

Massification, Capacity Pressure, and Performance Governance in Moroccan Public Universities: A System-Wide Analysis

Mohammed Benelmallam*

Researcher, Laboratoire Interdisciplinaire de Recherche en Économie, Finance et Management des Organisations (LIREFIMO), Sidi Mohamed Ben Abdellah University, Fez, Morocco

*Corresponding Author

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ABSTRACT

Massification has expanded access to higher education, but it can also create structural pressure when enrolment grows faster than physical capacity and stable academic staffing. This study examines how these pressures are associated with institutional performance across the Moroccan public-university system. It develops a capacity-resource alignment framework that links the intensity of the open-access mission, declared physical capacity, permanent academic staffing, and graduation intensity. The analysis covers the complete population of twelve Moroccan public universities reported in official 2024–2025 statistics. Four directional relationships are examined through descriptive statistics, Spearman rank correlations, standardised bivariate regressions with HC3 heteroscedasticity-consistent standard errors, graphical inspection, and influence sensitivity. Open-access institutions enrol 82.2% of students while operating with approximately 99 students per permanent academic staff member, compared with about 24 in regulated-access institutions. Across universities, capacity pressure is strongly and positively associated with staffing pressure ($\rho = 0.804$), while staffing pressure is negatively associated with graduation intensity ($\rho = -0.769$). Relationships involving open-access concentration follow the expected direction but are less stable in robust analyses. The findings show that institutional performance is more meaningfully interpreted when output indicators are contextualised by the access mission and the resources available to fulfil it. The diagnostic evidence most directly supports contextualised monitoring of capacity and permanent staffing pressure and motivates further evaluation of capacity-sensitive funding, staffing planning, benchmarking, dashboards, and performance contracts. Because the data are cross-sectional and aggregated, the results identify structural associations rather than causal effects, with particular relevance to systems experiencing rapid and uneven expansion.

Keywords: higher education massification, performance governance, capacity-resource alignment, public universities, Morocco

INTRODUCTION

Massification has become one of the defining transformations of contemporary higher education. Expanding participation advances social inclusion and responds to rising educational demand, yet it also increases the organisational burden placed on universities. When enrolment grows faster than classrooms, teaching infrastructure, academic staffing, student-support services, and coordination capacity, conventional performance indicators can become difficult to interpret. A university may report weaker output indicators not only because of managerial shortcomings, but also because it carries a heavier access mission under more constrained operating conditions. Performance governance in higher education therefore requires attention to both results and the institutional conditions under which those results are produced.

This problem is especially important in public higher-education systems where access, equity, quality, and accountability are pursued simultaneously. Trow (2007) showed that the transition from elite to mass participation requires changes in institutional structures and modes of coordination, while Marginson (2016) demonstrated that widened participation can coexist with persistent resource stratification. In African higher

education, massification has similarly been associated with pressure on infrastructure, staffing, and academic support when expansion is not matched by adequate investment (Mohamedbhai, 2014). These perspectives suggest that the central issue is not institutional size alone, but the alignment between demand and the resources available to absorb it.

Morocco provides a particularly informative setting because its public-university system combines open-access and regulated-access institutions within a shared national architecture. In 2024-2025, public universities enrolled 1,102,364 students. Open-access institutions accommodated 905,909 students (82.2%), whereas regulated-access institutions enrolled 196,455 students. Permanent academic staffing was distributed much more evenly: 9,118 permanent academics served open access and 8,206 served regulated access, corresponding to approximately 99 students per permanent academic in open access compared with 24 in regulated access (Ministry of Higher Education, Scientific Research and Innovation, 2025). The contrast reveals a structural asymmetry between the responsibility for absorbing student demand and the stable academic resources available to support that mission.

The policy relevance of this asymmetry has increased as Moroccan higher-education reforms place greater emphasis on autonomy, quality, inclusion, digitalisation, employability, accountability, and territorial development. These priorities encourage the use of dashboards, performance contracts, and comparative indicators. However, an education-sensitive performance system should distinguish output from context. Output-only benchmarking may disadvantage institutions carrying a disproportionate mass-access mission, whereas allocation based only on historical expenditure may reproduce inherited disparities. A more informative approach should therefore relate institutional outcomes to capacity and staffing pressure.

Existing Moroccan research has examined governance, management control, knowledge management, organisational contingencies, culture, and university performance. Governance has been identified as an enabling condition for management-control practices (Bendaoud & Benlakouiri, 2022), knowledge-management and governance mechanisms have been associated with perceived performance (Bousenna, 2023), and organisational contingencies and culture have been shown to shape performance conditions (El Bakkouchi et al., 2024; Kasmi & Helmi, 2025). International research likewise links governance, resource allocation, and staff capacity to organisational outcomes (Aghion et al., 2010; He & Ismail, 2023). Yet limited evidence examines the system-wide relationship among access concentration, physical capacity, permanent staffing, and institutional output using homogeneous indicators across all Moroccan public universities.

This study addresses that gap through the following research question: to what extent are open-access concentration and physical capacity pressure associated with permanent staffing conditions and graduation intensity across Morocco's public-university system? It makes three contributions. First, it develops capacity-resource alignment as a higher-education governance construct linking access responsibility, physical capacity, stable staffing, and institutional output. Second, it analyses the complete population of twelve Moroccan public universities using a common official statistical source. Third, it translates the observed relationships into practical implications for funding, staffing, benchmarking, and performance contracting. The analysis is deliberately diagnostic rather than causal: its purpose is to identify structural patterns that can improve the design and interpretation of performance-information systems in mass higher education.

THEORETICAL FRAMEWORK

Systems Perspective and Analytical Posture

The study adopts a post-positivist, hypothetico-deductive approach to higher-education governance. Administrative indicators are treated as observable but partial representations of institutional conditions. The analytical focus is the configuration of relationships among access responsibility, physical capacity, permanent academic staffing, and institutional output. Rather than seeking universal causal laws, the study tests whether theoretically expected associations form a coherent diagnostic pattern across the national university system.

