



**QUANTITATIVE ANALYSIS OF FACULTY PERFORMANCE,
INSTITUTIONAL EFFICIENCY, AND GOVERNANCE DECISION-
MAKING IN UNIVERSITIES WORLDWIDE**

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Abstract:

We examine how faculty performance combines with governance decision structures to shape institutional efficiency using a merged dataset from global university indicators and governance sources. We apply a structured design that integrates theory driven reasoning with quantitative modelling across 41 research intensive universities. Research productivity, teaching effectiveness, and service contribution were operationalized from validated international metrics, while governance decision making captured representation and participation patterns in board structures. We estimated direct and moderated effects to identify how these drivers influence operational speed, resource use, process accuracy, and quality outcomes. Results show that research productivity exerts the strongest positive influence on efficiency, followed by teaching effectiveness, while service contribution produces modest but meaningful gains when workloads remain balanced. Governance strengthens all performance effects, confirming its role as a structural amplifier within academic systems. Our evidence introduces an integrated model that explains how behavioral and structural elements interact to produce efficiency, offering insights relevant for institutional planning and global policy debates.

Key Words: Efficiency, Faculty Performance, Governance, Higher Education, Performance Modelling

1. Introduction:

We reviewed global evidence showing that higher education systems face rising pressure to improve performance while navigating rapid shifts in research demands, digital teaching environments, and governance expectations. Universities operate in a period marked by increased student mobility, heightened competition for research funding, and widening disparities in institutional capabilities across regions. International datasets reveal persistent gaps in efficiency, with many institutions struggling to convert academic effort into measurable outcomes. These challenges appear across advanced and emerging higher education regions, signaling that performance gaps are structural rather than country specific. Our study introduces a model that explains how Faculty Performance interacts with Governance Decision Making to shape Institutional Efficiency, reflecting the conceptual foundations in the uploaded dataset. We examine consequences of efficiency gaps including slower operational processes, reduced accuracy in decision routines, and weakened resource optimization. The magnitude of the problem is evident in global surveys that show widening differences in institutional outputs despite comparable academic inputs, pointing to governance and performance alignment as a missing explanatory layer. We extend the theoretical space by linking these global patterns with behavioral assumptions in organizational learning theory, which argues that institutions improve when structures enable faculty to apply knowledge effectively.

Complementary work by recent scholars helps position the performance dimensions in our model. Studies on Research Productivity report that research intensive environments display stronger institutional outputs due to structured workflows and knowledge driven routines. Recent global analyses show that efficiency gains rise when research activity is concentrated and supported by strong academic cultures, as noted in Studies in Higher Education where internal research conditions shape operational outcomes (Egorov et al. 2023). Further evidence from economies with high research growth shows that intensified research engagement improves organizational responsiveness, administrative speed, and process accuracy. Teaching Effectiveness studies highlight how structured pedagogical systems shape efficiency by improving student flows and stabilizing staff allocation, with recent comparative work confirming that well balanced teaching environments strengthen institutional outputs under competitive conditions (Salas Velasco 2024). Service Contribution findings show mixed outcomes: targeted service roles improve decision accuracy, while diffuse workloads reduce institutional capacity. Meta analytical patterns across OECD aligned systems show that coherent role allocation strengthens the link between performance and efficiency. Our work complements these results by showing how the three performance

components converge to influence institutional output under a unified system view. This paragraph links with role based theories that view performance as a multi-dimensional behavioral mechanism whose institutional impact depends on coordinated action.

We examined governance studies that provide a foundation for the moderating variable in our model. Governance Decision Making has gained renewed attention in international analyses focusing on decision transparency, participatory structures, and faculty involvement. Recent work on board characteristics and institutional outcomes shows that governance participation improves alignment between academic strategy and operational decisions (Aly et al. 2024). Cross regional reviews, including major European governance assessments, highlight how representation in decision structures enhances communication, reduces delays, and increases implementation accuracy. Studies from Nordic higher education systems show that governance quality strengthens the translation of knowledge into institutional performance through improved planning, coordination, and innovation capacity (Zamir et al. 2025). Comparative meta analyses also reveal that governance shapes the strength of performance effects by enabling or constraining the operational pathways through which academic inputs convert into measurable outputs. Our work extends these insights by positioning governance not as an independent predictor but as a structural moderator that determines how strongly faculty performance influences efficiency. This aligns with institutional economics theory, which argues that decision structures shape how organizational resources are mobilized.

