we examine what factors drive this internal brain drain. We determine what kind of jobs IIT students prefer and how this is influenced by their branch of study. We further assess the importance of the job profile, salary/package, and peer and parental pressure on the placement process. We explore how this brain drain is related to the 'student experience' in the IITs.

The nature of jobs: core versus non-core

We first define what is meant by core and non-core jobs. Core jobs have some connection with the engineering discipline (branch) of the student in terms of job profile. Therefore, any job – irrespective of which sector the company belongs to – that requires domain knowledge taught in a given branch is 'core' for that branch. As an example, consider a

Authors are in the Centre for Policy Studies, Indian Institute of Technology-Bombay, Mumbai 400 076, India.
*For correspondence. (e-mail: mehra@iitb.ac.in)

Table 1. Department-wise composition of respondents and the surveyed population

Department	No. of respondents	Population size
Aerospace Engineering	17	126
Chemical Engineering	41	249
Chemistry	9	65
Civil Engineering	26	242
Computer Science and Engineering	27	232
Electrical Engineering	33	324
Energy Science and Engineering	14	94
Environmental Science and Engineering	3	29
Humanities and Social Sciences	2	52
Mathematics	0	10
Mechanical Engineering	49	314
Metallurgical Engineering and Materials Science	36	274
Physics	12	98
Total	269	2109

chemical engineer: a job in chemical production, or in a consulting firm that provides services to the chemical industry, or in a company which makes software for the control of chemical plants, are all core jobs for this branch. Chemical industries also hire mechanical and electrical engineers for the maintenance and upkeep of equipment. So, even though such engineers may work in the chemical industry, their job requires knowledge of their respective disciplines.

Of course, every discipline fits into a variety of sectors and the breadth of this fit varies widely. For instance, the mechanical engineers can work in aerospace, software, technical consulting and construction, whereas a civil engineer may have a much lesser choice of sectors. At one extreme is the Computer Science and Engineering (CSE) branch. It is a unique case in a world so driven by computers and computing that it enables a CSE graduate to fit into almost any sector. For instance, software is ubiquitous – in other technical branches, as well as consulting, banking, analytics, etc. Therefore, there are many core jobs for this discipline across different sectors and CSE students can look forward to a job that relates – to a small or big extent – to what is being taught in the classroom.

How does placement work at IIT Bombay

The placement process at IIT Bombay is managed by the Placement and Training Cell (PT Cell). This Cell is largely managed by a team of student volunteers selected through rigorous interviews. They handle the complete process from contacting the companies and verifying resumes to slotting the companies; a faculty-in-charge supervises the functioning of the Cell. The companies highly preferred by students tend to be slotted earlier. The students can only apply to a certain number of companies slotted in the first few days. Thereafter, the companies allow 'walk-ins', i.e. interviews without shortlists. Once a student accepts an offer, he/she is not allowed to participate further in the placement process (with some exceptions).

Data and methodology

Study of factors affecting student choices

We surveyed to understand the core and non-core job preferences of undergraduates (UGs) in their third, fourth and fifth years – graduating batches of 2020, 2021, 2022 and 2023 (dual degree students only) at IIT Bombay. The first part of the survey inquired about students' career choices after graduation. The second part of the survey inquired about the factors that influence their choices. These factors can be broadly categorized as follows: quality of training and education, cultural and social norms, and job market-related issues. More details about the survey are given in Supplementary Information 6. We received 269 responses from 2109 students to whom the questionnaire was e-mailed. We got 198 responses from B.Tech. (Bachelor of Technology) students, 60 from dual-degree engineering students, 10 from BS (Bachelor of Science) students and one response from a dual-degree BS student.

Table 1 shows the departmental composition of student responses. We did not analyse internal trends in the following departments: Aerospace Engineering (AE), Chemistry (Ch), Engineering Physics (EP), Economics (Eco), Environmental Science and Engineering (EnvSE), Mathematics (Math), and Energy Science and Engineering (ESE) because the sample size was too small to draw statistically representative conclusions.

Analysis of placement data

For this part of the study, data were collected from the PT Cell for 2014–18. The data provided information about students' cumulative performance index (CPI), department and the company that they were placed in. Student identity was not part of the data, while company identity was kept confidential in this study. Using information about the sector and, if available, the job profile, the placement was tagged

as core or non-core. Except for EP, the sample size from other departments was large enough to draw meaningful inferences. The cohort different from the preference survey, but we assumed that the preferences did not change significantly.

The data did not cover those students who opted out of the campus placement process (due to various reasons like higher studies, preference for off-campus placement search, etc.). In view of anecdotal evidence, the 'package' data provided by the PT Cell may not indicate the actual in-hand salaries that the students may get. These touted 'salary packages' include base salary, performance bonus, joining bonus and often stock units. The publicized package value is thus a sum of the fixed and variable components. Such details usually do not make it to the media that reports these 'huge' numbers, resulting in popular impressions of highly inflated salary packages.

Table 2 shows the number of students from the B.Tech. programme who participated in campus placement from the batches that graduated from IIT Bombay in the years 2014–18, i.e. five cohorts. Table 3 shows the departmental distribution of these students.

We have used the median as an appropriate measure of central tendency in this study and not the arithmetic mean. The mean is influenced significantly by outliers such as very high or very low salaries, and may not be representative in such situations. The median salary is a better representative because it is that value, in the middle, where half the students earn less than it and half earn more. Extraordinarily high or low salaries, which only a few students earn, do not influence the value of the median salary significantly. This norm is also followed in research relating to income levels[7], so that a few extraordinarily high salaries do not make the overall status of a department or sector seem higher than it is.

With regard to the factors affecting student choices, we wanted first to explore the order of job preferences from the available options: non-core jobs, core jobs, startups and higher studies. Figure 1 *a* suggests that non-core jobs are the most preferred while startups are the least preferred. The preference for higher education (more details may be found in Supplementary Information 2) and core jobs was similar but lower than for non-core jobs.

Figure 1 *b* shows how the core and non-core choice plays out in selected departments. It is clear that students in the Electrical Engineering (EE) and CSE departments have the greatest preference for core jobs; students in Mechanical Engineering (ME) department show almost equal preference for both, but students in the other larger engineering departments (Chemical Engineering (ChE), Civil Engineering (CE), Metallurgical Engineering and Materials Science (MEMS)) show a strong preference for non-core jobs.

In the last few years, some 'novel' UG programmes have been started at IIT Bombay, such as the BS programme in Economics[8], Chemistry[9] and Mathematics[10]. It is not clear how much of this is based on fashionable narratives or on hard data which indicate the existence of an appropriate job market. The preference for non-core jobs in these new branches and some other interdisciplinary departments (ESE, Humanities and Social Sciences (HSS), EnvSE) is even higher than the conventional engineering branches (AE, CE, ChE, ME, MEMS, EP). While the sample size is small, the results are statistically significant.

Table 2. Number of B.Tech. students who participated in campus placement from 2014 to 2018

Year of placement	Number of students
2014	363
2015	320
2016	344
2017	449
2018	474

Factors driving student preferences

Figure 2 shows the most important factors that affect student decisions.

