MASALIQ
Jurnal Pendidikan dan Sains

e-ISSN: 2808-8115
p-ISSN: 2809-1051

Terindeks: Sinta 5, Copernicus, Dimensions, Scilit, Lens, Crossref, Garuda, Google Scholar, Base, etc

https://doi.org/10.58578/masaliq.v6i6.12248

Enrollment, Graduation, and Dropout Trends in Nepalese Higher Education: A Mathematical and Statistical Analysis

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Submitted:	Revised:	Accepted:	Published:
Sep 21, 2026	Oct 20, 2026	Oct 31, 2026	Nov 5, 2026

Abstract

Rapid enrolment growth in Nepalese higher education has coincided with persistently weak graduation and completion outcomes. This study examined enrolment trends, faculty and funding capacity, pass and graduation rates, and dropout dynamics across central and provincial universities. Secondary data from University Grants Commission Nepal Education Management Information System reports, national newspapers, and peer-reviewed studies were analysed using ordinary least-squares regression and log-linear exponential growth models. A four-state absorbing Markov chain representing active enrolment, delayed or repeated study, graduation, and dropout was calibrated to Tribhuvan University's reported aggregate pass rate of 29.3%. Enrolment increased from approximately 371,000 students in 2016/17 to over 633,000 in 2023/24. The linear model showed a strong fit ($R^2 = 0.933$), while the estimated enrolment compound annual growth rate was 7.93%, compared with 3.81% for faculty and 11.07% for government funding. The Markov model estimated a long-run dropout absorption probability of approximately 43% for first-attempt cohorts. Additional analyses characterized institutional fragmentation through the distribution of affiliated colleges by enrolment size and examined outbound student mobility, with more than 100,000 students annually obtaining No-Objection Certificates for overseas study. The findings indicate that enrolment growth has outpaced faculty expansion, while completion outcomes remain weak despite increased government funding. The study provides an integrated quantitative assessment to inform policies

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addressing imbalances between enrolment expansion, institutional capacity, and completion efficiency.

Keywords: Nepalese Higher Education; Enrolment Trends; Student Attrition; Regression Analysis; Absorbing Markov Chains

Introduction

Higher education is widely regarded as the principal engine of human capital formation, innovation capacity, and long-run economic mobility for developing economies. In Nepal, the tertiary education sub-sector has expanded dramatically since the turn of the twenty-first century, moving from a single-university system dominated entirely by Tribhuvan University (TU) to a plural landscape of roughly thirty universities, health-science academies, and more than 1,600 constituent and affiliated campuses spread across seven provinces. Alongside this quantitative expansion, however, persistent structural weaknesses—low graduation and pass rates, high nominal dropout, chronic under-investment in full-time faculty relative to enrolment, and an accelerating outflow of secondary-school leavers to universities abroad—have raised serious questions about the efficiency, quality, and sustainability of the system.

This paper undertakes a mathematical and statistical analysis of three interlinked phenomena in Nepalese higher education: (i) enrollment growth and its structural drivers; (ii) graduation and pass-rate performance across universities; and (iii) dropout and non-completion dynamics, including their relationship to outbound student migration. Rather than treating these as isolated descriptive facts, the paper applies formal quantitative tools—ordinary least-squares regression, exponential growth modelling, compound annual growth rate (CAGR) decomposition, index-number comparison, and an absorbing Markov chain—to characterise the underlying trend structure and to generate testable projections for the remainder of the decade.

Nepal's context makes this analysis particularly important. According to the national census-linked estimates, adult literacy stood at 76.3 percent as of 2021 (83.6 percent for males and 69.4 percent for females), reflecting long-standing gender disparities that continue to echo through the higher-education pipeline. Meanwhile, the University Grants Commission (UGC) reports that overall higher-education enrolment increased by around 71 percent between 2016/17 and 2023/24, even as the number of full-time faculty at constituent

campuses grew by less than 30 percent over the same period. Tribhuvan University alone continues to account for roughly three-quarters of total national enrolment, and its own leadership has publicly acknowledged that the university's aggregate pass rate has remained below 30 percent for at least the past decade. At the same time, more than 100,000 Nepalese students obtain No-Objection Certificates (NOC) each year to pursue higher education overseas, a volume equivalent to roughly one-sixth of total annual domestic enrolment growth capacity.

The remainder of the paper is organised as follows. Section 2 reviews the relevant literature on higher-education expansion, quality, and attrition in Nepal and comparable South Asian contexts. Section 3 provides an institutional overview of the Nepalese higher-education system. Section 4 details the data sources and the mathematical and statistical methodology employed. Sections 5 through 12 present the empirical results—enrollment trends, funding and faculty capacity, pandemic-era disruption, graduation and pass rates, institutional fragmentation, a Markov-chain dropout model, outbound migration, and field-of-study concentration. Section 13 develops forecasts to 2028/29. Section 14 synthesises the statistical findings, Section 15 discusses policy implications, Section 16 notes the study's limitations, and Section 17 concludes.

Literature Review

A growing body of Nepalese scholarship has documented the tension between quantitative expansion and qualitative stagnation in the country's tertiary education system. Comprehensive analyses of enrollment trends published in Nepalese academic journals note that, despite the physical and administrative expansion of faculties and campuses, several disciplines—most visibly education and the humanities—have experienced declining per-campus enrolment in recent years, a pattern attributed to blurred academic focus, limited facilities, and an inability of individual campuses to attract and retain students even as national totals rise. Similar work tracing doctoral and postgraduate output finds that fewer than one-quarter of enrolled Ph.D. candidates nationally complete their degrees within a given reporting cycle, underscoring that attrition is not confined to the undergraduate level.

Research focused specifically on Tribhuvan University's performance metrics is unambiguous in its assessment: the university's aggregate pass rate has not exceeded 30 percent in any of the academic years between 2013/14 and 2021/22, a pattern that a recent

internal concept paper by the Vice-Chancellor's office attributes to examination delays, prolonged programme durations (three-year degrees frequently taking five years to complete), and systemic administrative inefficiencies rather than to a single identifiable cause. Complementary reporting on cross-university comparisons shows substantial heterogeneity: while medical-education specialist institutions such as the National Academy of Medical Sciences and the B.P. Koirala Institute of Health Sciences report undergraduate pass percentages above 90 percent, provincial universities such as Mid-Western University and Far-Western University report pass percentages below 25 percent, suggesting that institutional capacity, selectivity, and resourcing—not student ability alone—are material determinants of completion outcomes.

A parallel and increasingly urgent strand of the literature addresses outbound student migration. Nepalese newspaper investigations synthesising Ministry of Education data report that approximately 110,000 students obtained No-Objection Certificates to study abroad in a single recent fiscal year, with the pace of departures continuing into the subsequent year at a rate implying comparable or higher annual volumes. This literature frames outbound migration not merely as a personal-choice phenomenon but as a structural response to perceived quality deficits, delayed graduation timelines, and limited domestic labour-market returns to a Nepalese degree—effectively functioning as a substitute form of "dropout" from the domestic system even where the student in question does eventually graduate, abroad.

Internationally, the higher-education economics literature has long used compound growth decomposition, cohort-survival analysis, and Markov-chain transition modelling to characterise enrollment and completion dynamics in expanding systems (see, for example, foundational treatments in Gujarati and Porter's econometrics texts and Norris's treatment of Markov chains). This paper draws on that broader methodological tradition, applying it for what is, to the authors' knowledge, one of the first attempts at a formal mathematical treatment of Nepal-specific enrollment, graduation, and dropout time series using publicly available UGC and government data.

Overview of the Nepalese Higher Education System

Nepal's modern tertiary education system traces its origin to Tri-Chandra College, established in 1918 and initially affiliated with Patna University in India. Tribhuvan University (TU) was established by statute in 1959, incorporating Tri-Chandra College as its

founding constituent institution, and remained the sole degree-granting university in the country until the late 1980s. Since then, the sector has diversified substantially: as of the most recent UGC reporting cycle, Nepal operates through roughly 21 universities (15 central and 6 provincial) and 8 health-science academies (6 central and 2 provincial), delivering instruction through 1,608 constituent and affiliated campuses nationwide, including community-managed and privately owned institutions.

Despite this diversification, Tribhuvan University continues to dominate the system numerically: recent Economic Survey figures indicate that TU accounts for approximately 75.3 percent of total national higher-education enrolment, split between 47.9 percent enrolled directly in TU's own constituent campuses and 27.4 percent enrolled in TU-affiliated community and private colleges. Kathmandu University, Purbanchal University, and the more recently established provincial universities together account for the remainder. Governance of the sector is anchored by the University Grants Commission (UGC), a statutory body responsible for coordinating funding allocation, academic standard-setting, and the collection of the Education Management Information System (EMIS) data that underlie most of the empirical analysis in this paper.