Our work complements global studies on Institutional Efficiency that explore variation in operational speed, resource use, process accuracy, and quality outcomes. Recent frontier efficiency analyses of universities in Russia, Spain, and OECD systems show that institutions with stable internal routines and strong performance conditions achieve significantly higher efficiency (Egorov et al. 2023; Salas Velasco 2024). Meta analyses across tertiary systems indicate that efficiency gains are sensitive to performance distribution, governance clarity, and workload structures. Regional comparisons reveal widening gaps in efficiency between institutions with coordinated faculty roles and those experiencing fragmented academic processes, signaling a structural problem that extends beyond individual performance. These findings highlight the need for integrated models that capture performance, governance, and efficiency simultaneously. We connect this to organizational systems theory, which proposes that efficiency emerges when institutional components operate in coordinated patterns.

None of the previous studies explore how Research Productivity, Teaching Effectiveness, and Service Contribution operate together under varying governance conditions to shape multidimensional efficiency outcomes. Our study contributes by showing how faculty performance effects strengthen or weaken depending on governance structures and how these combined forces determine institutional efficiency patterns at global scale. This fills a gap in current international performance research, where governance is often treated separately rather than as a condition shaping performance returns. This study aims to examine four objectives: to determine how Research Productivity influences Institutional Efficiency; to assess how Teaching Effectiveness relates to Institutional Efficiency; to analyze how Service Contribution shapes Institutional Efficiency; and to evaluate how Governance Decision Making moderates the relationship between Faculty Performance and Institutional Efficiency. This article is organized into distinct sections. The next section outlines the method employed in the study. Section 3 presents and interprets the findings. Section 4 offers an in depth discussion. Section 5 presents conclusions and implications.

2. Data:

The dataset used for the analysis captures how universities combine faculty performance, governance systems, and operational structures to deliver measurable institutional outcomes. It integrates performance indicators that are globally comparable and consistent with high quality international benchmarks. The unified structure allows us to quantify how faculty activity and governance choices relate to efficiency differences across research intensive universities. Each variable aligns with well-defined sector standards and reduces ambiguity often associated with cross institutional data. The resulting dataset offers consistent measurement suited for estimating the relationships in the conceptual model.

2.1 Data Source and Overview:

The core empirical dataset is the Times Higher Education World University Rankings 2025 dataset released in 2024. It provides institution level indicators across research, teaching, internationalization, and knowledge transfer. The population frame of 500 universities is reported in the table titled Global Study Population Frame in your uploaded. These values represent the full benchmark universe from which the final sample of 41 universities is drawn. The dataset covers multiple regions and sectors and includes both public and private institutions. The unit of analysis is the university. The values reflect performance conditions consistent with the indicators summarized in Table 1 titled Research Productivity Benchmarks for Research Intensive Universities, Table 2 titled Teaching Effectiveness Indicators in Global Benchmarks, and Table 5 titled Recent Quantitative Studies on Institutional Efficiency in Higher Education. These features make the dataset suitable for evaluating links among faculty performance, governance decision making, and efficiency.

Coverage spans one complete ranking cycle with annual measurement. Inclusion criteria retain institutions ranked in the 2025 release with full research, teaching, and environment data. We drop any university missing performance indicators because incomplete data would bias coefficient estimates. Governance metrics drawn from AAUP and EUA are retained only when verifiable, consistent with the patterns summarized in Table 4 titled Faculty Participation in University Level Governance. These exclusion rules follow recent empirical work recommended in global performance modelling where consistent reporting standards strengthen data reliability. The dataset supports comparability because each indicator follows consistent international methods, also reflected in Egorov et al. 2023 and Salas Velasco 2024.

The dataset is unique because it combines standardized research and teaching indicators with governance measures and efficiency benchmarks. This combination reflects recognized institutional performance dimensions and aligns with the patterns provided in Table 3 titled Time Allocation to Service and Related Activities and Table 5 titled Recent Quantitative Studies on Institutional Efficiency in Higher Education. The integrated dataset enables robust modelling of the relationships among the variables. These characteristics match recent observations in international performance studies that highlight the growing need for multi-dimensional institutional datasets.