Job related factors: These are regarding pay, career growth and flexibility, and they play a key role in influencing student decisions. Students with non-core preferences gave these factors more importance compared to students interested in core jobs (more details given in Supplementary Information 3). Non-core recruiters often pitch competitive pay along with challenging opportunities for exposure to a variety of industries in a short span of time as the key benefits which conform with the students' preferences.

Institute-related factors: The results show that a lack of core opportunities, internships or self-learning projects and skill gaps in the curriculum affect students' placement preferences. Respondents suggested multiple solutions for these issues, such as contacting more core companies, providing opportunities for UG students which are currently available only for Master's students, incorporating practical courses and developing interdisciplinary courses.

Another issue concerns the slotting of recruiting companies. Despite their interest in core companies, some students give into the pressure of getting placement 'at the earliest' and finally choose non-core companies to avoid a stressful situation. This is facilitated by the fact that many non-core companies get the earliest slots. Several students commented that non-core companies prefer slots on days 1–3.

Cultural issues: The institution has a culture that glorifies positions of responsibility (PoRs) and extracurricular activities. Around 54.4% of students mentioned that their placement choices were affected by such a culture. This factor

Table 3. Departmental composition of graduating B.Tech. students who signed for campus placement, from 2014 to 2018

Year ⇒	2014	2015	2016	2017	2018
Branch					
Aerospace	23	20	21	22	22
Civil Engineering	71	56	52	73	67
Chemical Engineering	61	58	70	81	94
Computer Science and Engineering	67	60	59	84	106
Electrical Engineering	37	35	34	49	42
Engineering Physics	9	8	8	8	4
Mechanical Engineering	60	60	63	80	87
Metallurgy and Material Science	35	23	37	52	52

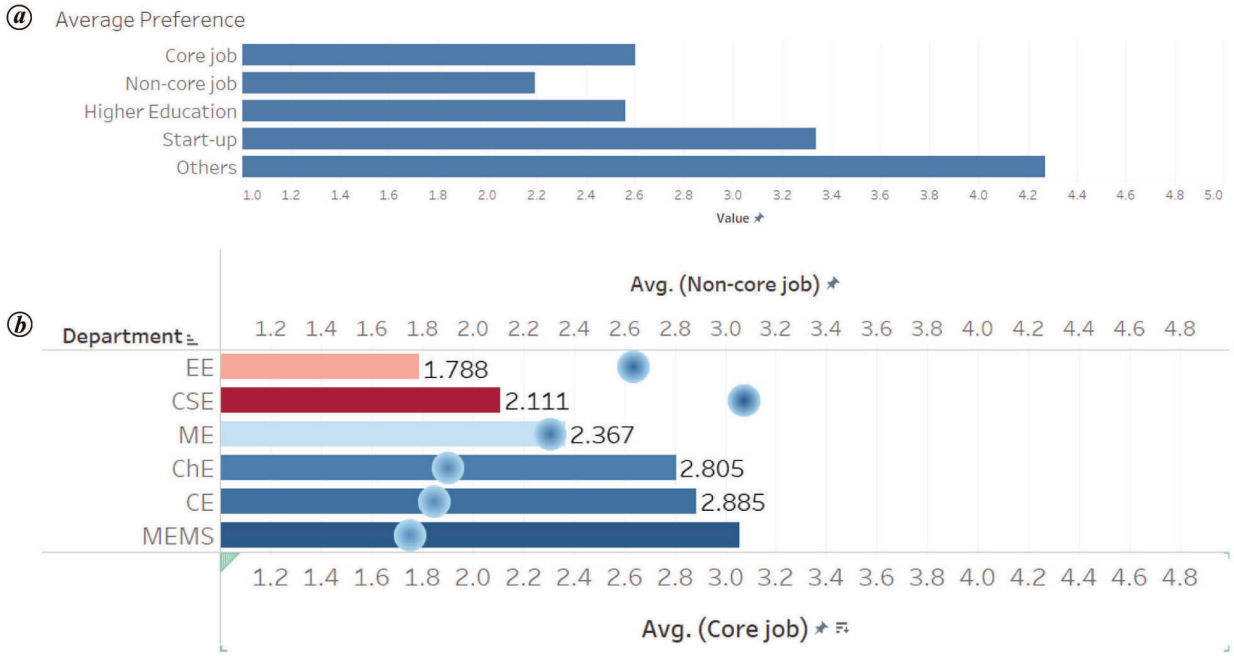

Figure 1. ***a***, Aggregate preferences for what students want to do after graduating. 1, Most preferred; 5, Least preferred; smaller value indicates greater preference. ***b***, Department-wise average of preference for core and non-core jobs. Density balls, Non-core jobs; Bars, Core jobs (1 = most preferred, 5 = least preferred; smaller value indicates greater preference for core jobs).

is equally important for students who prefer core and non-core jobs. This glorification encourages students to focus more on extracurricular activities relative to academics, leading to many being underprepared for core jobs requiring domain knowledge. Often students with a PoR are seen as role models and greatly influence other students. There is also anecdotal evidence that students opting for PoRs prefer non-core jobs. This creates an impression that non-core jobs are more glamorous and thus an indicator of success. Students do not have enough exposure to core courses as they have only spent one year studying them to be able to analyse these arguments rationally.

This narrative creates a self-reinforcing cycle: The students understand that the probability of getting core jobs is less than that of non-core jobs, which makes them focus on extracurricular activities and PoRs. This increases the demand for non-core jobs and reduces takers for core jobs. Based on this information, more non-core companies are invited for on-campus recruitment. This leads newer students to observe that core placements are low which further reduces student focus on core academics.

Let us now analyse the placement data.

International placements

International placements are the talk of the town each year during the placement period for many reasons, the most important being the '1 crore plus' salary figure associated with them[11]. Another factor is the prestige reputed tech companies – who make these coveted offers – bring to the table.

However, the most significant reason for the '1 crore plus' jobs hype is the instant multiplication of foreign currency figures with the rupee exchange rate resulting in huge values in rupees. This is the norm while reporting placement-related articles, as it creates the necessary buzz and hype