Academic programming is heavily concentrated in a small number of disciplinary streams. Management is by a wide margin the most popular field of study, and its share of total enrolment has grown from approximately 39 percent in 2015 to more than 47 percent in the most recent reporting year; together with education and humanities/social-science programmes, these three streams account for roughly four-fifths of all higher-education enrolment in the country, while technical and scientific streams such as engineering and agriculture remain comparatively small.

Existing studies strongly demonstrate the growing importance of mathematical modelling, numerical methods, and machine learning in solving complex real-world challenges. Sah et al. (2024) highlighted critical issues in Nepal's education system and emphasized the necessity of effective reforms and technology-based solutions. Further, Sahani and colleagues showed how numerical approaches can be effectively applied to analyze cultural, educational, and social dynamics.

Recent research by Sahani et al. (2026) strongly supports the integration of artificial intelligence with analytical and mathematical frameworks to improve risk prediction, uncertainty management, and decision-making processes. Overall, the literature confirms

that hybrid computational approaches have significant potential for developing innovative, reliable, and data-driven solutions across diverse fields.

Methodology

Data Sources

The empirical analysis draws on secondary data compiled from four categories of sources. First, the University Grants Commission (UGC) Nepal's Education Management Information System (EMIS) reports for 2023/24 provide institution-level enrolment, faculty, and funding figures. Second, national English-language newspapers with dedicated education desks — principally The Kathmandu Post, Khabarhub, and the education-sector portal Edusanjal — provide time-series figures for years and institutions not separately tabulated in the most recent EMIS release, including pandemic-era enrolment figures for Tribhuvan University and Kathmandu University, and pass-rate figures disaggregated by university. Third, peer-reviewed and student-journal publications indexed on Nepal Journals Online (NepJOL) provide cohort-level detail on doctoral and postgraduate completion. Fourth, government economic-survey releases provide the most recent (2024/25) national enrolment totals. Because these sources vary somewhat in scope (e.g., 'total higher-education enrolment' is defined slightly differently across the UGC EMIS series and the Ministry of Finance Economic Survey series), all figures are reported with their source clearly attributed, and no attempt is made to force sources of differing scope into a single unbroken series; where a break in series occurs, this is noted explicitly in the corresponding results section.

Mathematical and Statistical Framework

Six complementary quantitative tools are used to characterise the enrollment, funding, graduation, and dropout data.

(a) Compound Annual Growth Rate (CAGR)

For any quantity observed at an initial value V_0 and a final value V_n separated by n years, the compound annual growth rate is defined as:

$$CAGR = (V_n / V_0)^{(1/n)} - 1$$

CAGR provides a single smoothed annualised growth figure that is comparable across series of different length and is used here to compare the growth trajectories of enrollment, faculty headcount, and government funding on a common footing.

(b) Ordinary Least-Squares (OLS) Linear Regression

For a time series of enrollment values Y_i observed at year-index X_i, the linear trend model $Y = a + bX$ is fitted by minimising the residual sum of squares:

$$b = \Sigma(X_i - \bar{X})(Y_i - \bar{Y}) / \Sigma(X_i - \bar{X})^2 \ , \quad a = \bar{Y} - b\bar{X}$$

The coefficient of determination, $R^2 = 1 - (SSres / SStot)$, measures the proportion of variance in enrollment explained by the linear time trend, and the Pearson correlation coefficient $r = \sqrt{R^2}$ (sign-adjusted) measures the strength and direction of the linear association between time and enrolment.

(c) Log-Linear Exponential Growth Model

As an alternative to the linear specification, an exponential growth model $Y = Y_0 \cdot e^{(kt)}$ is estimated by taking natural logarithms and applying OLS to the transformed series:

$$ln(Y) = ln(Y_0) + kt$$

The parameter k is interpreted as the continuously compounded instantaneous growth rate, and $e^k - 1$ gives the equivalent discrete annual growth rate for direct comparison against the CAGR computed in (a).

(d) Index-Number Comparison

To compare the relative growth of two series with different natural units and scales (for example, students and faculty headcount), each series is re-based to an index value of 100 in the initial year: $I_t = (V_t / V_0) \times 100$. This allows the relative widening of the enrollment–faculty gap to be visualised directly regardless of the absolute magnitudes involved.

(e) Cohort Attrition and Gender Parity Index

The cohort (aggregate) dropout-equivalent rate is computed from the observed pass rate as:

$$Dropout\text{-}equivalent\ rate = 1 - Pass\ rate$$

This measure treats any student who does not complete the programme within the officially prescribed timeframe (whether through repeated failure, withdrawal, or transfer) as a non-completion. It therefore over-states 'dropout' in the strict sense of permanent

withdrawal, and Section 10 develops a more granular Markov-chain model that separates temporary delay/repetition from permanent exit. Where sex-disaggregated enrollment data are available, the Gender Parity Index (GPI), defined as the ratio of the female to male gross enrollment ratio, GPI = GERfemale / GERmale, is used as the standard UNESCO-recommended measure of gender-based access disparity.

(f) Absorbing Markov Chain Model of Cohort Progression

Student cohort progression is modelled as a discrete-time Markov chain with two transient states — S_1 (Active/Enrolled) and S_2 (Delayed/Repeating) — and two absorbing states — S_3 (Graduated) and S_4 (Dropped Out). Writing the transition matrix in canonical form with the transient sub-matrix Q and the transient-to-absorbing sub-matrix R, the fundamental matrix $N = (I - Q)^{-1}$ gives the expected number of periods spent in each transient state before absorption, and the matrix $B = N \cdot R$ gives the ultimate probability of absorption into each absorbing state from each transient starting state. This model is calibrated in Section 10 using Tribhuvan University's reported aggregate pass rate as an anchor parameter.

Enrollment Trends: Results and Analysis

Table 1 summarises the four anchor data points for total national higher-education enrollment for which consistent UGC/EMIS-scope figures are available. Enrollment rose from 371,000 in 2016/17 to 633,053 in 2023/24, a cumulative increase of 70.6 percent over seven years.

Table 1. Total Higher-Education Enrollment in Nepal, Selected Years (2016/17–2023/24)

Academic Year	Total Enrollment	Index (2016/17=100)	Source
2016/17	371,000	100.0	UGC EMIS / Kathmandu Post (2026)
2019/20	466,828	125.8	UGC records, Kathmandu Post (2023)
2020/21	460,826	124.2	UGC records, Kathmandu Post (2023)
2023/24	633,053	170.6	UGC EMIS 2023/24

Fitting an ordinary least-squares linear trend to these four anchor points yields the estimated equation:

$$\hat{Y} = 354.9 + 36.57\,X \quad \textit{(thousands of students; } X = 0 \textit{ at 2016/17)}$$

with a coefficient of determination $R^2 = 0.933$ and a Pearson correlation coefficient $r = 0.966$, indicating that a simple linear time trend explains over 93 percent of the year-to-year variation in the four observed enrollment figures. The slope coefficient implies an average absolute increase of approximately 36,570 students per year. Expressed instead as a compound annual growth rate, enrollment grew at 7.93 percent per year between 2016/17 and 2023/24.