The research is quantitative, explanatory in intention and exploratory in inference. It examines directional associations using a census of the twelve public universities observed in one academic year. Because these

twelve units constitute the complete Moroccan public-university population for 2024–2025, the analysis does not use inferential statistics to generalise from a random sample to a larger national population. Instead, coefficients and p-values are treated as secondary diagnostic descriptors of the observed configuration and are interpreted alongside effect direction, magnitude, graphical evidence and sensitivity checks. Exhaustive national coverage reduces coverage bias, but it does not resolve the limitations of cross-sectional aggregation. The unit of analysis is therefore the university as an organisational system, not the individual student, academic, programme or constituent institution.

Analytical parsimony is essential because the system contains only twelve institutional units. Multivariable models with several predictors would be unstable, vulnerable to overfitting and difficult to justify without longitudinal or programme-level observations. The empirical strategy therefore combines descriptive statistics, non-parametric rank correlations, standardised bivariate regressions with HC3 robust standard errors, graphical inspection and leave-one-out sensitivity checks. Convergence across these forms of evidence is treated as stronger diagnostic support than reliance on a single significance threshold. Formal causal or super-population inference is not claimed.

Capacity-Resource Alignment and Performance Governance

From a higher-education governance perspective, massification is not merely an increase in student numbers. It changes the volume and composition of teaching demand and consequently the scale of assessment, scheduling, supervision, guidance, student support, and academic coordination. Altbach, Reisberg, and Rumbley (2009) and Mohamedbhai (2014) emphasise that participation growth without corresponding investment can intensify institutional inequalities. Organisational capacity is therefore multidimensional: physical places, permanent academic staff, administrative support, digital infrastructure, and coordination mechanisms operate as complementary resources that shape the conditions of teaching and learning.

Capacity–resource alignment is defined here as the degree to which an institution’s enrolment responsibility is matched by declared physical capacity and permanent academic staffing. The construct is relational rather than absolute. A large university need not be under greater pressure than a smaller one when infrastructure and staffing scale with demand; conversely, a medium-sized institution may face severe pressure when enrolment grows faster than resources. This relational formulation makes alignment a governance property of the system rather than a simple size indicator.

Performance governance refers here to the design and use of indicators, allocation rules, targets, and accountability mechanisms through which public authorities and universities interpret and steer institutional results. Higher education produces multidimensional outcomes, yet comparable administrative indicators remain necessary for budgeting, contracting, planning, and public accountability. Such indicators become more educationally meaningful when they are interpreted alongside resource conditions, mission intensity, and organisational contingencies rather than used as decontextualised ranking devices (Hood, 1991; Pollitt & Bouckaert, 2017).

Open-access concentration represents the intensity of the mass-access mission carried by each university. A larger open-access share is expected to increase the organisational workload associated with heterogeneous student demand. Capacity pressure captures the physical dimension of misalignment through the ratio of enrolment to declared places, whereas staffing pressure captures the human-resource dimension through students per permanent academic staff member. If expansion is not matched by resource growth, these two forms of pressure should move together.

The final relationship concerns institutional output. Permanent academic staff contribute not only to classroom delivery but also to programme coordination, assessment, supervision, feedback, student guidance and institutional governance. Higher staffing pressure may therefore be associated with weaker output flow. However, graduation also depends on programme duration, disciplinary mix, repetition, student preparation and socio-economic conditions. The model consequently specifies directional associations rather than causal effects, preserving the distinction between a diagnostic performance system and a causal production function.

From Theoretical Framework to Empirical Model

The theoretical framework is intentionally broader than the empirical model. Trow (2007), Altbach et al. (2009), Mohamedbhai (2014) and Marginson (2016) motivate the expectation that rapid participation growth can create organisational and resource strain when institutional capacity does not expand proportionately. Hood (1991) and Pollitt and Bouckaert (2017) support the governance argument that performance indicators should be interpreted within their organisational and resource context, while Aghion et al. (2010) and He and Ismail (2023) motivate attention to governance, resource allocation and staff capacity when interpreting institutional outcomes. The empirical model operationalises only four dimensions that are available consistently for all twelve universities—open-access concentration, declared physical-capacity pressure, permanent staffing pressure and graduation intensity. It is therefore a parsimonious diagnostic representation of the broader framework, not a complete causal model of university performance.

H1: A higher share of students in open-access institutions is associated with a higher student-to-permanent-academic-staff ratio.

H2: Higher capacity pressure is associated with a higher student-to-permanent-academic-staff ratio.

H3: A higher student-to-permanent-academic-staff ratio is associated with lower graduation intensity.

H4: A higher share of students in open-access institutions is associated with lower graduation intensity.

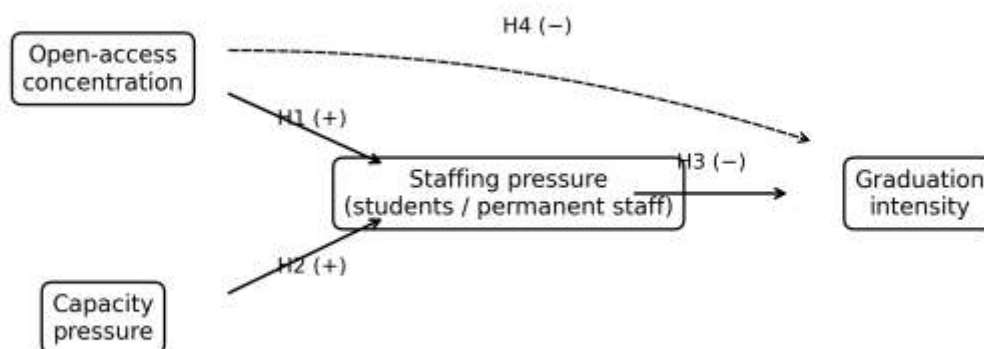


Figure 1 Capacity–resource alignment model and research hypotheses.

Source: Author’s construction.