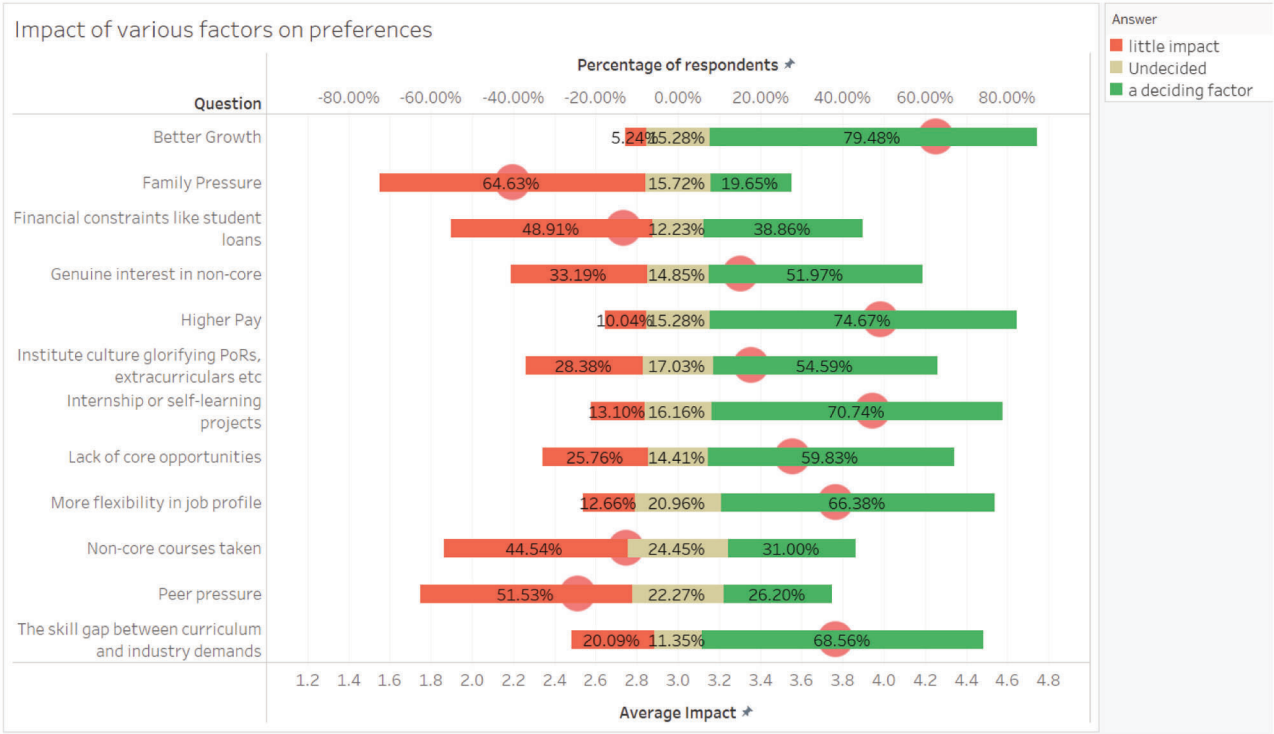

Figure 2. Factors influencing the preference for non-core jobs. 1, No impact; 5, Deciding factor. For simplification, responses indicating 1 or 2 and 4 or 5 were combined. Density ball represents the average value.

Table 4. Indian rupee (INR) per US dollar (USD) for purchase power exchange and financial exchange rates

Year	2014	2015	2016	2017	2018
Purchase power parity exchange rate (INR/USD)	18.389	19.236	19.897	20.648	20.986
Financial exchange rate (INR/USD)	61.03	64.152	67.195	65.122	68.389

and is an all-time favourite clickbait. Even when the institutions try not to reveal these package values until the majority of the batch gets placed, news hunters often find these figures and report them.

A more realistic way of assessing these package values is to use purchasing-power-parity (PPP) exchange rates between currencies. Purchasing power parities are the rates of currency conversion that are based on equalizing the purchasing power of different currencies by accounting for the differences in price levels between countries. Official PPP conversion rates are based on assorted data[12]. Table 4 shows the PPP exchange currency rates[13] and financial exchange currency rates[14].

Placement package values based on these PPP exchange rates show that the median values of international and domestic packages differ by less than 10%. For instance, an annual salary of 4,600,000 Japanese Yen converted using the regular exchange rate is equivalent to 3,000,000 INR, whereas the same salary conversion performed using the PPP exchange rate shows the equivalent salary to be around 800,000 INR.

Figure 3 shows that the domestic salaries are comparable to international ones barring a few exceptions. The hype surrounding the '1 crore plus' packages is thus unwarranted.

It is important to note that, based on the number of offers, international jobs are below 10% of the total. For the years 2014–18, they are between 5% and 10%. Our analysis shows that CSE and EE get the lion's share of international placements.

Core versus non-core placements

Placement data in Figure 4 shows the extent of core and non-core jobs in select departments, aggregated overall years. Non-core placement is dominant in AE, EP and MEMS; non-core jobs are still a majority in ChE and CE, but by a small margin; EE and ME core and non-core jobs are roughly split equally; CSE is the only department which shows a high dominance of core jobs.

Figure 5 shows that for CE, CSE and EP, the non-core median salary is significantly higher than the core salary;

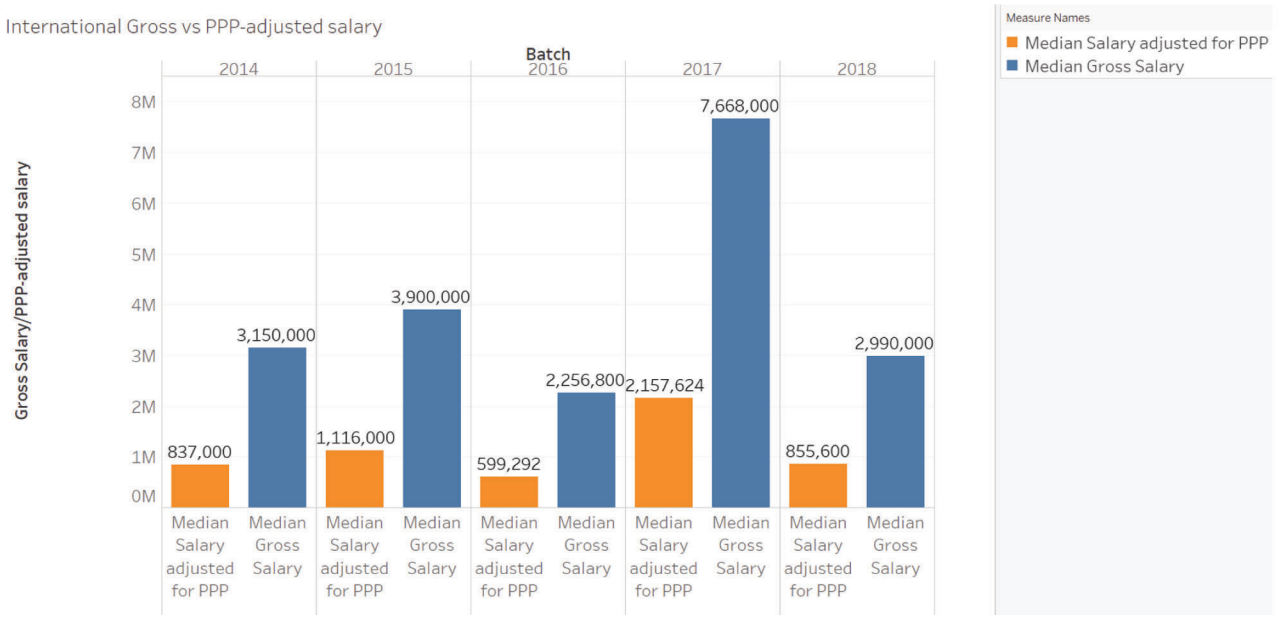

Figure 3. Median salary in foreign currency converted to Indian rupee (INR) equivalent using financial exchange rate and purchasing-power-parity (PPP) exchange rate for international placements across all years.