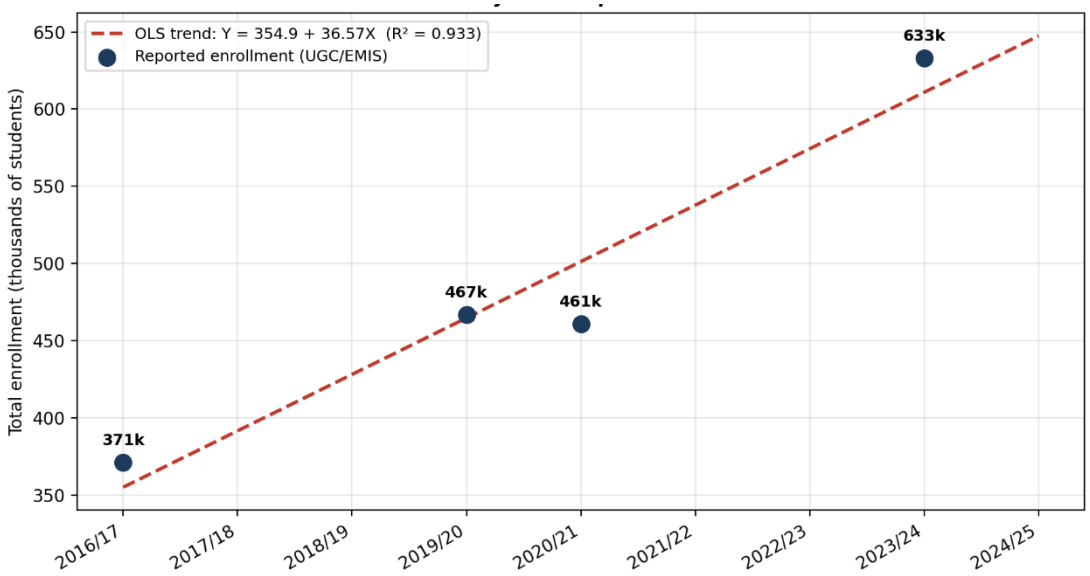


Figure 1. Total higher-education enrollment in Nepal, 2016/17–2023/24, *with fitted OLS linear trend line ($R^2 = 0.933$)*

It is notable that the trend is not perfectly monotonic: enrollment fell slightly between 2019/20 and 2020/21 (from 466,828 to 460,826, a decline of about 1.3 percent), coinciding with the global COVID-19 pandemic and its disruption of admissions and examination cycles (examined further in Section 7), before resuming a steep upward trajectory to reach 633,053 by 2023/24 and — per Economic Survey figures using a marginally broader institutional scope — 672,489 in 2023/24 and 745,770 in 2024/25, a further year-on-year increase of 10.9 percent.

This most recent acceleration is consistent with a rebound effect following both the pandemic-era contraction and a temporary tightening of international study-visa regimes in several destination countries, which the Kathmandu Post's 2026 reporting explicitly links to a resurgence of interest in home-country enrolment. The overall pattern — steady underlying growth, a pandemic-era dip, and a subsequent acceleration — is best understood as the superposition of a long-run structural growth trend (well captured by the linear and

exponential models above) and short-run shocks that a simple trend model cannot, by construction, capture.

Government Investment and Faculty Capacity

Government public financing allocated to Nepal's universities and academies increased from NPR 9.3 billion in 2017/18 to NPR 17.457 billion in 2023/24 — a compound annual growth rate of 11.07 percent, notably faster than the 7.93 percent CAGR of enrollment over almost the same period. However, this headline comparison conceals an important composition effect: the great majority of the additional funding has reportedly been directed toward infrastructure and block grants rather than the recruitment of full-time faculty, particularly at institutions located outside the Kathmandu Valley.

This composition problem is visible directly in the faculty data. Full-time teaching staff at constituent campuses increased from 9,299 in 2016/17 to 12,082 in 2023/24 — a CAGR of only 3.81 percent, roughly half the growth rate of enrollment. Table 2 summarises the three growth rates on a common CAGR basis, and Figure 2 expresses enrollment and faculty on a common index basis (2016/17 = 100) to visualise the widening gap directly.

Table 2. Compound Annual Growth Rates: Enrollment, Faculty, and Government Funding

Series	Initial Value	Final Value	Period	CAGR (% p.a.)
Total enrollment	371,000 (2016/17)	633,053 (2023/24)	7 years	7.93%
Full-time faculty (constituent)	9,299 (2016/17)	12,082 (2023/24)	7 years	3.81%
Government funding	NPR 9.3 bn (2017/18)	NPR 17.457 bn (2023/24)	6 years	11.07%

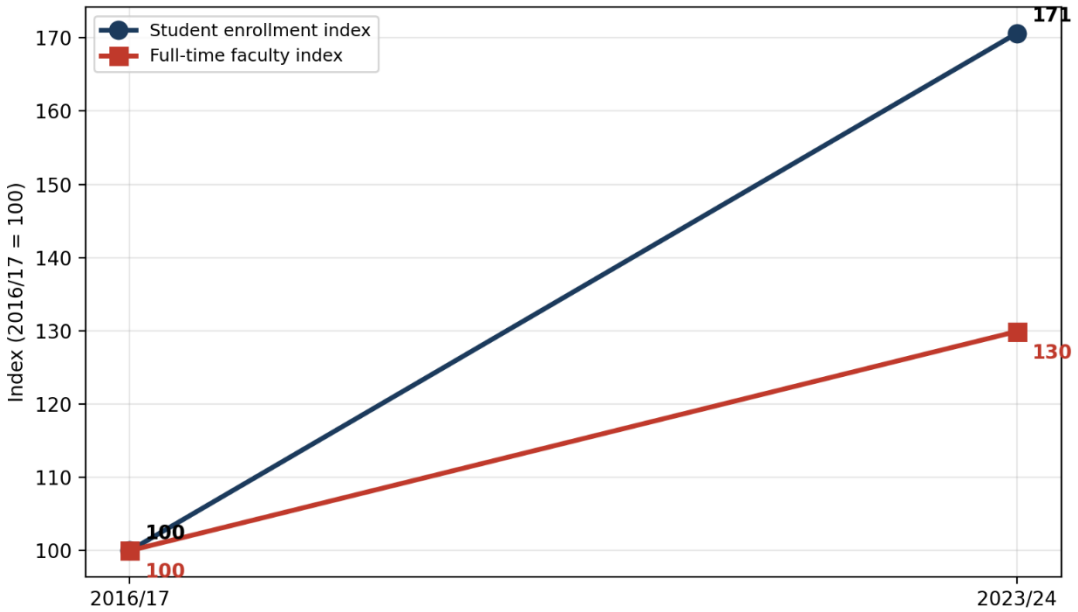


Figure 2. Growth index of student enrollment versus full-time faculty *at constituent campuses (2016/17 = 100).*

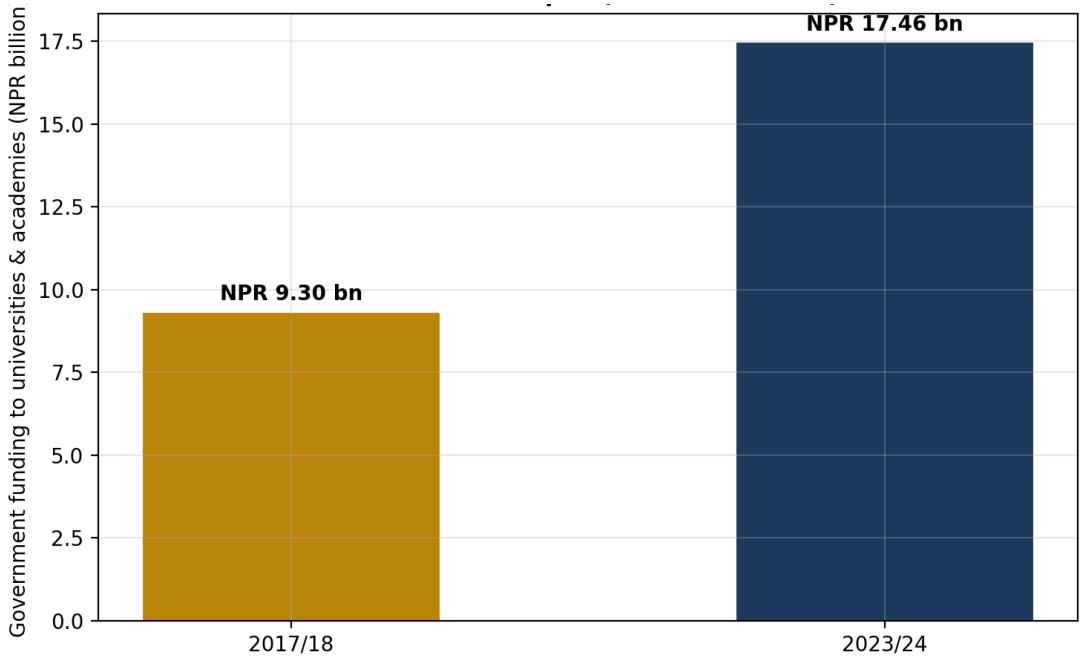


Figure 3. Government public funding to universities and academies, 2017/18 vs 2023/24.

The practical consequence of the enrollment–faculty gap is a deteriorating student–faculty ratio. Because only constituent campuses (which enrol an estimated 38 percent of the 633,053 total students, the remaining 62 percent being enrolled in community and private affiliated campuses that are not required to report full-time faculty registers) can be matched against the reported 12,082 full-time faculty figure, the implied constituent-campus student–

faculty ratio is approximately 19.9 students per full-time faculty member — at the very upper edge of the internationally recommended planning range of 10:1 to 20:1, and this ratio would be considerably worse if the unreported faculty complement at affiliated and community campuses is, as EMIS data suggest, proportionately thinner still.