METHODOLOGY

The field of investigation is the Moroccan public-university system. The analytical population comprises all twelve public universities included in University Statistics – Public University Higher Education 2024–2025. Three public research institutes without student enrolment are not treated as autonomous analytical units because the indicators require a student denominator. The study therefore covers the full set of universities responsible for public higher education enrolment during the reference year.

The data were obtained from the Directorate of Strategies and Information Systems of the Ministry of Higher Education, Scientific Research and Innovation. For each university, the official source reports total enrolment, enrolment by access type, the number of constituent institutions, declared physical capacity, permanent academic staff and graduates. The graduate count refers to 2023–2024, while the enrolment and capacity indicators refer

to 2024–2025. The temporal difference is explicitly retained in the interpretation of graduation intensity and prevents the indicator from being presented as a cohort completion rate.

Data reliability was addressed through several checks. National totals were reconciled across open-access and regulated-access categories. Derived indicators were recalculated uniformly from the source tables, and the arithmetic consistency of percentages and ratios was verified. University names and institutional codes were harmonised before analysis. The use of a single official publication reduces definitional heterogeneity across universities, although it cannot eliminate potential administrative-reporting errors or differences in how declared capacity is operationalised locally.

Operationalisation of Variables

Table 1 presents the measures used in the analysis. Open-access share is calculated as open-access enrolment divided by total enrolment. It identifies where the responsibility for non-selective mass access is concentrated. Capacity pressure is total enrolment divided by declared physical capacity. A value of one indicates an exact correspondence between enrolment and declared places, whereas a value above one indicates saturation. The indicator is only a proxy for pressure on declared physical resources: it does not capture actual classroom utilisation, timetable arrangements, laboratory availability, facility quality, student-space ratios, digital-learning capacity or discipline-specific infrastructure requirements.

Staffing pressure is total enrolment divided by permanent academic staff. It is interpreted as a proxy for the potential availability of stable academic support and not as a direct measure of individual teaching load. The indicator excludes temporary and part-time lecturers because comparable university-level counts were not available in the source; it also does not capture workload distribution, disciplinary teaching intensity or academic-support personnel. This limitation is substantive: institutions may partly compensate for permanent staffing deficits through temporary teaching, but such compensation does not necessarily provide the same continuity in programme coordination, supervision and institutional service.

Graduation intensity is calculated as graduates in 2023–2024 divided by enrolment in 2024–2025. It is an annual output-flow proxy and must not be confused with a graduation rate for a defined cohort. The measure is affected by programme duration, disciplinary structure, repetition, doctoral enrolment and year-to-year changes in the student stock. Its value is comparative rather than causal: it supplies a common output indicator that can be related to capacity and staffing conditions while its limits remain visible. Institutional size, measured as total enrolment per constituent institution, is used descriptively to distinguish absolute scale from relative saturation.

Table 1 Operationalisation of the variables used to diagnose capacity–resource alignment.

Variable	Formula	Interpretation	Source
Open-access share	Open-access students / total enrolment	Concentration of the mass-access mission	MESRSI (2025)
Capacity pressure	Total enrolment / declared capacity	Relative saturation of declared physical places	MESRSI (2025)
Staffing pressure	Total enrolment / permanent academic staff	Potential availability of stable academic support	MESRSI (2025)
Graduation intensity	Graduates 2023–2024 / enrolment 2024–2025	Annual output-flow proxy; not a cohort completion rate	MESRSI (2025)
Institutional size	Total enrolment / number of institutions	Average scale of constituent university units	MESRSI (2025)

Source: Author’s construction from Ministry of Higher Education, Scientific Research and Innovation (2025).

Data Processing and Diagnostic Analytical Strategy

The analysis was conducted in Python 3.11 using pandas for data management, SciPy for non-parametric statistics and statsmodels for regression estimation. It proceeded in four stages. First, national and university-level descriptive statistics documented the concentration of enrolment and the dispersion of capacity, staffing and output conditions. Second, Spearman rank correlations assessed monotonic relationships. Spearman's coefficient is appropriate for a small number of units and is less sensitive than Pearson's correlation to extreme values and linearity assumptions.

Third, each directional relationship was examined through a simple linear regression using standardised variables. Standardisation places predictors and outcomes on a common scale, so the slope can be interpreted as a standardised beta coefficient. HC3 heteroscedasticity-consistent standard errors were retained as a small-sample robustness device for the bivariate slopes. The models remain bivariate in order to preserve degrees of freedom and avoid unstable multivariable specifications. R-squared and p-values are reported for transparency but are interpreted descriptively; neither is treated as evidence of causal explanation or as a stand-alone decision rule.

Fourth, robustness was assessed through methodological triangulation and influence sensitivity. A relationship was regarded as comparatively stable when the Spearman coefficient, the standardised regression, the graphical pattern and the substantive interpretation pointed in the same direction. In addition, each of the four focal relationships was re-estimated twelve times, omitting one university at a time, to assess whether direction or substantive interpretation depended on a single institutional observation. P-values were retained as secondary descriptors rather than threshold-based decision rules. No causal language is used because the design lacks temporal depth, exogenous variation and individual-level controls.

The ethical risk of the study is minimal because it uses aggregated public institutional data and contains no personal or identifiable information. Reproducibility is supported by reporting the source, formulas, software environment and analytical decisions. These safeguards do not remove the limitations of the data, but they make the diagnostic reasoning transparent and auditable.

RESULTS

National Structure: Concentrated Massification

The first result concerns the architecture of the public-university system. In 2024–2025, the twelve universities enrolled 1,102,364 students across 162 teaching institutions, excluding three public research institutes. Open-access institutions represented 67 of these institutions and enrolled 905,909 students, or 82.2% of the public-university population. Regulated-access institutions represented 95 institutions and enrolled 196,455 students, or 17.8%. The average open-access institution therefore carried a substantially larger student population than the average regulated-access institution.