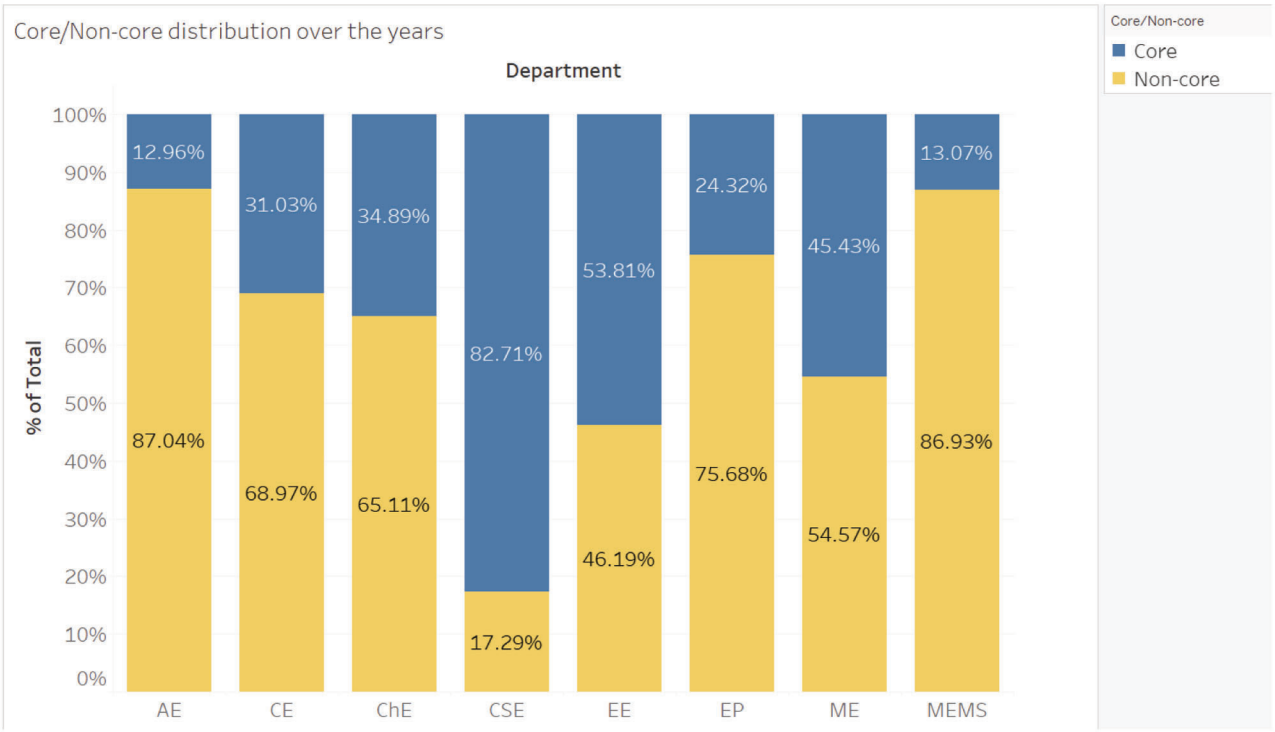

Figure 4. Per cent core and non-core jobs in select departments aggregated over all years.

in all other cases, the values are comparable. CSE remains an outlier in terms of the much higher salaries in both the core and non-core segments. The higher median salary in the non-core segment for CSE may not be important as the absolute salaries are higher and students tend to be interested in their discipline courses.

Sectoral analysis

Diversity in domestic placements: The distribution of domestic job offers across different sectors shows that more than 80% of such offers come from the following sectors: engineering and technology, IT/software, consulting and analytics

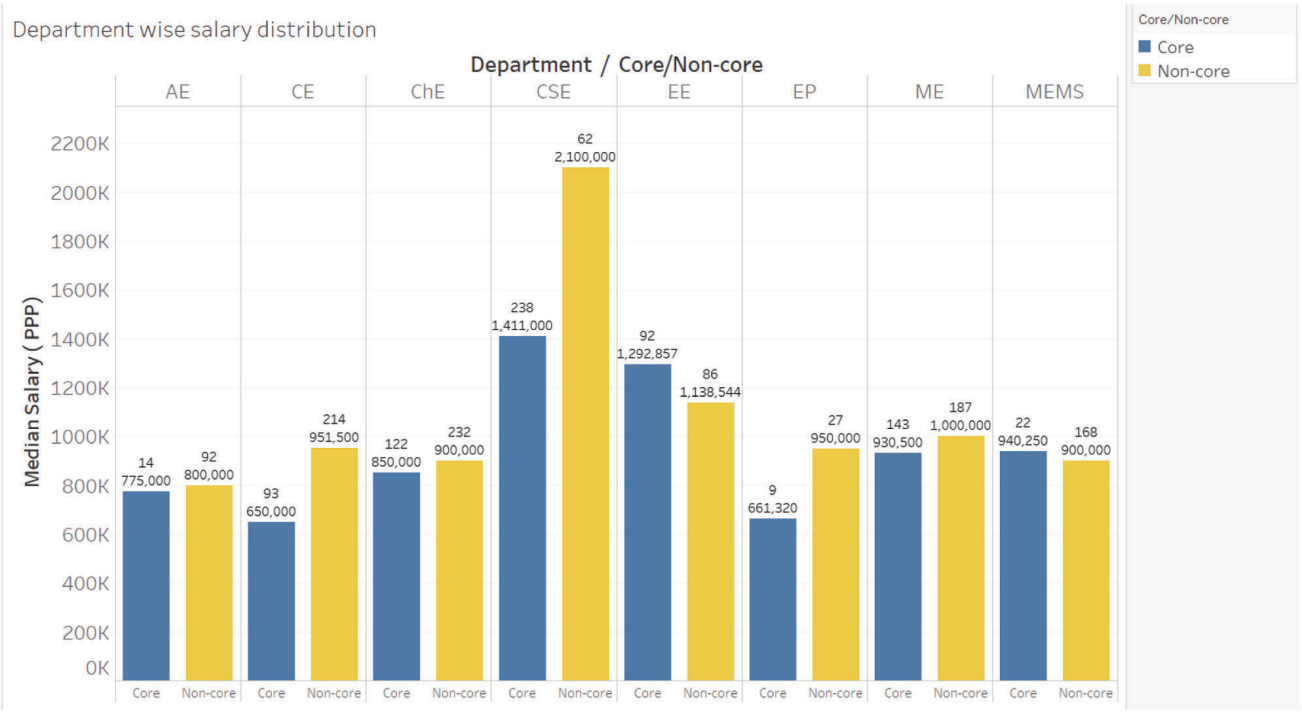

Figure 5. Department-wise median salary in core and non-core domestic placements.