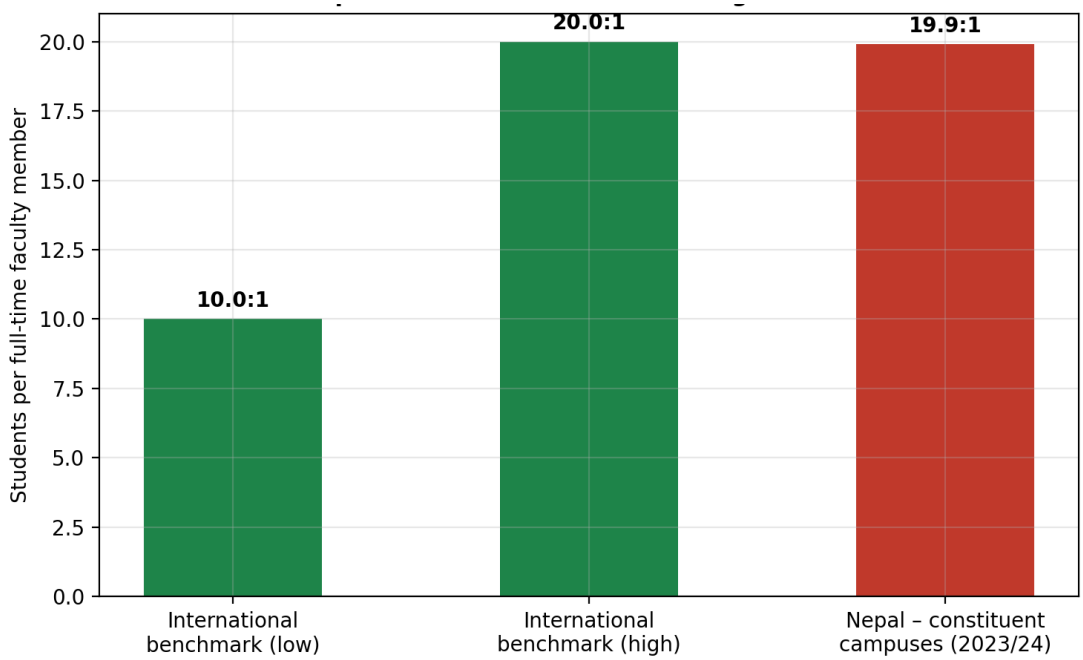


Figure 4. Student–faculty ratio at Nepal's constituent campuses (2023/24) compared with the international planning benchmark of 10:1–20:1.

Pandemic-Era Disruption and Institutional Enrollment Decline

Disaggregated institutional data confirm that the national 2019/20–2020/21 enrollment dip documented in Section 5 was broad-based across both the largest and most internationally oriented Nepalese universities. Tribhuvan University's enrolment fell from 356,654 in 2019/20 to 347,269 in 2020/21, a decline of 2.63 percent, while Kathmandu University — Nepal's leading private research university — recorded a considerably steeper decline, from 18,643 to 16,046 students, a fall of 13.93 percent.

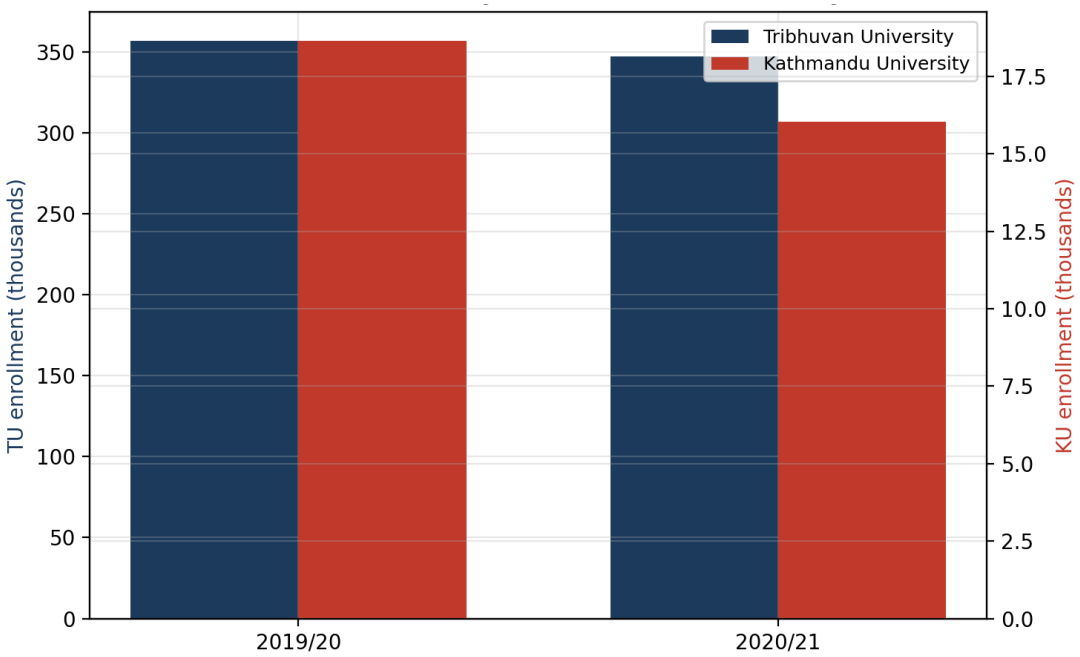


Figure 5. Pandemic-period enrollment contraction at Tribhuvan University and Kathmandu University, 2019/20–2020/21.

The disproportionate impact on Kathmandu University is consistent with its more fee-dependent and internationally benchmarked academic model: households facing pandemic-era income shocks appear to have been more likely to defer or cancel enrolment at a comparatively higher-cost private institution than at TU's comparatively low-fee constituent campuses. This differential sensitivity has direct relevance for dropout modelling, since it indicates that a meaningful share of the observed enrollment contraction in this period reflects deferred or interrupted access rather than permanent programme non-completion — an important qualification carried forward into the Markov-chain analysis of Section 10, which is calibrated on pre-pandemic pass-rate data precisely in order to avoid conflating a temporary demand shock with the system's structural completion rate.

Graduation and Pass-Rate Analysis

Graduation performance is the most direct available proxy for effective (as opposed to nominal) system output, and the evidence here is markedly less encouraging than the enrollment growth story of Section 5. Tribhuvan University's own Vice-Chancellor's office has publicly acknowledged, in a 2024 internal concept paper, that the university's aggregate pass rate has remained below 30 percent in every academic year from 2013/14 through 2021/22, with the rate for 2019/20 specifically recorded at 29.3 percent — meaning that

more than two-thirds of students enrolled in a given TU cohort fail to complete their programme within the officially prescribed timeframe.

Cross-institutional comparison reveals that this is not a uniform, sector-wide phenomenon but rather one strongly correlated with institutional type and resourcing. UGC's 2023 institutional report on undergraduate medical education found that while three of the sixteen medical-education-providing institutions with the largest undergraduate concentrations recorded a combined pass percentage of only 29.33 percent, specialist tertiary-referral-linked institutions performed far better: the National Academy of Medical Sciences recorded a 95 percent pass rate and the B.P. Koirala Institute of Health Sciences 92.44 percent, with Kathmandu University at 90 percent. At the opposite extreme, the same reporting cycle found Mid-Western University's pass percentage at only 23.5 percent and Far-Western University's at 20.66 percent — both newer, more resource-constrained provincial universities.