The distribution of permanent academic staff was markedly less concentrated than the distribution of students. Open access had 9,118 permanent academics, compared with 8,206 in regulated access. This produced approximately 99.4 students per permanent academic staff member in open access and 23.9 in regulated access. The ratio in the mass-access segment was therefore more than four times the ratio in the regulated segment. This contrast is the clearest descriptive indication that access responsibility and stable academic staffing are not aligned at national level.

The result should not be interpreted as evidence that regulated-access programmes are over-resourced. Many selective programmes require laboratories, specialised equipment, clinical facilities or small-group teaching. The relevant conclusion is comparative: the segment absorbing most student demand operates with a much thinner permanent-staff base relative to enrolment. The structural imbalance places greater pressure on assessment, tutoring, guidance and coordination in open access and suggests that national averages conceal the segmentation of operating conditions.

Heterogeneity across the Twelve Universities

National totals also conceal pronounced differences among universities. Table 2 reports the comparable indicators for all twelve units. Enrolment ranges from 30,165 students at Chouaib Doukkali University to 149,021 at Hassan II University of Casablanca. The open-access share ranges from 66.4% at Hassan First University to 89.4% at Ibn Zohr University. This variation shows that all universities contribute to mass access, but the intensity of that mission differs substantially.

Table 2 Comparative indicators for the twelve Moroccan public universities in 2024–2025.

University	Students	Open access	Capacity pressure	Students / staff	Graduation intensity
Mohammed V – Rabat	91,668	72.6%	1.41	34.5	15.7%
Hassan II – Casablanca	149,021	83.3%	1.99	62.7	14.3%
Sidi Mohamed Ben Abdellah	99,335	82.1%	1.51	53.7	13.1%
Cadi Ayyad	120,235	84.1%	2.28	66.1	13.9%
Mohammed First	81,481	82.4%	2.26	67.7	10.7%
Chouaib Doukkali	30,165	80.3%	1.63	40.5	13.1%
Abdelmalek Essaadi	139,419	83.8%	2.80	92.6	11.7%
Moulay Ismail	82,196	85.2%	1.84	67.7	12.6%
Ibn Tofail	81,580	84.6%	2.50	94.9	9.7%
Ibn Zohr	145,438	89.4%	1.64	84.2	12.7%
Hassan First	35,295	66.4%	1.49	55.4	14.6%
Sultan Moulay Slimane	46,531	68.1%	1.19	54.4	17.8%

Source: Author’s calculations from MESRSI (2025, pp. 6–28).

Capacity pressure ranges from 1.19 enrolled students per declared place at Sultan Moulay Slimane University to 2.80 at Abdelmalek Essaadi University. No university records a ratio at or below one. Physical saturation is therefore a system-wide condition, although its severity varies. Abdelmalek Essaadi, Ibn Tofail, Cadi Ayyad and Mohammed First universities operate above two students per declared place. By contrast, Sultan Moulay Slimane, Mohammed V, Hassan First and Sidi Mohamed Ben Abdellah universities show lower, though still positive, saturation.

Staffing pressure also varies sharply. Mohammed V University records approximately 34.5 students per permanent academic staff member, while Ibn Tofail University records 94.9 and Abdelmalek Essaadi 92.6. Ibn Zohr also operates above 80 students per permanent academic staff member. These differences are not explained by enrolment size alone. Hassan II University is the largest institution but has a staffing ratio of 62.7, whereas Ibn Tofail has a smaller student population and a considerably higher ratio. The comparison reinforces the relational nature of capacity–resource alignment.

Graduation intensity ranges from 9.7% at Ibn Tofail University to 17.8% at Sultan Moulay Slimane University. Mohammed First records 10.7%, while Abdelmalek Essaadi records 11.7%. Mohammed V, Hassan First and Sultan Moulay Slimane combine comparatively favourable staffing ratios or lower physical pressure with

graduation intensity above the national mean. These observations are descriptive and do not isolate programme composition or student characteristics, but they identify institutional configurations that warrant closer managerial examination.

Descriptive Statistics and Correlation Structure

The descriptive statistics in Table 3, Panel A, confirm substantial dispersion. The mean open-access share is 80.2%, with a standard deviation of 7.2 percentage points. Mean capacity pressure is 1.88, indicating that the average university enrolls nearly twice its declared physical capacity. The mean student-to-permanent-staff ratio is 64.53, with a standard deviation of 18.85. Graduation intensity averages 13.3% and varies by more than eight percentage points between the minimum and maximum. Institutional size also varies considerably, showing that the university map combines different organisational scales.

Table 3 Descriptive statistics and Spearman correlation matrix for the institutional indicators.

Panel A – Descriptive statistics	Minimum	Maximum	Mean	Std. dev.	
Open-access share	66.4%	89.4%	80.2%	7.2%	
Capacity pressure	1.19	2.80	1.88	0.49	
Students / permanent staff	34.51	94.86	64.53	18.85	
Graduation intensity	9.7%	17.8%	13.3%	2.2%	
Students / institution	3,579.31	8,278.94	6,520.08	1,851.01	
Panel B – Spearman correlations	1	2	3	4	5
1. Open-access share	1.000				
2. Capacity pressure	0.692**	1.000			
3. Students / permanent staff	0.748***	0.804***	1.000		
4. Graduation intensity	−0.671**	−0.769***	−0.769***	1.000	
5. Institutional size	0.629**	0.678**	0.455	−0.385	1.000

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. Source: Author's calculations.

The Spearman matrix in Table 3, Panel B, is consistent with the analytical framework. Open-access share is positively correlated with capacity pressure ($\rho = 0.692$; $p = 0.013$) and staffing pressure ($\rho = 0.748$; $p = 0.005$). Capacity pressure is strongly associated with staffing pressure ($\rho = 0.804$; $p = 0.002$). Graduation intensity is negatively correlated with open-access share ($\rho = -0.671$; $p = 0.017$), capacity pressure ($\rho = -0.769$; $p = 0.003$) and staffing pressure ($\rho = -0.769$; $p = 0.003$). Institutional size is positively related to open-access share and capacity pressure, while its association with graduation intensity is comparatively weak ($\rho = -0.385$). The reported p-values are descriptive diagnostics for the observed national census and are not used to infer to a larger random population.