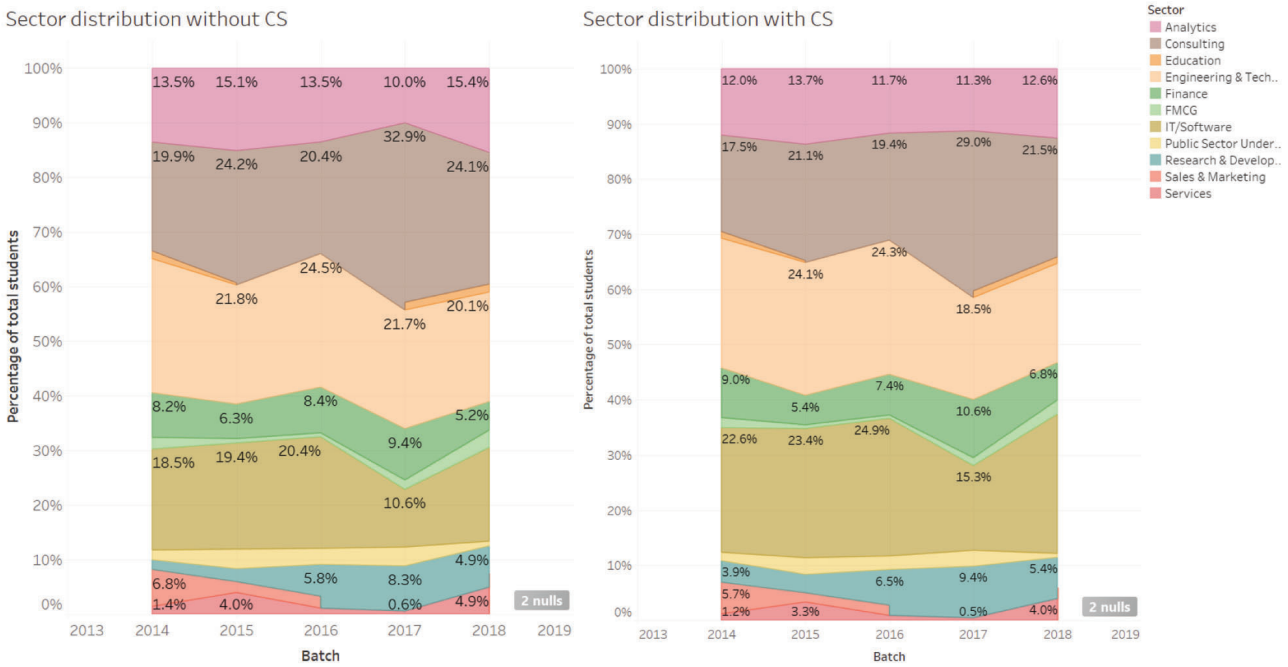

Figure 6. Area chart depicting the sector-wise composition of domestic offers for all years. The figure on the left excludes Computer Science and Engineering (CSE) placement data, while that on the right includes it.

(Figure 6). Engineering and technology have been consistent recruiters contributing 20–25% of the offers. IT/software has also been a dependable sector. Analytics is another major recruiter and its preference among non-CSE students has gradually increased.

In contrast, international placements show less diversity than domestic ones. While non-core fields like consulting, analytics and IT/software (for non-CSE/EE) dominate domestic jobs, international offers tend to be dominated by core jobs from engineering, research and IT/software (for CSE/EE).

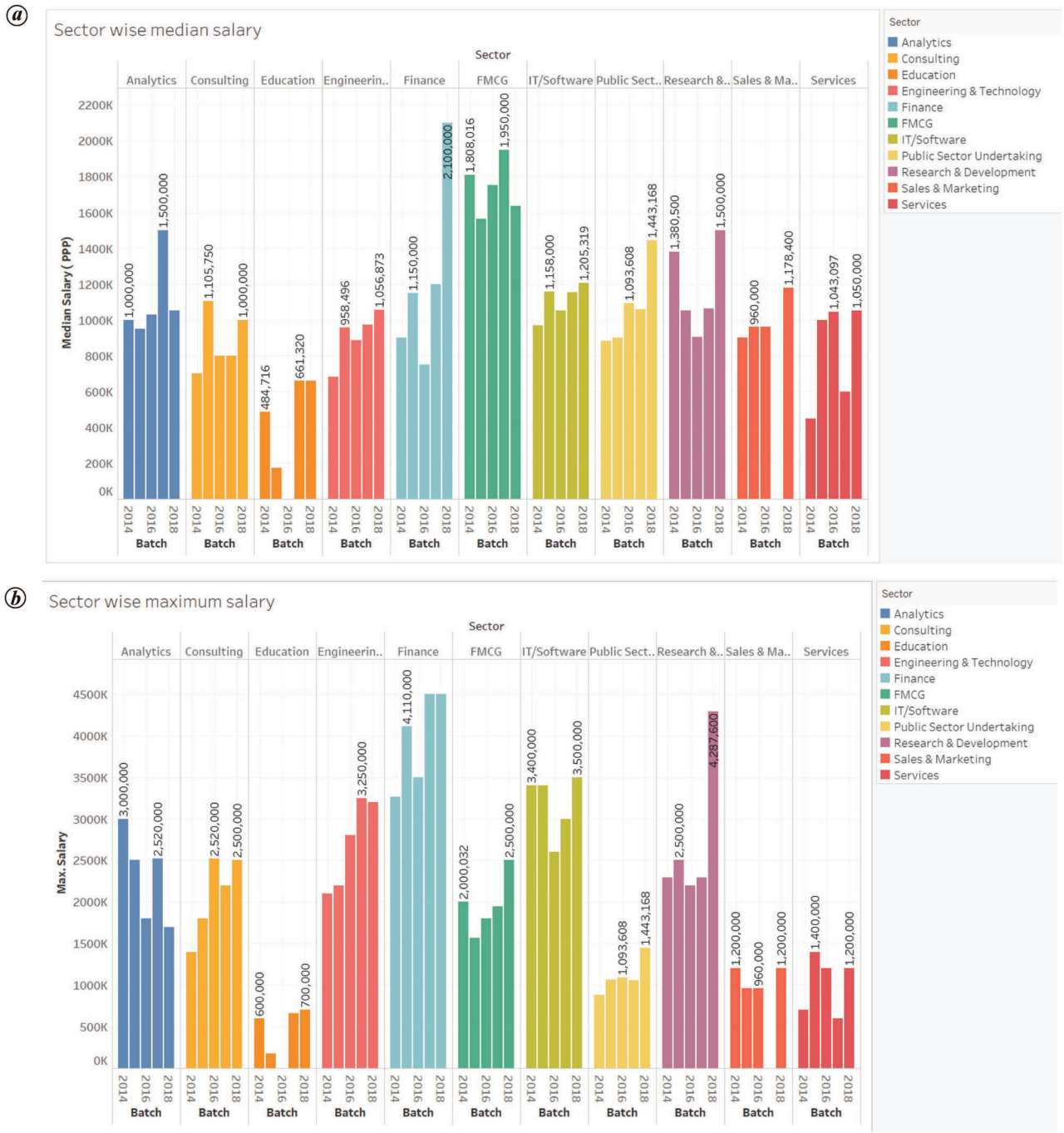

Figure 7. ***a***, Median salary for domestic placements across various sectors for all years. ***b***, Maximum salary for domestic placements across various sectors for all years.

Top-paying domestic sectors: Figure 7 *a* shows the median salary for domestic placements across all sectors for all years. The sector-wise median salary is consistently the highest in the fast-moving consumer goods (FMCG) sector for all years. However, it must be noted that the number of offers is less compared to other sectors (Figure 6). The other well-paying sectors which are also major recruiters in terms of the number of jobs are IT/software and analytics.

Figure 7 *b* shows the maximum salary for domestic placements across all sectors for all years. The correlation between the highest salary and the median salary is not strong. For most sectors, the median salary is in the narrow range of 800,000–1,100,000 INR, while the maximum salary ranges from 700,000 to 4,500,000 INR. This indicates that even though a few students get exceptionally high offers, the majority of them get much smaller packages. Two sectors that

Figure 8. Median salary for domestic placements across various sectors aggregated over all years. The figure at the bottom excludes CSE placement data, while that on the top includes it.

show a large difference between the median and maximum salaries are education and FMCG but these sectors offer relatively fewer jobs.