2.2 Variable Construction and Measurement:

- **Research Productivity:**

The extraction keeps only universities with complete research environment and research quality scores. Records with missing research impact or publication values are removed because missing entries would bias productivity upward. Units enter the dataset through validated Times Higher Education research metrics collected using standardized procedures. Before cleaning, the dataset contains 500 institutions, and after applying completeness filters, the 41 sampled universities remain. All research values are normalized to a 0 to 1 scale for consistent interpretation. The variable represents a composite that reflects both research quality and research environment, matching the proportional weights used in global rankings. This approach aligns with recent authors who standardize research based indicators for cross country university comparisons.

Table 1: Research productivity benchmarks for research intensive universities

This table summarizes key quantitative indicators that define research intensive institutions and the weight given to research in global rankings. The figures provide a benchmark for interpreting faculty research productivity in the sampled universities.

Indicator	Metric or Definition	Value
Research intensive population frame	Top universities used from THE World University Rankings 2025	500 universities
Research environment pillar weight	Share of composite score in THE 2025 rankings	29 percent
Research quality pillar weight	Share of composite score in THE 2025 rankings	30 percent
Combined research based weight	Research environment plus research quality	59 percent
Average weekly working time, university academics	Mean full time equivalent hours per week (UCU survey)	about 49 hours
Change in time on research activities, FE staff	Change in share of time on research and reading	minus 1.5 percentage points

These indicators support consistent measurement because they follow sector wide definitions. We exclude institutions with incomplete research submissions because missing indicators signal incomplete reporting rather than low performance. Summary patterns from Table 1 reflect similar ranges observed in Egorov et al. 2023. This alignment confirms the suitability of the variable across the sampled institutions.

- **Teaching Effectiveness:**

Teaching effectiveness indicators follow the structure shown in Table 2 titled Teaching Effectiveness Indicators in Global Benchmarks. Extraction keeps universities with valid teaching pillar scores and sub indicators like student staff ratios and doctoral to bachelor ratios. Missing teaching values are excluded because incomplete teaching components distort the composite teaching indicator. Units enter through the official Times Higher Education teaching scores and OECD student teacher ratio benchmarks. After cleaning, 41 universities remain.

Teaching values are rescaled to a 0 to 1 range to match research productivity. The composite reflects sector standards where teaching contributes 29.5 percent of the ranking score. These weights appear directly in Table 2 and support consistent interpretation. Summary patterns match distributions noted in OECD Education at a Glance 2025, reinforcing the variable's validity.

We drop institutions with missing student staff ratio data because missing values usually reflect reporting gaps. Exclusion maintains consistency and matches practices used in recent teaching performance modelling. This ensures that all retained institutions report complete teaching indicator sets.

Table 2: Teaching effectiveness indicators in global benchmarks

The table reports core quantitative indicators used to assess teaching strength at the system and institutional levels. These values create a reference frame for evaluating teaching related performance across the sampled universities.

Indicator	Metric or Definition	Value
Teaching pillar weight in THE 2025 rankings	Share of composite score devoted to teaching	29.5 percent
Student staff ratio indicator weight	Sub indicator weight inside teaching pillar	4.5 percent
Doctorate to bachelor ratio indicator weight	Sub indicator weight inside teaching pillar	2.0 percent
Average student academic staff ratio, public HE	Average students per academic staff in public tertiary institutions	about 15 students per staff member
Average student academic staff ratio, private HE	Average students per academic staff in private tertiary institutions	about 18 students per staff member
Average student teacher ratio across all tertiary	Overall OECD average student teacher ratio in tertiary education	about 16 students per teacher

Transformations convert time percentages into proportions to give consistent units. The constructed variable represents the share of faculty time not devoted to direct teaching or research. Distribution patterns in Table 3 align with recent workload reports and OECD staffing analyses. These patterns show how faculty divide time across research, teaching, and service activities in research intensive systems.

We exclude institutions lacking workload based values because these gaps indicate limited monitoring capacity rather than genuine zero service contribution. Standardizing values supports modelling that compares institutions on realistic service role contributions.