Two implications follow from this structure. First, physical saturation and permanent staffing pressure appear to be interconnected rather than independent difficulties. Universities facing greater pressure on declared places also tend to have more students per permanent academic staff member. Second, graduation intensity is more closely associated with relative capacity and staffing pressure than with absolute institutional size. The correlation between institutional size and graduation intensity is negative but comparatively weak ($\rho = -0.385$). This pattern supports the claim that massification should be analysed as relative misalignment rather than simply as large enrolment.

Exploratory Association Tests

Figure 2 visualises the relationship between capacity pressure and staffing pressure. Universities above two students per declared place generally exhibit high student-to-permanent-staff ratios. The positive pattern is visible across several universities rather than being attributable to a single isolated observation. Figure 3 presents the relationship between staffing pressure and graduation intensity. The pattern slopes downward: universities with higher student-to-permanent-staff ratios tend to produce fewer graduates relative to their current enrolment stock.

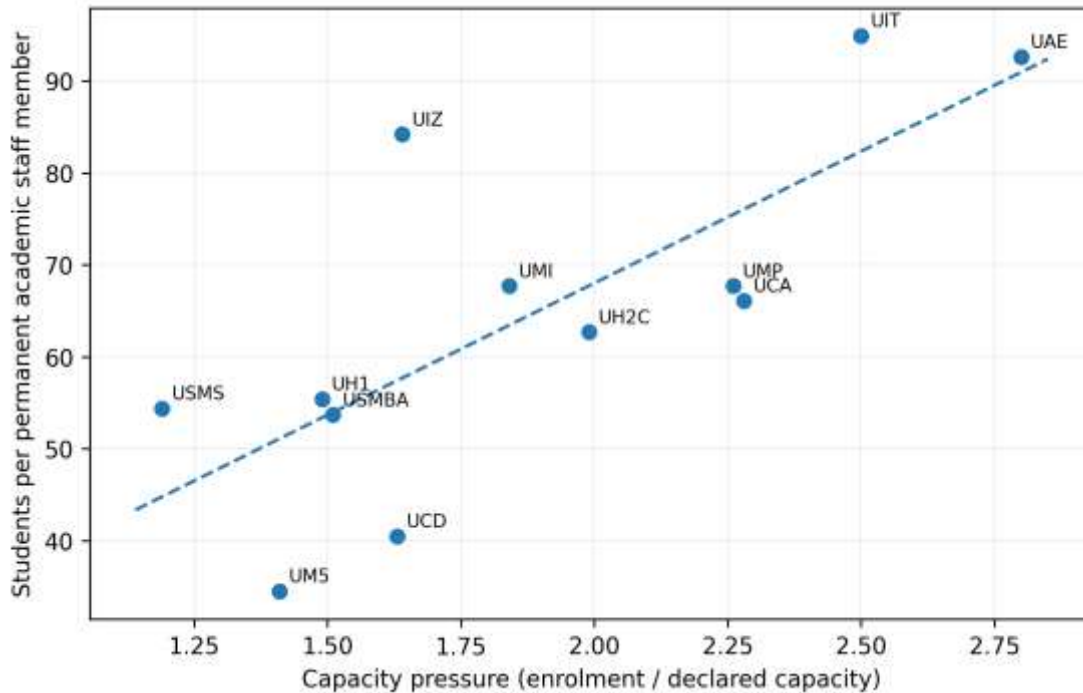


Figure 2 Relationship between capacity pressure and students per permanent academic staff member.

Source: Author's calculations. University abbreviations identify the twelve observations.

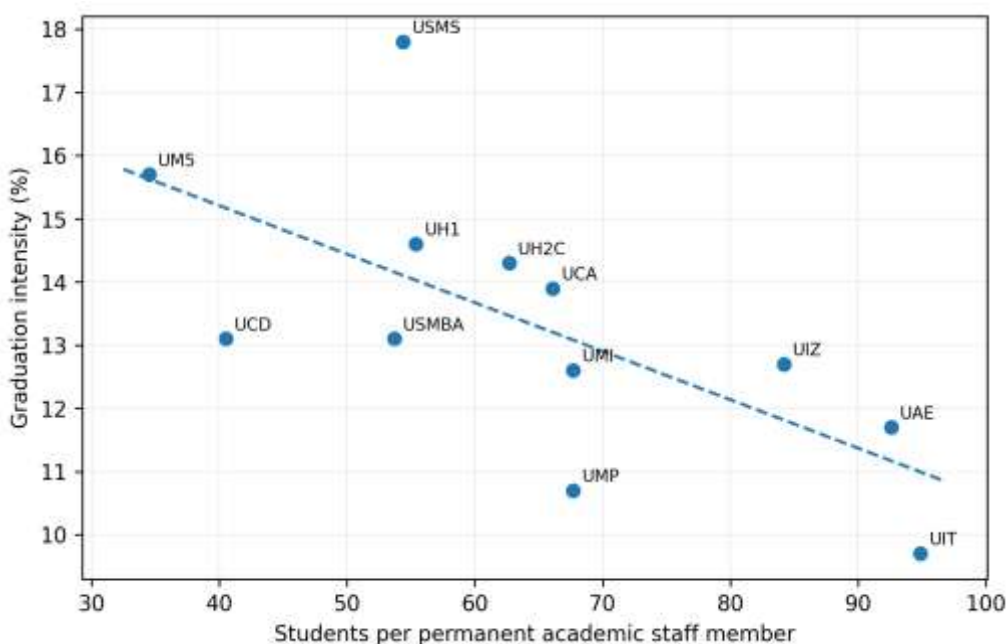


Figure 3 Relationship between staffing pressure and graduation intensity.

Source: Author's calculations. Graduation intensity is an annual output-flow proxy.