The IT/software sector has also earned a bad reputation for 'luring' students from other core engineering disciplines into coding jobs. Hence, many students invest a lot of time preparing for programing modules, starting from the first year itself, in the race to become competent coders[15].

Analytics, which has been in the shadow of IT/software for a long time, has now emerged as a favourite among students. It offers them a wide variety of roles, such as data scientists, strategists, etc. These roles demand strong mathematics skills and pattern recognition abilities which are abundant in IIT graduates. Many companies hire graduates mostly based on their 'coding' skills and do not care much about which discipline a student belongs to.

After excluding the jobs opted for by CSE students, a significant decrease is seen in the median salary of traditional core sectors, i.e. engineering and technology, research and development and IT/software (Figure 8). This suggests that salaries in these sectors for non-CSE students are lower compared to CSE students.

Some examples/special cases: Figure 9 shows the department-wise sector composition of non-core job branches where non-core placements are significant (more details given in Supplementary Information 4). Consider the case of the Chemical Engineering department. Analytics, management consulting and IT/software make up significant portions of the jobs. Analytics and consulting constitute more than 60% of the total offers in AE, CE and MEMS departments.

CPI-based perspective on placement

CPI is an indicator of the academic performance of a student and is computed with a maximum base of 10. Generally, shortlisting for placements uses CPI as a criterion.

For analysis, we have divided students into three categories:

(a) High CPI students: CPI > 8.
(b) Medium CPI students: 8 > CPI > 7.
(c) Low CPI students: CPI < 7.

Figure 10 shows the CPI in select departments for all years (more details given in Supplementary Information 5). The distribution pattern indicates that CSE is the leader with the highest CPI. EE shows the widest distribution. The five departments being compared here have a similar batch strength. Further, we see only a small difference between the median CPIs across departments with all values falling between 7 and 8.

Usually, students with a high CPI are eligible to apply to most companies. Thus, their placement sector is likely to reflect their choice, rather than arising out of constraints placed by other factors.

Figure 11 *a* shows the distribution of core and non-core jobs for low and medium CPI holders compared with those with a high CPI for all years. Figure 11 *b* shows the same data, but with CSE excluded.

It can be seen from these figures that non-core jobs are a dominant preference, for the years 2016, 2017 and 2018, the distribution tends to become more even handed for

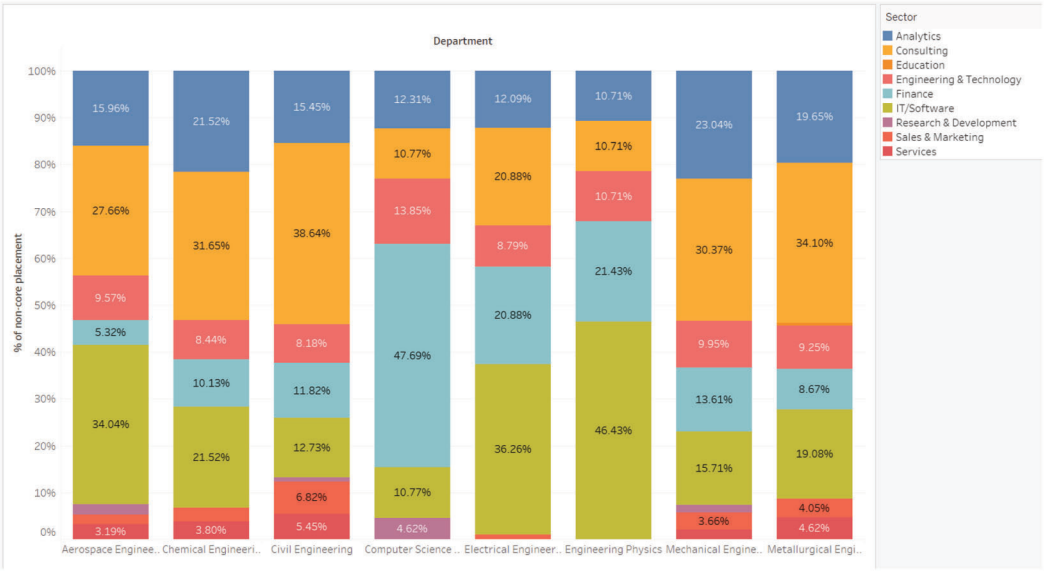

Figure 9. Bar chart depicting sector composition of non-core jobs in selected branches of engineering aggregated over all years.

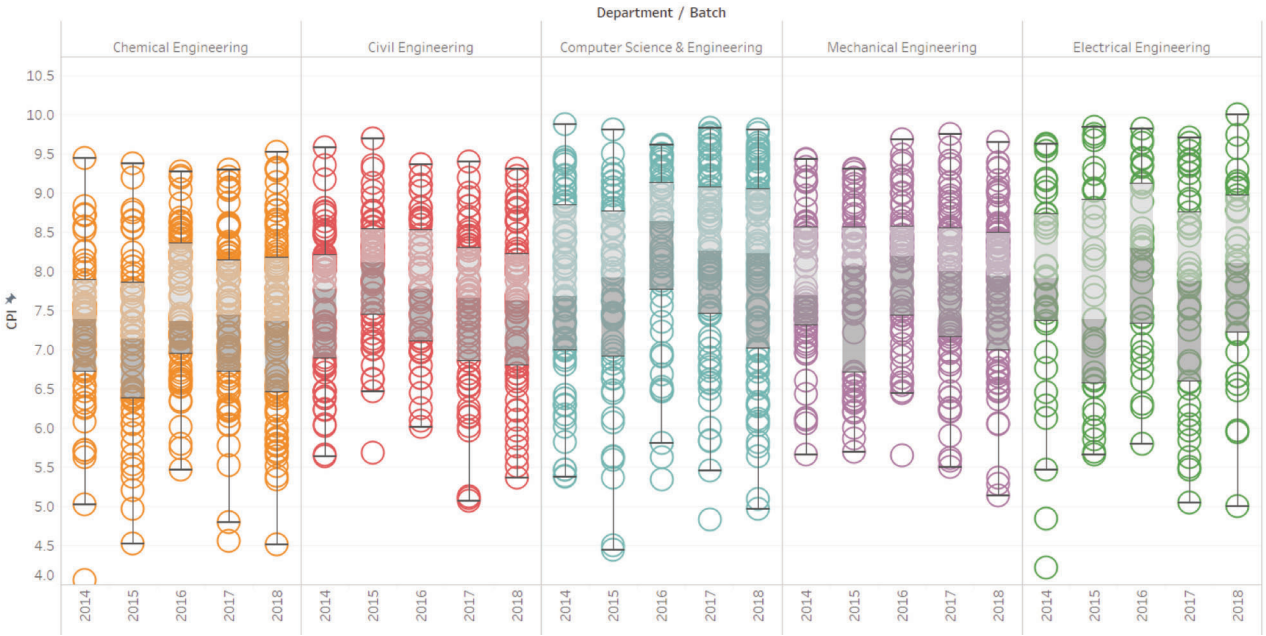

Figure 10. Cumulative performance index (CPI) distribution in select departments across all years.

medium and low scorers. CSE contributes heavily to the core basket, and its exclusion from the data skews the preference for non-core jobs even further.