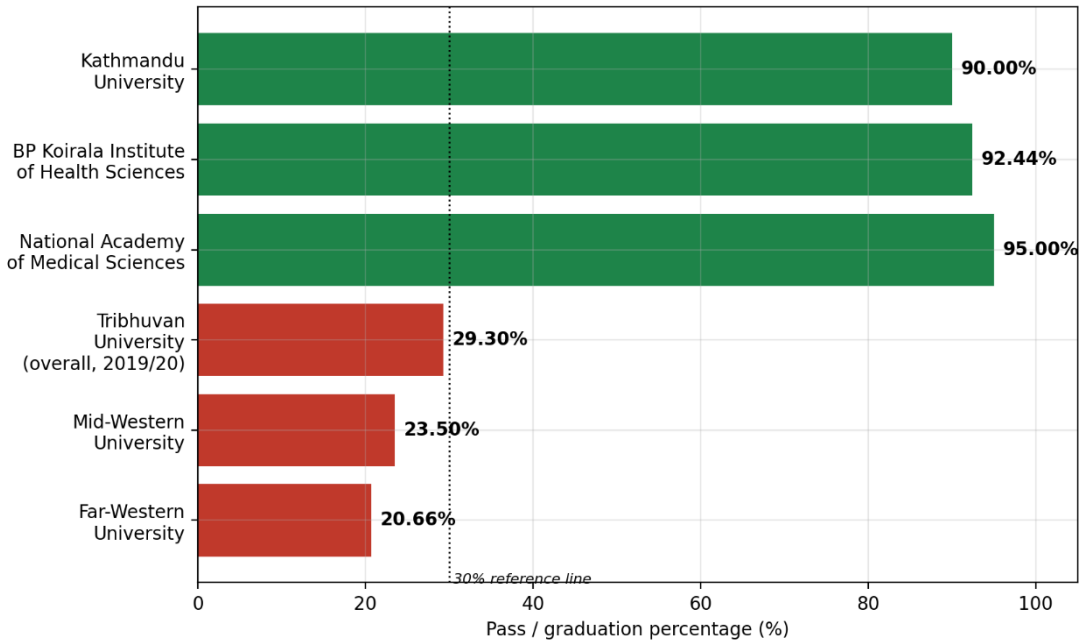


Figure 6. Undergraduate pass percentage by institution (UGC Nepal report, selected institutions).

A useful supplementary case is doctoral-level completion, which — while numerically small — offers a controlled illustration of the completion gap at the most advanced level of study. National data for the 2021/22 academic year record 874 students enrolled in Ph.D. programmes across Nepal, of whom only 201 completed (graduated) in that cycle, an aggregate production/completion rate of approximately 23 percent. At Tribhuvan University specifically, 314 doctoral candidates were enrolled and 136 completed

— a completion rate of 43.3 percent, notably higher than the national doctoral average, illustrating that even within a single university, completion performance varies substantially by degree level and discipline.

Table 3. Graduation / Pass-Rate Performance by Level and Institution

Level / Institution	Enrolled	Completed / Passed	Completion Rate
National Ph.D. cohort, 2021/22	874	201	23.0%
Tribhuvan University Ph.D., 2021/22	314	136	43.3%
Tribhuvan University (overall, 2019/20)	—	—	29.3%
Mid-Western University (UG, medical)	—	—	23.5%
Far-Western University (UG, medical)	—	—	20.66%
National Academy of Medical Sciences (UG)	—	—	95.0%
BP Koirala Institute of Health Sciences (UG)	—	—	92.44%
Kathmandu University (UG)	—	—	90.0%

The consistent pattern across Tables 2 and 3 — wide dispersion in completion rates, with the largest and most heavily subsidised public institutions clustering toward the lower end — motivates the more formal dropout model developed in Section 10.

Institutional Fragmentation: College-Size Distribution

A structural feature of the Nepalese affiliated-college system that plausibly contributes to both weak graduation rates and rising dropout is extreme fragmentation: a very large number of degree-granting colleges operate with enrolments too small to sustain full academic staffing, laboratory infrastructure, or programme continuity. UGC records for the 2022/23 academic year show that, of a total of 1,155 affiliated colleges nationwide, 555 (48.1 percent) enrolled fewer than 100 students in total, and a further 270 (23.4 percent) enrolled between 100 and 199 students — together meaning that more than seven in ten affiliated colleges in the country operate with fewer than 200 total students across all programmes and years combined.

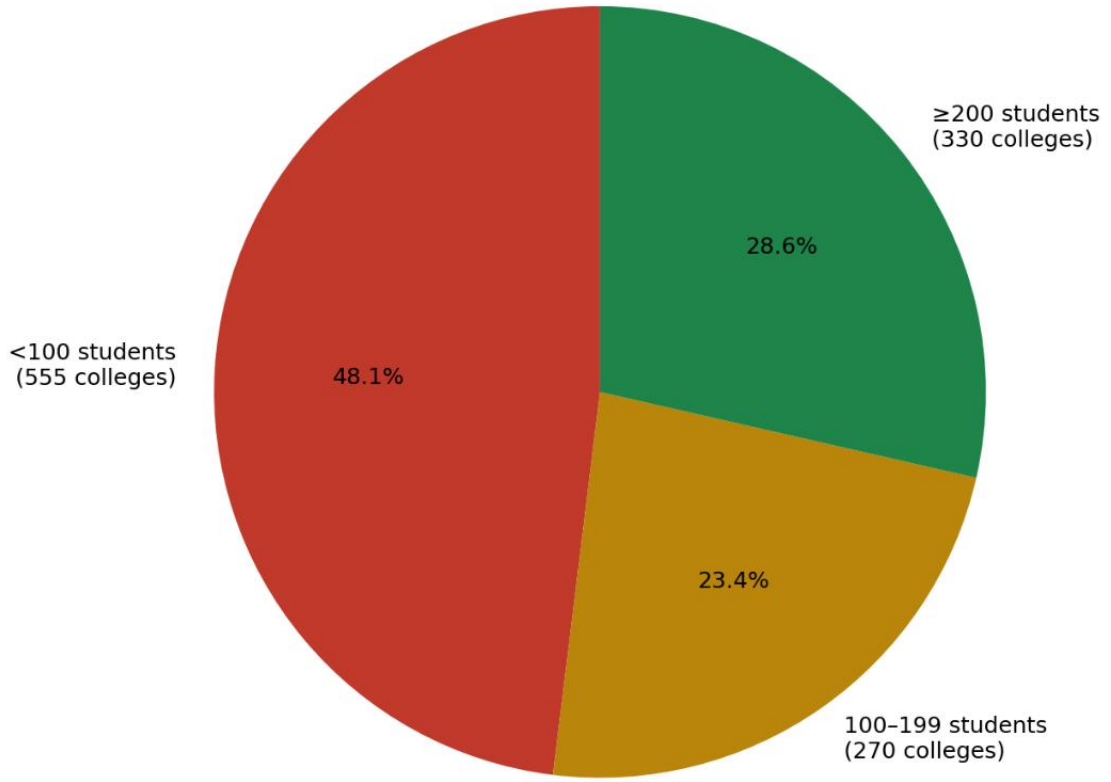


Figure 7. Distribution of affiliated colleges by total enrollment size, academic year 2022/23 (n = 1,155 colleges).

This fragmentation is directly linked in sector reporting to declining demand at the level of the individual campus even during a period of rising national totals: as illustrated by the case of Tri-Chandra Campus, seat utilisation in programmes such as microbiology, chemistry, and engineering has fallen well below nominal capacity, and Tribhuvan University has begun a formal process of phasing out selected under-subscribed programmes for want of students. Such under-enrolled institutions are structurally less able to retain qualified faculty, maintain examination schedules, or provide the kind of continuous cohort support associated with lower attrition, and their sheer number — more than half of all affiliated colleges nationally — means that this is not a marginal phenomenon confined to a handful of remote campuses, but a system-wide characteristic of Nepalese higher education that the aggregate national enrollment growth documented in Section 5 tends to obscure.

Dropout Dynamics: An Absorbing Markov-Chain Model

Aggregate pass rates, as reported in Section 8, conflate two analytically distinct phenomena: (i) students who are merely delayed — repeating a year or an examination but remaining enrolled and eventually completing — and (ii) students who permanently

withdraw from the system. To separate these effects, this paper develops a four-state absorbing Markov chain: S_1 (Active/Enrolled), S_2 (Delayed/Repeating), S_3 (Graduated, absorbing), and S_4 (Dropped Out, absorbing).

Because Nepal does not publish a cohort-level transition matrix directly, the model's transition probabilities are calibrated illustratively so as to reproduce the observed aggregate first-cycle pass rate of 29.3 percent reported for Tribhuvan University in 2019/20, while allocating the residual 70.7 percent of a first-attempt cohort between temporary delay and permanent dropout in proportions broadly consistent with the qualitative reporting reviewed in Section 8 (namely, that delay/repetition — driven by examination and result-publication backlogs — is the more common near-term outcome, while permanent dropout, though smaller in any single year, accumulates substantially over a multi-year programme). The resulting illustrative transition probabilities are: from S_1, a 42 percent chance of moving to delayed status ($S_1 \rightarrow S_2$), a 29 percent chance of graduating on schedule ($S_1 \rightarrow S_3$), and a 29 percent chance of permanent dropout ($S_1 \rightarrow S_4$); from S_2, a 20 percent chance of returning to active status ($S_2 \rightarrow S_1$), a 55 percent chance of eventually graduating ($S_2 \rightarrow S_3$), and a 25 percent chance of dropping out from delayed status ($S_2 \rightarrow S_4$).