Table 4 combines the non-parametric correlations and standardised regressions. H1 receives partial support. The rank correlation between open-access share and staffing pressure is positive ($\rho = 0.748$; $p = 0.005$), and the standardised robust regression is also positive ($\beta = 0.599$; robust $p = 0.055$; $R\text{-squared} = 0.359$). The concordant direction is coherent with the theory, but the difference in inferential precision across methods and the leave-one-out sensitivity results do not justify an unqualified conclusion.

Table 4 Exploratory association results using rank correlations and HC3 robust regressions.

Hyp.	Spearman ρ	p	HC3 β	Robust p	R-squared	Decision
H1	0.748	0.005	0.599	0.055	0.359	Partially supported
H2	0.804	0.002	0.748	0.003	0.559	Supported
H3	-0.769	0.003	-0.662	0.015	0.438	Supported
H4	-0.671	0.017	-0.707	0.059	0.500	Partially supported

Source: Author's calculations. Regressions use standardised variables and HC3 heteroscedasticity-consistent standard errors.

H2 receives the clearest support. Capacity pressure is strongly and positively associated with staffing pressure ($\rho = 0.804$; $p = 0.002$; $\beta = 0.748$; robust $p = 0.003$; $R\text{-squared} = 0.559$). The result indicates that universities experiencing greater physical saturation also tend to operate with fewer permanent academics relative to their student population. Because the data are cross-sectional, the coefficient does not establish whether capacity shortages produce staffing shortages, whether both result from common allocation mechanisms, or whether rapid enrolment growth simultaneously affects both dimensions. It nevertheless identifies a coherent structural configuration.

H3 is also supported. Staffing pressure is negatively associated with graduation intensity ($\rho = -0.769$; $p = 0.003$; $\beta = -0.662$; robust $p = 0.015$; $R\text{-squared} = 0.438$). The estimated direction is consistent with the expectation that thinner permanent staffing relative to enrolment may reduce the availability of stable academic support. However, the result cannot be interpreted as a direct productivity function. Graduation intensity is influenced by programme duration, disciplinary mix, repetition, student preparation and annual changes in enrolment. The finding is therefore best treated as a contextual association with managerial relevance.

H4 receives partial support. Open-access share is negatively related to graduation intensity in the rank analysis ($\rho = -0.671$; $p = 0.017$), and the robust regression points in the same direction ($\beta = -0.707$; robust $p = 0.059$; $R\text{-squared} = 0.500$). The evidence is therefore directionally coherent but less stable than for H2. This result must not be read as evidence that open access intrinsically reduces performance. Open access is a social mission and an institutional arrangement, not a treatment randomly assigned to universities. The relationship more plausibly reflects the concentration of demand and the resource conditions accompanying that mission.

Taken together, the most stable empirical chain connects capacity pressure to staffing pressure and staffing pressure to graduation intensity. The open-access share follows the expected direction in both models, but its robust evidence remains weaker. The final interpretation therefore distinguishes supported relationships from suggestive ones and avoids presenting the four hypotheses as equally established.

Robustness, Validity and Internal Consistency

The internal consistency of the results rests on convergence among several analytical elements. For H2 and H3, the rank correlations, robust regressions, explained variance and scatterplots point in the same direction. HC3 estimation is relevant because the small number of universities makes ordinary standard errors sensitive to heteroscedasticity and leverage. A leave-one-out sensitivity analysis was also conducted by re-estimating each focal relationship after omitting each university in turn. The sign of the Spearman coefficient and the standardised regression slope remained unchanged in all twelve re-estimations for H1–H4. H2 was the most

stable relationship; H3 retained a consistently negative direction but its inferential precision was more sensitive to individual omissions, while H1 and H4 showed the greatest variation. This pattern reinforces the interpretation of H2 and H3 as the central diagnostic links and of the open-access relationships as suggestive rather than definitive.

The results involving open-access concentration are less stable, which is itself informative. Open-access share varies within a relatively narrow range for most universities because the mass-access mission is common across the system. The limited dispersion reduces statistical power. In addition, open-access concentration may influence performance indirectly through capacity, staffing, student composition and programme structures rather than through a single direct path. The partial support for H1 and H4 therefore suggests that future research should test mediation and contingency models with multi-year and programme-level data.

Construct validity remains bounded by the nature of administrative indicators. Declared capacity is a formal count of places and does not reveal the quality, utilisation rate or disciplinary suitability of facilities. The staffing ratio excludes temporary lecturers and does not measure workload distribution. Graduation intensity is not a cohort completion rate. These limitations weaken any attempt to interpret coefficients as causal effects, but they do not eliminate the comparative value of the indicators. Each measure is constructed consistently across the same institutional population and captures a distinct dimension of system pressure.

External validity should also be considered carefully. The results are directly valid for the configuration of Moroccan public universities in 2024–2025. Transfer to other years or countries requires attention to differences in admission systems, university autonomy, funding formulas and institutional missions. The model is most likely to be useful in systems where a group of open-access institutions absorbs a disproportionate share of demand. In such contexts, capacity–resource alignment provides a transparent starting point for benchmarking and policy diagnosis.

Synthesis of the Empirical Model

The empirical model can be summarised in three propositions. First, massification is concentrated: the open-access segment carries most student demand while operating with a substantially higher student-to-permanent-staff ratio. Second, relative pressure is more informative than absolute size: capacity saturation is strongly associated with staffing pressure, whereas institutional size is not significantly related to graduation intensity. Third, performance must be contextualised: universities with greater staffing pressure tend to have lower graduation intensity, but this relationship remains embedded in programme and student characteristics that are not observed in the aggregate data.

The final model therefore retains a robust link between physical capacity pressure and staffing pressure, a robust negative link between staffing pressure and graduation intensity, and two suggestive links involving open-access concentration. This differentiated conclusion is more useful for management than a binary acceptance of all hypotheses. It identifies where evidence is sufficiently stable for immediate diagnostic use and where additional data are required before policy decisions are made.