Figure 12 shows a cluster analysis of CPI and salary variables for high CPI students for select departments. As can be seen, a high salary cluster is not present for CE. This trend is also seen in some other departments like ChE, AE (not shown here). On the other hand, students in CSE, ME and EE get high-salary jobs.

Our analysis also shows the general notion that recruiters reward high CPI. We note a positive correlation between CPI and salary. Further, we see that non-core recruiters reward higher CPI than core recruiters, but this effect is likely because of the high salaries that non-core jobs offer to CSE students.

Concluding discussion and insights

Strong non-core preference

We could show that students in most departments, except CSE and EE, had a stronger preference for non-core jobs

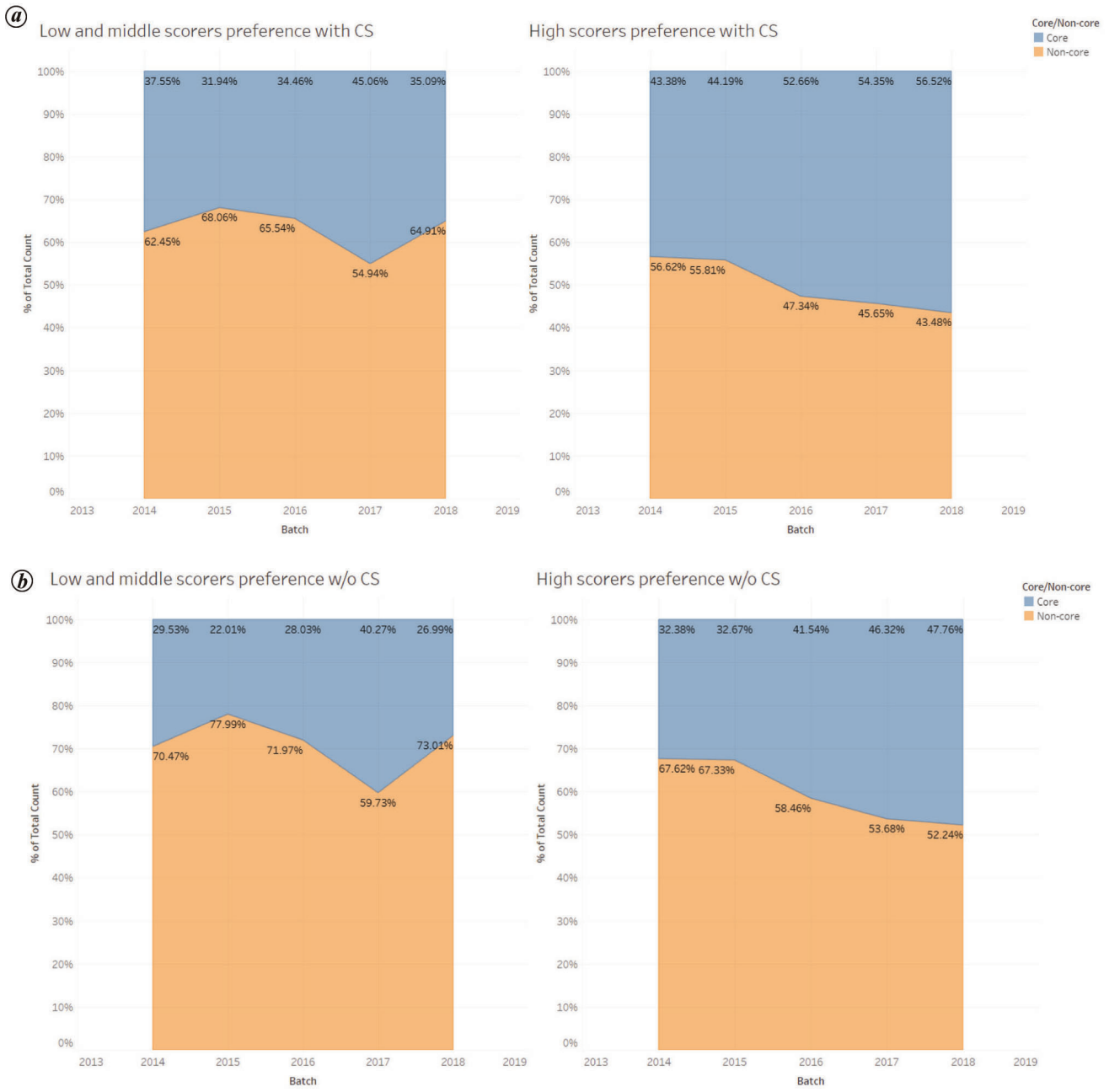

Figure 11. ***a***, Comparison of core and non-core composition of high scorers versus low and medium composition for all years. ***b***, Comparison of core and non-core composition of high scorers versus low and medium composition for all years, excluding placement data of CSE.

compared to cores jobs (Figure 1 *b*). Non-core jobs constituted about 60% of the domestic offers accepted, as observed over the five-year study period (Figure 4).

Major recruiters

Consulting, IT/software and engineering remained the major recruiting sectors for the years (Figure 6). The IT/software and engineering sectors were consistent recruiters with the combined proportion of total jobs at around 40%.

Salary may not be the dominant factor affecting student choices

Contrary to popular belief, median salaries for core and non-core jobs were similar for most departments (Figure 5), except for CSE, EP and CE. Even though consulting and IT/software together provided around 40% of the jobs, both sectors had lower than the overall median salary. However, this similarity must be considered with a caveat: low-paying core jobs, which are perhaps not taken up by anyone, are not reflected in the placement data we have used because the