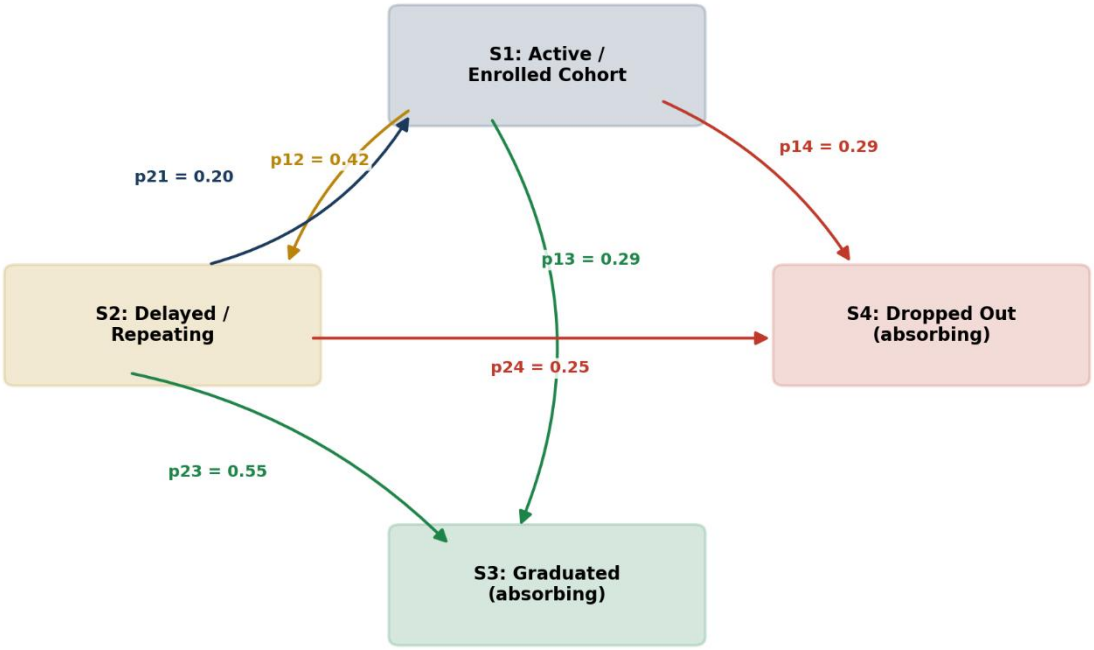


Figure 8. Illustrative four-state absorbing Markov chain of student cohort progression, calibrated to UGC aggregate pass-rate data.

Writing the transient sub-matrix Q and the transient-to-absorbing sub-matrix R as:

$$Q = [[0, 0.42], [0.20, 0]] \qquad R = [[0.29, 0.29], [0.55, 0.25]]$$

the fundamental matrix $N = (I - Q)^{-1}$ is computed as:

$$N = [[1.0917, 0.4585], [0.2183, 1.0917]]$$

The diagonal entries of N indicate that a student starting in the active state (S_1) is expected to spend approximately 1.09 periods in that state before eventual absorption, while a student starting in the delayed state (S_2) is expected to spend approximately 1.09 periods there; summing each row gives the total expected number of periods to absorption — approximately 1.55 periods from S_1 and 1.31 periods from S_2 — consistent with the qualitative finding that Nepalese undergraduate programmes routinely extend well beyond their nominal duration.

Multiplying N by R gives the matrix B of ultimate absorption probabilities:

$$B = N \cdot R = [[0.569, 0.431], [0.664, 0.336]]$$

This result implies that, under the calibrated model, a student who begins in active/first-attempt status has an estimated 56.9 percent long-run probability of eventually graduating and a 43.1 percent long-run probability of ultimately dropping out permanently — a considerably more concerning figure than the 29.3 percent single-cycle pass rate would suggest in isolation, though also somewhat less severe than a naive '1 − pass rate = 70.7 percent dropout' interpretation would imply, precisely because the model correctly credits delayed students with their eventual, if late, graduation probability. A student who has already entered delayed/repeating status has a somewhat higher 66.4 percent probability of eventually graduating, reflecting the fact that persistence through at least one additional attempt is associated with a higher conditional completion probability — a standard finding in cohort-survival modelling more generally.

Table 4. Markov-Chain Absorption Probabilities and Expected Time to Absorption

Starting State	P(eventual graduation)	P(eventual dropout)	Expected periods to absorption
S1: Active / First attempt	56.9%	43.1%	1.55
S2: Delayed / Repeating	66.4%	33.6%	1.31

Two policy-relevant implications follow directly from this model. First, because the $S_1 \rightarrow S_2$ (delay) transition probability of 42 percent is the single largest transition weight in the entire chain, interventions that reduce examination and result-publication backlogs — the specific mechanism identified in Tribhuvan University's own internal diagnosis — would be

expected to have the largest marginal effect on the model's long-run graduation probability, since they act directly on the transition most students actually experience. Second, because the model shows delayed students have a higher eventual graduation probability than a naive reading of low first-cycle pass rates would suggest, policy responses calibrated only to the headline 29 percent pass-rate figure risk over-stating the true scale of permanent attrition and under-investing in support specifically targeted at students in extended, rather than first-attempt, enrollment.

Outbound Migration and the "Brain-Drain" Dimension of Dropout

A structurally distinct but quantitatively significant form of attrition from the domestic higher-education system is outbound student migration. Ministry of Education records indicate that approximately 110,000 students obtained No-Objection Certificates (NOC) — the mandatory consent document required to pursue study abroad — in a single recent fiscal year, with a further 45,000 NOCs issued in just the first five months of the subsequent fiscal year, an annualised pace of roughly 108,000, indicating that outbound volumes have remained essentially stable at scale rather than declining.

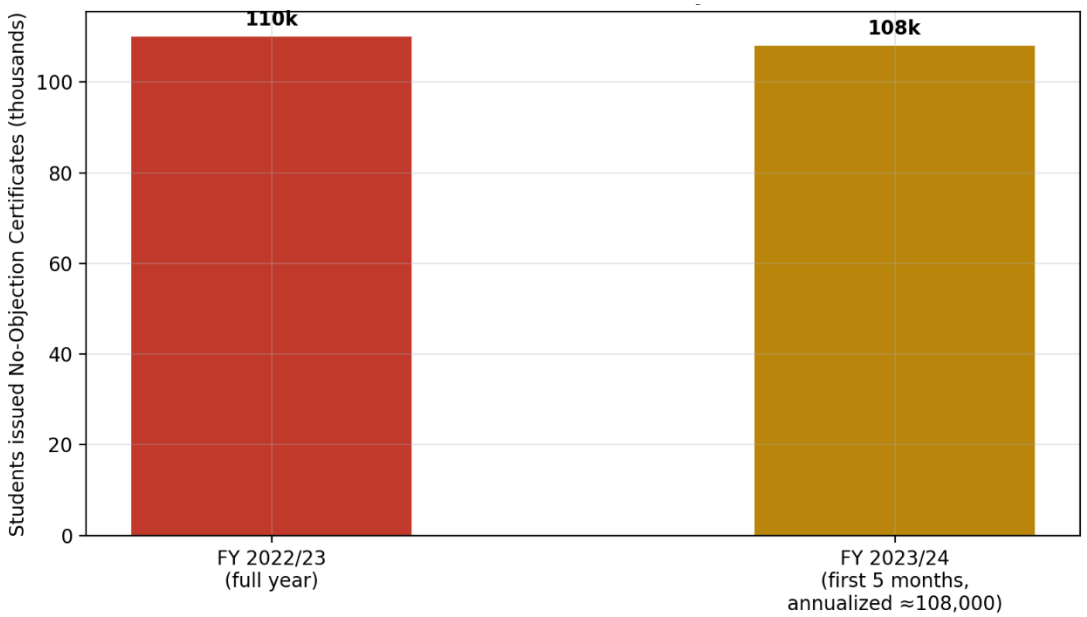


Figure 9. Outbound student migration: No-Objection Certificates issued for study abroad, by fiscal year.