DISCUSSION

Massification as Relative Organisational Pressure

The principal theoretical implication is that massification should be understood as relative institutional pressure rather than absolute enrolment. The Moroccan evidence shows that university size alone does not determine operating conditions: some large universities maintain comparatively favourable staffing ratios, whereas some medium-sized institutions combine high physical saturation with high staffing pressure. Capacity-resource alignment therefore sharpens the massification perspective by identifying the organisational mechanism through which expanded participation becomes difficult to sustain: student demand generates pressure when the physical and human resources needed to support teaching and academic coordination do not scale proportionately.

This interpretation is consistent with Trow's (2007) argument that mass systems require institutional transformation and with Marginson's (2016) observation that expanded participation may coexist with stratification. It also extends Moroccan studies focused on governance and internal management. Bendaoud and Benlakouiri (2022) emphasise governance conditions for management control, while El Bakkouchi et al. (2024) show that performance is shaped by organisational contingencies. The present study identifies capacity and staffing pressure as measurable structural contingencies that should be incorporated into higher-education performance systems.

Staffing Pressure and Institutional Output

The negative association between staffing pressure and graduation intensity is theoretically plausible because permanent academics contribute to a set of functions extending beyond classroom delivery. They coordinate programmes, organise assessment, supervise projects and theses, provide feedback, support students and participate in institutional governance. When the number of students per permanent academic rises, the available time for these functions may become constrained. The result is compatible with research linking staff capacity and performance-oriented resource allocation to organisational outcomes (He and Ismail, 2023).

Nevertheless, the association must remain carefully bounded. The study does not observe individual teaching practices, student preparation, programme duration, disciplinary costs or temporary staffing. Graduation intensity also combines graduates and enrolment from adjacent academic years. The result therefore supports contextualisation, not mechanical staffing norms. A low student-to-staff ratio cannot guarantee strong outcomes, and a high ratio does not make poor outcomes inevitable. Management quality, organisational culture, digital systems and student-support practices can moderate the relationship. Kasmi and Helmi (2025), for example, show that organisational culture strengthens the relationship between managerial innovation and university performance.

Contributions to Systems-Oriented Performance Governance

The first contribution is conceptual. Capacity-resource alignment connects massification, organisational capacity, and performance governance within a single higher-education framework. Instead of treating access, infrastructure, staffing, and output as separate indicators, it interprets them as interdependent dimensions of the institutional conditions under which teaching and student support are delivered. This changes the evaluative question from whether a university is simply large or small to whether the resources available are proportionate to the educational mission and workload it carries.

The second contribution is empirical. The study covers the complete population of twelve Moroccan public universities using one official statistical source and homogeneous indicator definitions. This system-wide design complements studies centred on individual universities, actor perceptions or internal management practices. Although the number of units is small, the coverage is exhaustive for the national public-university system and reveals institutional configurations concealed by national averages.

The third contribution is methodological. The article distinguishes diagnostic inference from causal inference and uses a deliberately parsimonious analytical strategy suited to a small institutional population. Rank correlations, standardised HC3 regressions, graphical inspection and substantive interpretation are combined to assess whether the same relationships remain visible under different analytical lenses. This approach is particularly useful for performance-governance settings in which decision makers must work with complete but aggregated administrative data.

For higher-education policy and institutional governance, the broader implication is that performance measurement should incorporate structural context. An output indicator may be technically correct yet managerially misleading when detached from the access mission and resource configuration of the institution being assessed. Contextualisation should therefore not be viewed as a relaxation of accountability; rather, it is a condition for making accountability more informative, equitable, and useful for improvement.

Managerial And Policy Implications

The present evidence most directly supports two diagnostic priorities: monitoring physical-capacity pressure jointly with permanent staffing pressure, and interpreting graduation intensity in relation to those resource conditions. The broader instruments discussed below—funding weights, performance contracts, infrastructure expansion, diversified provision and mobility mechanisms—are policy proposals that are consistent with the observed patterns but were not causally evaluated in this study. Their effectiveness therefore requires longitudinal, programme-level and implementation evidence.

The first, and most directly evidence-linked, implication concerns diagnostic funding information. The strong association between capacity pressure and staffing pressure indicates that allocation reviews should consider these pressures jointly rather than rely on enrolment or output alone. A balanced funding mechanism could therefore be explored using a core grant complemented by transparent indicators of capacity saturation and staffing deficits, while discipline-sensitive costs, student vulnerability and improvement weights would require additional evidence before operational use.

The second directly supported implication concerns performance monitoring and contracting. Because graduation intensity is associated with staffing and capacity conditions, outcome targets should be contextualised by baseline resource pressure. Performance contracts could link graduation or student-success objectives to measurable trajectories for recruitment and capacity relief. Extensions to employability, digital support and student services are plausible governance proposals, but their effectiveness is not tested by the present data.

The third implication is multi-year academic staffing planning. Recruitment priorities should be linked to enrolment forecasts, disciplinary needs, tutorial-group organisation, assessment workloads, supervision, and student-support requirements. Aggregate university ratios remain useful for national diagnosis, but internal planning should be disaggregated by institution, field, and cycle. Temporary lecturers can provide flexibility, yet permanent academic staff remain essential for programme continuity, supervision, academic coordination, and governance.

The fourth implication concerns the university map and educational infrastructure. New campuses, extensions, and institutional restructuring should be informed by regional demographics, student mobility, labour-market needs, current saturation, and staffing feasibility. Physical construction is necessary where pressure is chronic, but infrastructure without academic recruitment and operating resources may not translate into effective educational support. Conversely, guidance, reorientation, transferable credits, and inter-university mobility can help redistribute student flows.

The fifth implication is the development of contextualised public dashboards. A national higher-education dashboard should report enrolment, declared capacity, students per permanent and temporary academic, progression, dropout, graduation, employment outcomes, expenditure per student, and student-support indicators. Definitions and metadata should remain stable over time. Benchmarking should compare universities with similar access missions and pressure profiles rather than rely on a single undifferentiated ranking.

Table 5 Decision matrix for capacity-sensitive management of Moroccan public universities.