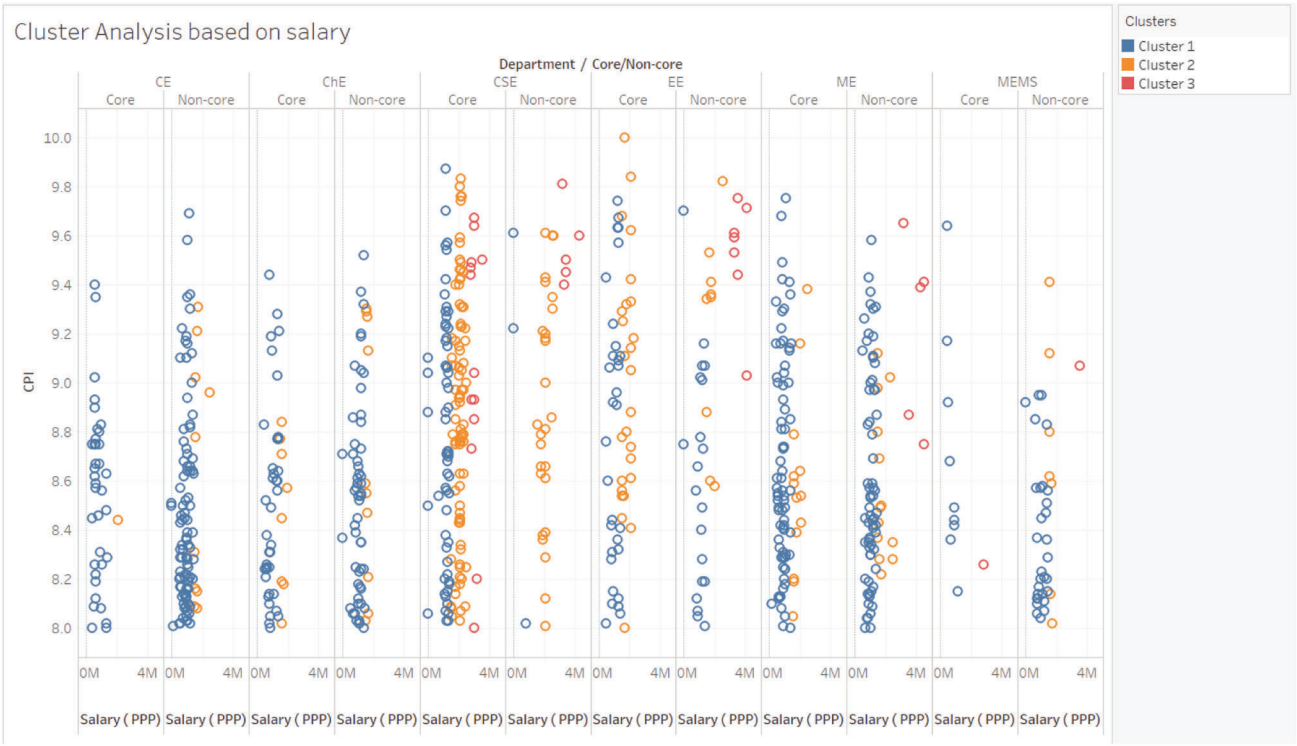

Figure 12. Cluster analysis of CPI and Salary for core and non-core jobs for high-CPI students aggregated over all years.

data are only about the jobs taken. Thus the salary difference between core and non-core jobs may seem smaller than it actually is. This is perhaps also indicative of a scenario where enough well-paying core jobs are unavailable. Nevertheless, this suggests that other factors are at play in deciding the core versus non-core choices.

Significantly, there are aspirational forces at play. The huge non-core salaries – often accessible only to CSE students – have a great signalling effect. These set aspirational hopes and serve to orient ambitions. Therefore, median salary comparisons between core and non-core jobs within a department are perhaps not as relevant as the general notion of non-core jobs as extremely well-paying (Figure 5).

The 'other' factors

The data clearly show a historical preponderance of non-core jobs. Anecdotally, this seems to drive a narrative – perpetuated by seniors and peers – that is favourable towards non-core jobs and the decision whether to stick to core technical interests or move to non-core skilling (e.g. accounting, coding, etc.) is taken around the end of the first year or early in the second year for UG students.

The choice of non-core pursuits is also made easier because these jobs require fairly generic skills, and lack the burden of imbibing and keeping up with specialized technical domain knowledge. Thus students who have lost interest in core jobs, or those who assess that they do not have any other option (due to lack of the right internships, low CPI, etc.) opt for coding as a fail-safe option. This perception of easy entry into the job market leads to many students opting for non-core jobs.

Students also consider that more flexibility and career growth opportunities are afforded by non-core jobs. Further, there is a perception that the ceiling of (maximum) salaries in non-core jobs is comparatively higher than in core jobs. Many students also mention the lack of internships and projects in core jobs. This becomes an obstacle in getting pre-placement offers. Students are under tremendous pressure to get a job as quickly as possible – this is the 'day 1' syndrome[16]. In order to get rid of the uncertainty and anxiety associated with the optics of the placement process, many students end up choosing jobs in the early non-core slots rather than waiting for the later core slots.

Solutions: what can be done

Improvements in the PT cell

The PT Cell should attempt to collect more well-paying core profiles. Some core companies leave empty-handed because no one shows interest because of the low pay. In any case, attempts to find more well-paying core jobs will reveal whether such jobs are available or not. This can be done through feedback from those involved in core jobs like the tech teams as well as the faculty.

Another suggestion is to arrange more slots for well-paying core profiles in the initial days of placement. However, this carries a risk that some students may lose out on non-core jobs. The method by which the PT Cell arrives at how slots should be sequenced is not transparent. This should be opened up for wider participation by students and faculty, and the slotting decisions should be based on processing past data by a publicly declared algorithm.

Institution-led survey

The institution should commission a massive, professionally conducted survey across industries to assess what kinds of job profiles and salaries are available. This should be supplemented by a survey of students to assess their interests and aspirations. A similar exercise across faculty will provide information about faculty expectations, their assessment of the job market and how it correlates to curricular content. Based on these data, the institution should re-design placement strategies and slotting algorithms.

In addition, after developing reference-level databases from a starting year, placement data should be updated every year to track emerging trends by each IIT and the NITs. Providing such information to various departments and centres will make them more self aware of what they are doing, what they ought to be doing, and encourage them to engage in well-informed debates with industry leaders.

A small research cell within the PT Cell may be able to do such data recording in a dedicated manner. It may also be able to carry out specific analyses, track sectoral trends, identify new placement opportunities, and so on.

Rationalization of seats across departments

The data should also be used to rationalize seats across various branches of the institution. The default policy of increasing seats by a certain percentage now and then leads to unviable and large batches in many conventional departments. Since many students are aware that they would be opting for non-core jobs, they lose interest in core courses.

One observation that stares us in the face is that the job market is changing rapidly. An emerging category is jobs in startups and growing student interest in starting their own ventures, which makes the employment scenario even more complex. Organizing science and engineering education by sticking to conventional departments is a losing proposition. There is a strong argument for starting novel, multidisciplinary programmes and gradually channelling a majority of students into these while keeping the batch size in conventional branches at realistic levels.

Technical skills: science versus practice

Many students mention that they do not have the required skills to take up core jobs in the industry. They especially complain about not being introduced to contemporary software and techniques used in the industry. This is a more complex issue than it seems, because some of this perception among students stems on account of their already having a disconnect with core courses and domain knowledge – which has now become a self-reinforcing cycle.

In many sectors, the industry is 'backward' because it 'practically' focused on production rather than any serious research and development. Most such industries use imported technology. Therefore, they do not have much interest in a curriculum that is 'advanced' and science-driven. Students and industries often complain that the courses being taught as being 'too theoretical'. Many of these industries also do not pay well and the job profiles tend to be routine and 'boring'. This divide is much less in regions that develop technologies, such as Europe and USA. One way to tackle this divide, with the objective of generating technical engagement, may be to increase the use of projects related to 'real-life' problems in the curriculum. However, in the long run this requires greater planning and prioritization of what training the IITs should cater to.

This issue also gets coupled with faculty hiring. Faculty recruitment in the IITs is largely based on research publications ('advanced' engineering science) which dwell on topics that are 'far ahead' of 'routine' practices, especially in India. Torn between industry pressure to be 'practically' focused and the research pressure to be scientifically 'advanced', the IITs have evolved a 'mixed' curriculum that simultaneously tries to be (a) science-driven (research focus), practice-driven (for the industry) and (c) generic (with focus on basic stuff). The existing curriculum does none of these particularly well. This mishmash of objectives perhaps causes many industries to be dissatisfied with the 'quality' of engineers coming out of the IITs. Also, there is a public expectation that IITs ought to be doing much better in terms of research (and therefore international rankings) as well as technology development.

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