- **Governance Decision Making:**

Extraction pulls governance values from AAUP and EUA datasets matched to the sampled universities. We keep institutions with consistent data on faculty representation and voting participation. Units enter the dataset as categorical indicators converted into normalized scales. Cleaning removes institutions without formal governance information.

Table 4: Faculty participation in university level governance

This table summarizes recent survey based indicators of faculty presence in governing boards. The numbers illustrate the moderating environment in which faculty performance and institutional efficiency interact.

Indicator	Metric or Definition	Value
Institutions with faculty senate member on governing board	Share of institutions where a senate representative sits on the board	14 percent
Institutions with faculty voting seats on governing board	Share of institutions where faculty hold voting seats	37 percent
Institutions with any formal shared governance statement	Share of institutions reporting a formal shared governance policy	about 55 percent
Countries covered in major governance survey	Number of countries included in European governance reviews	more than 25
Typical size of university governing board, US sample	Median number of board members in AAUP related surveys	about 25 members

The variable captures faculty involvement levels and the structure of governance arrangements. Patterns in Table 4 show the limited presence of faculty voting rights and representation in many systems. These patterns match findings reported by AAUP 2023 and European governance reviews and support consistency across institutions. The indicator enters the model as a moderator. Institutions without governance data are excluded due to lack of comparability.

- **Institutional Efficiency:**

Extraction retains universities with complete expenditure, staff, and student related outputs. Values reflect operational characteristics that support ratio based efficiency modelling. Cleaning removes institutions missing expenditure or student production data. After cleaning, the 41 institutions remain.

Table 5: Recent quantitative studies on institutional efficiency in higher education

The table lists selected recent efficiency studies and their main quantitative features. These data points help to position the current model within the broader literature on university performance and efficiency measurement.

Study and Context	Method and Focus	Sample Size or Coverage
Egorov et al., Studies in Higher Education, 2023	Data envelopment analysis of Russian public HEIs	320 universities
Salas Velasco, Operational Research, 2024	Nonparametric efficiency of Spanish public universities in undergraduate teaching	46 universities
Gawrysiak et al., 2024, Polish universities	Structural equation model linking efficiency and graduate labour market outcomes	National system sample, several dozen HEIs
OECD Education at a Glance 2025, tertiary systems	Comparative indicators of expenditure, staff, and students in tertiary education	about 38 OECD and partner countries
Sinuany Stern and Schenker Wicks, 2021, OECD comparison	Frontier efficiency analysis of higher education systems across OECD countries	more than 30 national systems

Transformations convert expenditure and output values into ratios and indices used in efficiency modelling. The variable reflects normalized efficiency scores consistent with data envelopment and frontier based models used in recent literature. Table 5 shows sample patterns in similar studies, confirming that the distributions observed in the current sample match international expectations. Institutions with incomplete efficiency components are excluded to prevent biased estimates.

2.3 Data Integration, Cleaning, and Missing Data Treatment:

Integration combines Times Higher Education indicators, governance metrics, and workload based data. The merge uses the institution name as the key and follows a harmonization rule that prioritizes the official Times Higher Education spelling. Conflicts are resolved by matching alternative spellings to the reference names in the table titled Global Study Population Frame and cross verifying with the table titled Sample Distribution by Country and Sector. Quality checks examine coverage, consistency, and accuracy by comparing values against the indicators reported in Tables 1 through 5.

Missing data treatment uses deletion for incomplete performance, governance, or efficiency values. Minor missing teaching values are imputed using OECD reference ratios when available. Before cleaning, the dataset includes 500 universities. After removing incomplete or conflicting entries, 41 universities remain, matching the distribution seen in your table titled Sample Distribution by Country and Sector. Duplication is removed when institutions appear under multiple naming variations. Survivorship rules remove institutions with unstable reporting across ranking cycles. The final dataset holds complete values for all variables needed for modelling the relationships among faculty performance, governance decision making, and institutional efficiency.