Diagnosis	Management instrument	Monitoring indicator	Expected effect
High capacity pressure	Expansion plan, shared facilities and flow management	Enrolment / declared capacity	Progressive reduction in saturation
Insufficient permanent staffing	Targeted recruitment, tutoring and workload planning	Students / permanent staff by field and cycle	Improved continuity and student support

High open-access concentration	Compensatory allocation and diversified provision	Open-access share and student profile	Greater pedagogical equity
Low graduation intensity	Programme-pathway diagnosis and targeted support	Progression, dropout and completion by cohort	Sustainable improvement in output
Territorial heterogeneity	Regional contracts and mobility mechanisms	Capacity, flows and employment outcomes	A more coherent university map

Source: Author's proposal based on the empirical findings. The monitoring priorities are evidence-linked; the associated management instruments are policy propositions requiring further longitudinal and implementation evaluation.

Transferability And Conditions Of Use

The capacity-resource alignment framework may be transferable to higher-education systems characterised by differentiated access regimes, rapid enrolment growth, and uneven resource expansion. Its indicators are deliberately simple and can be reproduced from administrative data, which makes the approach potentially useful for ministries and universities with limited access to individual-level microdata. It can also support longitudinal monitoring by showing whether new investment reduces saturation and whether staffing growth keeps pace with changes in enrolment.

Transferability is conditional rather than automatic. Declared capacity may be defined differently across countries, and permanent staffing may have different contractual meanings. Some systems rely heavily on part-time faculty, digital delivery or inter-university mobility. The model should therefore be adapted to local institutional arrangements. Its core principle remains applicable: output comparisons are more meaningful when interpreted alongside the access mission and the resources available to fulfil it.

Limitations And Research Perspectives

Five limitations define the scope of the conclusions. First, the study is cross-sectional and cannot distinguish persistent structural differences from annual fluctuations or establish temporal ordering. Second, the twelve-unit national population restricts model complexity and makes estimates sensitive to institutional configurations, even though leave-one-out checks reduce concern that the principal directions are driven by a single university. Third, aggregation at university level conceals variation by constituent institution, discipline, cycle and student background. Important potential confounders are not observed consistently, including socioeconomic composition, admission selectivity, programme mix and duration, funding and expenditure per student, progression, dropout, temporary staffing and student-support services. Fourth, the measures are imperfect proxies: declared capacity does not capture utilisation or infrastructure quality, staffing pressure excludes temporary and part-time inputs and workload distribution, and graduation intensity is an annual output-flow proxy rather than a cohort completion rate. Fifth, open-access concentration, capacity pressure and staffing pressure are conceptually related manifestations of massification; their correlations may partly reflect a shared structural origin and should not be interpreted as proof of a sequential causal pathway.

Future research should construct multi-year panels and estimate fixed-effects or dynamic models capable of separating stable institutional differences from temporal change. Programme- and cohort-level data would permit progression, dropout, completion and time to graduation to be modelled more accurately. Staffing measures should incorporate temporary and part-time academics, workload distribution, student-staff ratios by discipline and academic-support personnel; capacity measures should incorporate classroom utilisation, laboratory availability, student-space ratios, digital-learning capacity and infrastructure quality. Expenditure per student, admission selectivity, student socioeconomic characteristics, student services and employability outcomes

should also be incorporated. With a larger dataset, carefully justified multivariable, mediation or path models could examine whether open-access concentration is related to outcomes indirectly through capacity and staffing pressure. Qualitative interviews with university leaders, deans, administrators and academics would further clarify the mechanisms connecting resource decisions, organisational responses and student outcomes.

CONCLUSION

This study examined whether the concentration of open access and the saturation of declared physical capacity are associated with permanent staffing conditions and graduation intensity across the complete population of Moroccan public universities. The results reveal a differentiated but coherent pattern. Capacity pressure is strongly and positively associated with staffing pressure, while staffing pressure is negatively associated with graduation intensity. Relationships involving open-access concentration follow the expected direction but are less stable under robust regression.

The central conclusion is that university performance should be interpreted in relation to the institutional conditions under which education is delivered. Absolute size alone is insufficient to explain operating pressure. What matters is the alignment between the demand a university absorbs, the physical capacity available to accommodate that demand, and the stable academic staffing available to support teaching, supervision, coordination, and student services. Capacity-resource alignment therefore provides a concise framework for contextualising performance governance in mass higher education.

The study contributes conceptually by linking access, organisational capacity and performance governance; empirically by providing a homogeneous comparison of all twelve Moroccan public universities; and methodologically by demonstrating a transparent diagnostic strategy for a small institutional population. The evidence most directly supports contextualised monitoring of capacity, permanent staffing and graduation intensity. Broader funding, contracting and infrastructure instruments should be treated as policy propositions to be evaluated with richer longitudinal and programme-level data.

These conclusions remain bounded by the cross-sectional, aggregated design and the twelve-unit national population. The study does not establish that changing staffing or capacity would automatically change graduation outcomes. Its value is diagnostic: it identifies structural patterns that can guide better performance-information systems and define priorities for future explanatory research.

Future research should extend the framework through multi-year panels, programme- and cohort-level data, richer resource and student indicators, and mixed methods. These extensions would permit stronger tests of temporal ordering, confounding, mediation and institutional mechanisms, moving the framework from system-level diagnosis toward more explanatory models of institutional change and student success.

Ethical Considerations

The study uses aggregated, publicly available institutional statistics and does not involve human participants, personal data, animals, or experimental interventions. Formal ethical approval was therefore not required. The analysis was conducted in accordance with principles of research integrity, transparency, and accurate reporting.

Data Availability

The data used in this study are publicly available in University Statistics - Public University Higher Education 2024-2025, published by the Directorate of Strategies and Information Systems of the Moroccan Ministry of Higher Education, Scientific Research and Innovation. All derived indicators are defined in the methodology section and can be reproduced from the cited source.

Conflict Of Interest

The author declares no conflict of interest.

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