To place this figure in context, the roughly 108,000–110,000 students obtaining NOCs annually is equivalent to more than one-quarter of the entire net increase in domestic enrollment recorded between 2016/17 and 2023/24 (approximately 262,000 additional

students over seven years, or roughly 37,400 per year on the linear trend estimated in Section 5). In other words, outbound migration each year removes from the domestic pipeline a number of prospective students comparable in scale to nearly three years' worth of the system's own net domestic enrollment growth. Nepalese students reportedly spent approximately NPR 67 billion on foreign study fees and living costs in a single recent fiscal year — a sum representing roughly 3.8 times the total annual government funding allocated to the entire domestic university system in 2023/24 (NPR 17.457 billion, per Section 6).

From a systems perspective, outbound migration functions as a parallel and largely unmeasured channel of 'dropout' from the domestic higher-education system: a student who leaves Nepal to enrol at a foreign university is recorded neither in UGC enrollment statistics nor in any university's pass/fail cohort data, yet represents a permanent loss to domestic higher-education capacity utilisation, faculty employment demand, and — in the many cases where the student does not return — the domestic skilled-labour stock. Newspaper analysis directly links this outflow to the same quality and completion concerns documented in Sections 8 and 9: prolonged programme durations, contracting per-campus enrolment, and a widening gap between the number of academic institutions (1,155 affiliated colleges) and the number able to sustain full academic staffing (fewer than half, per Section 9) are cited by education-sector stakeholders as material push factors alongside the conventional pull factors of foreign labour-market access.

Field-of-Study Concentration and Structural Imbalance

Enrollment growth in Nepalese higher education has been highly uneven across disciplines, with management studies absorbing a disproportionate and growing share of the expansion documented in Section 5. UGC-based reporting indicates that the management faculty's share of total higher-education enrollment rose from approximately 39 percent in 2015 to 47.1 percent (and, on Economic-Survey-scope figures for 2024/25, above 50 percent) in the most recent reporting cycle, with an estimated 350,000 students currently enrolled in management programmes nationally, compared with roughly 150,000 in education and 70,000 in humanities and social sciences — together placing close to four-fifths of all Nepalese higher-education students in just three broad, comparatively low-cost-to-deliver disciplinary streams.

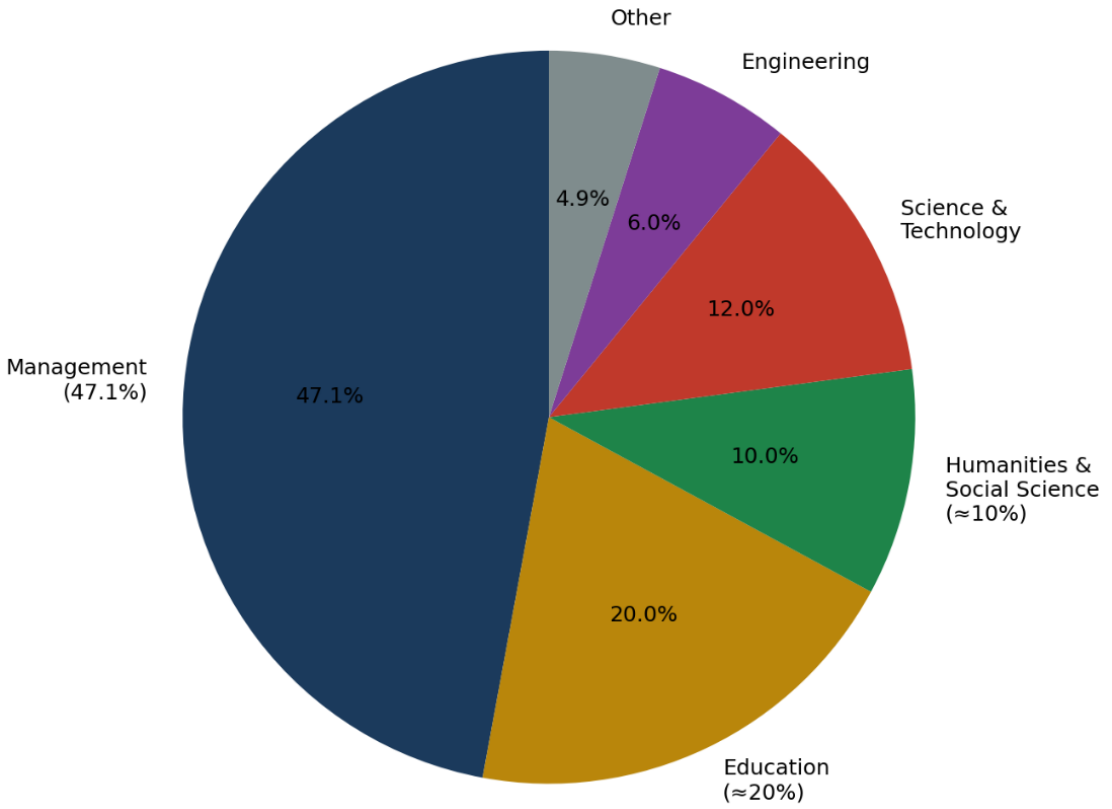


Figure 10. Approximate distribution of higher-education students by field of study, 2025 (illustrative shares based on reported management, education, and humanities totals).

By contrast, government reporting places agriculture-related enrollment at approximately 0.15 percent of the national total, and science, technology, and engineering streams collectively well below one-fifth. This concentration pattern has two consequences directly relevant to the dropout and graduation analysis of Sections 8 through 10. First, because management and humanities programmes are typically less capital-intensive to deliver than laboratory-based science and engineering programmes, the extreme fragmentation documented in Section 9 (many colleges with fewer than 100 students) is disproportionately a management/humanities-college phenomenon, meaning that a very large share of at-risk, under-resourced enrollment is concentrated precisely in the disciplinary streams that already dominate national totals. Second, a persistent mismatch between the disciplinary composition of graduates and the skill composition of domestic labour demand is frequently cited by education-sector analysts as a contributing factor in the outbound migration pattern documented in Section 11, insofar as students and families increasingly perceive a foreign STEM or professional qualification as commanding a more favourable return than a comparable domestic management or humanities degree.

Forecasting Future Enrollment (2024/25–2028/29)

Using the OLS linear trend and log-linear exponential growth models estimated in Section 5, enrollment can be projected forward from the 2023/24 anchor point. The exponential model, fitted as ln(Y) = ln(365.22) + 0.0746t, implies a continuously compounded growth rate of 7.46 percent per year, equivalent to a discrete annual growth rate of 7.74 percent — closely consistent with, though marginally below, the 7.93 percent CAGR computed directly from the 2016/17 and 2023/24 endpoints in Section 5, and considerably below the 10.9 percent year-on-year growth actually observed between the Economic-Survey-scope 2023/24 and 2024/25 figures (672,489 to 745,770 students).

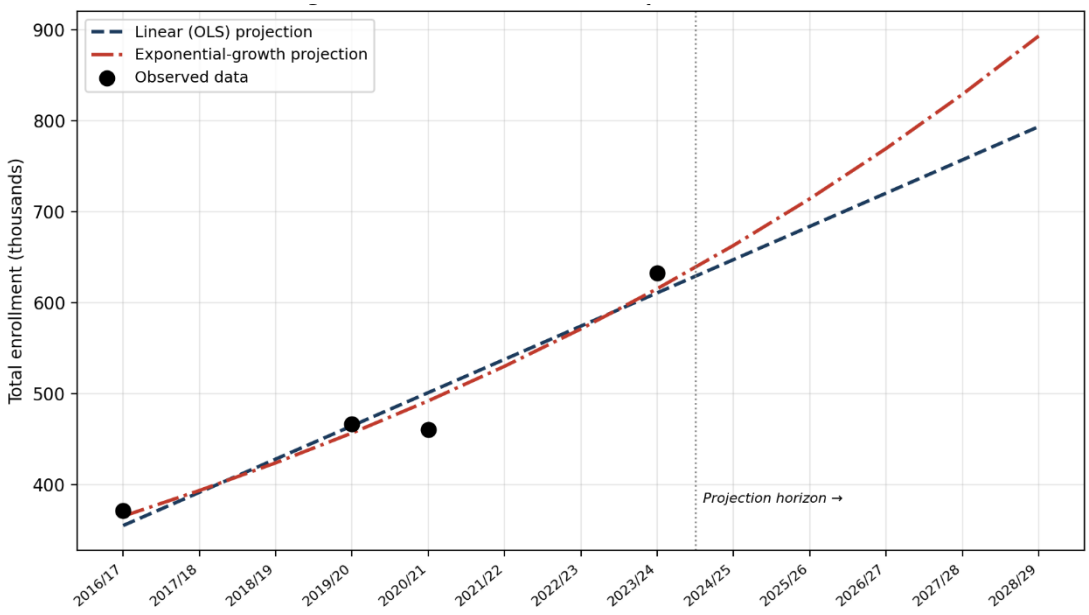


Figure 11. Projected higher-education enrollment in Nepal through 2028/29 under linear (OLS) and exponential growth models, benchmarked against observed anchor data.

Both models project total enrollment surpassing 800,000 students by approximately 2027/28 if pre-2023/24 structural growth rates persist, while the more recent 10.9 percent single-year growth rate, if sustained, would bring the system to a comparable figure considerably sooner — implying that, on any of the three growth assumptions considered, Nepal's higher-education system is on a trajectory to add several hundred thousand additional students over the remainder of the decade without any corresponding change in the funding or faculty-growth trajectories documented in Section 6. Absent a marked acceleration in faculty recruitment (running at a CAGR of only 3.81 percent against enrollment CAGR of 7.93–10.9 percent), the student–faculty ratio computed in Section 6 (already at 19.9:1, the upper edge of international benchmarks) would be expected to

deteriorate further, plausibly breaching the internationally recommended 20:1 ceiling within the forecast horizon under either growth scenario.

These projections should be read as trend extrapolations conditional on the continuation of currently observed structural drivers, not as unconditional predictions; Section 16 discusses the corresponding limitations explicitly.

Discussion: Statistical Synthesis

Bringing together the results of Sections 5 through 13, a coherent statistical picture emerges. Enrollment has grown at a robust and statistically well-fitted compound rate of approximately 7.9 to 10.9 percent per year ($R^2 = 0.933$ for the linear specification), but this growth has systematically outpaced the growth of both faculty capacity (CAGR 3.81 percent) and, on a per-student basis, effective funding, even though aggregate funding itself grew faster than enrollment in nominal terms (CAGR 11.07 percent) — the discrepancy being explained by the reported allocation of most incremental funding to infrastructure and block grants rather than instructional staffing.

The Markov-chain model of Section 10 indicates that the true long-run dropout probability facing a first-attempt student (approximately 43.1 percent) is both considerably worse than the single-cycle pass rate alone would optimistically suggest is 'safe' and considerably better than a naive 1-minus-pass-rate calculation (70.7 percent) would pessimistically suggest — underscoring the analytical value of separating temporary delay from permanent non-completion when interpreting Nepal's headline pass-rate statistics. This distinction matters directly for policy: interventions such as expedited examination and result-publication processes act primarily on the $S_1 \rightarrow S_2$ transition (delay) rather than directly reducing permanent dropout, yet the model shows that even modest improvements in this transition — by reducing the pool of students who stall in delayed status for extended periods, a state from which a meaningful minority (33.6 percent) still ultimately drop out — would be expected to raise the overall graduation probability more than interventions targeted narrowly at first-attempt dropout alone.

The institutional fragmentation evidence of Section 9 (71.5 percent of affiliated colleges enrolling fewer than 200 students) and the disciplinary concentration evidence of Section 12 (approximately four-fifths of enrollment concentrated in three low-capital-intensity streams) together suggest that Nepal's enrollment growth has been substantially

absorbed by an expanding periphery of small, likely under-resourced colleges concentrated in a narrow set of disciplines, rather than by a proportionate expansion of well-resourced capacity across the full disciplinary spectrum — a structural pattern consistent with, and plausibly contributory to, both the weak graduation outcomes of Section 8 and the substantial outbound migration documented in Section 11, which each year removes a number of students equivalent to roughly one-quarter of the system's own net annual enrollment growth.

Policy Implications and Recommendations

The statistical evidence assembled in this paper points toward several concrete, evidence-linked policy priorities:

- Rebalance incremental UGC funding toward full-time faculty recruitment, given that faculty CAGR (3.81%) has run at less than half the enrollment CAGR (7.93–10.9%) despite funding CAGR (11.07%) comfortably outpacing both.
- Prioritise examination-cycle and result-publication reform at Tribhuvan University and comparable large constituent-campus universities, since the Markov-chain model identifies the Active→Delayed transition (42%) as the single largest probability weight in the entire cohort-progression chain.
- Introduce targeted academic and financial support specifically for students already in delayed/repeating status, since this sub-population still faces a non-trivial 33.6% long-run dropout probability despite a higher overall completion probability than first-attempt students.
- Consolidate or merge the large number (555, or 48.1% of all affiliated colleges) of severely under-enrolled colleges with fewer than 100 total students, redirecting the associated affiliation, examination, and quality-assurance overhead toward viable institutions.
- Diversify disciplinary capacity investment beyond management, education, and humanities — which together already absorb roughly four-fifths of enrollment — toward science, engineering, and agriculture programmes where domestic labour-market demand and outbound-migration pressure both appear concentrated.
- Establish a standardised, publicly reported cohort-tracking system (a true panel of student IDs followed from admission to graduation or exit) so that future analyses can move

beyond the calibrated, illustrative Markov-chain parameters used in this paper to empirically estimated transition probabilities.

- Monitor the No-Objection Certificate outflow (currently on the order of 108,000–110,000 students annually) as a standing indicator of domestic system quality and completion-time competitiveness, rather than treating it purely as an independent migration-policy matter.

Limitations of the Study

Several limitations should be borne in mind when interpreting the results presented above. First, the enrollment time series used for the OLS and exponential regressions in Section 5 comprises only four consistently-scoped anchor years (2016/17, 2019/20, 2020/21, and 2023/24); while the resulting R^2 of 0.933 indicates a strong linear fit to these points, a four-observation regression carries wide uncertainty around the fitted parameters, and the model should be treated as indicative of the underlying trend rather than as a precise forecasting instrument. Second, figures drawn from the UGC EMIS series and from the government Economic Survey series differ somewhat in institutional scope (for example, 633,053 versus 672,489 students for 2023/24), and the paper has deliberately avoided splicing these into a single unbroken series; readers should treat comparisons across these two source families as approximate rather than exact. Third, and most importantly for the dropout analysis, Nepal does not publish an official cohort-level transition matrix of the kind required to estimate Markov-chain transition probabilities directly from micro-data; the parameters used in Section 10 are therefore illustrative, calibrated to reproduce the one aggregate pass-rate figure that is publicly documented (29.3 percent for Tribhuvan University, 2019/20), and should be understood as a methodological demonstration of how such a model could be populated once genuine cohort-tracking data become available, rather than as a precise empirical estimate of national dropout probability. Finally, the field-of-study and gender-parity discussions in Sections 12 and elsewhere rely on approximate percentage shares reported in secondary sources rather than on primary disaggregated UGC tables, and should be read as indicative of broad structural patterns rather than as precise point estimates.

Conclusion

This paper has applied a battery of mathematical and statistical tools — OLS linear regression, log-linear exponential growth modelling, compound annual growth rate decomposition, index-number comparison, and an absorbing Markov chain — to characterise enrollment, graduation, and dropout dynamics in Nepalese higher education using data compiled from UGC Nepal, national news reporting, and peer-reviewed sources. The central finding is a persistent and, on current trends, widening gap between the scale of the system (enrollment growing at 7.9–10.9 percent per year, $R^2 = 0.933$ for the linear trend) and its effective capacity and completion performance (faculty growing at only 3.81 percent per year; aggregate pass rates below 30 percent for a decade; an estimated long-run dropout probability of approximately 43 percent for first-attempt students under the calibrated Markov-chain model).

This gap is compounded by extreme institutional fragmentation (nearly half of all affiliated colleges enrolling fewer than 100 students), heavy disciplinary concentration in a small number of comparatively low-cost fields, and a substantial and apparently stable outbound-migration channel (approximately 108,000–110,000 students obtaining No-Objection Certificates to study abroad each year) that functions as a parallel, largely unmeasured form of attrition from the domestic system. Taken together, the evidence suggests that Nepal's higher-education policy challenge over the coming decade is less a matter of generating further enrollment growth — which appears likely to continue robustly under any of the models estimated in Section 13 — than of building the faculty capacity, examination-cycle efficiency, and institutional consolidation required to convert that growth into commensurate graduation output. Future research, ideally supported by the establishment of an official cohort-tracking system as recommended in Section 15, should aim to replace the illustrative Markov-chain parameters used here with directly estimated transition probabilities, enabling more precise identification of the specific intervention points at which policy effort would yield the largest improvement in national completion rates.

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