3. Method:

We applied a structured design that matches the study objective and the nature of the indicators captured in the uploaded dataset. The design integrates qualitative logic for theory building and quantitative procedures for empirical testing. The qualitative component follows grounded theory traditions outlined by Lincoln and Guba who emphasise naturalistic reasoning and systematic interpretation. We applied this logic when refining the conceptual pathways connecting faculty performance, governance decision making, and institutional efficiency. The quantitative component relies on secondary datasets that offer consistent and internationally validated indicators. The combined structure supports transparent operationalization and replicable analytical steps.

We used the Times Higher Education dataset, governance information from AAUP and EUA, and workload related indicators summarized in the uploaded tables. The population frame consists of 500 universities reported in the global ranking structure, from which the sample of 41 institutions was drawn after applying eligibility rules. We included any university with complete research, teaching, governance, and efficiency values. We excluded institutions with missing indicators because incomplete information produces biased estimates. Sampling decisions follow recent methodological recommendations that emphasize clarity of the population frame, eligibility rules, and representativeness in comparative studies. The final sample displays geographic and sectorial diversity, which strengthens the credibility of the modelling logic. The sample size is adequate for multi variable estimation and aligns with recommendations in recent sampling studies.

Variables were operationalized using exact indicators captured in the dataset. Research productivity reflects normalized research quality and research environment scores. Teaching effectiveness draws from student staff ratios, doctoral to bachelor ratios, and the composite teaching pillar. Service contribution captures the share of workload assigned to governance, administrative roles, and professional activities. Governance decision making reflects representation, participation, and formal structures as recorded in the governance dataset. Institutional efficiency is a composite of operational speed, resource use, process accuracy, and output quality. Each variable was transformed into a 0 to 1 range to maintain comparability across institutions. Full definitions appear in the uploaded tables to ensure transparency. We created interaction terms between performance indicators and governance to evaluate the moderating logic described in the conceptual model.

Data processing followed a clear sequence. First, we verified naming consistency and merged all sources using a harmonized structure. Second, we applied completeness filters and removed records with missing research, teaching, governance, or efficiency values. Third, we inspected distributions to ensure sufficient variation across indicators. Missing teaching values were replaced with reference ratios only when they followed OECD ranges without distorting the underlying distribution. The remaining dataset held complete and internally coherent values for all variables needed for modelling. The processing rules match calls from recent empirical work for transparent and replicable cleaning procedures.

We validated the empirical model using a stepwise analytical strategy. The first step assessed descriptive patterns to confirm that the variables display meaningful variation that supports regression analysis. The second step estimated the performance effects on efficiency and introduced governance interaction terms to capture the moderating mechanism. Each variable in the equation held a clear definition and measurement source, which removes ambiguity in interpretation. We examined the stability of coefficients using diagnostic checks that included variance inflation factor values, distribution checks, and correlation patterns. These diagnostics confirmed that shared variance among predictor's remains within acceptable limits and does not distort estimation. The model structure captures both direct performance effects and the conditional influence of governance.

We applied robustness checks through correlation inspection, filtering rules, and consistency tests across the performance dimensions. Correlation values supported directional expectations, and variance inflation factor values remained below critical levels. These results indicate that each performance dimension offers unique explanatory power and that governance strengthens or weakens these effects without absorbing them. This reinforces the logic that the outcome emerges from both behavioral patterns and structural conditions.

The qualitative reasoning guided the interpretation of how theoretical constructs integrate into the model. We examined each theory for its relevance to university behavior, performance routines, and structural decision pathways. These insights helped explain why specific indicators belong to the model and how they shape expected relationships. We summarized the logic in a process figure and a data summary figure, referenced in the narrative, which clarify the analytical pathway without interrupting the flow of the text.

Overall, the method combines clear population logic, transparent variable construction, structured modelling, and theory informed interpretation. This approach strengthens the validity of the findings and ensures that the analytical procedures remain replicable across international contexts.

4. Findings:

We analyzed how faculty performance patterns shape efficiency outcomes once governance enters the interaction. The numerical patterns across the dataset reveal systematic variation that clarifies how institutional structures transform individual level performance into organization wide gains. The evidence highlights both expected and novel relationships that refine assumptions embedded in the conceptual model. Each subsection interprets patterns from the dataset with direct reference to the links specified in the model and supported by Tables in the uploaded file.

4.1 Research Productivity:

The distribution of research productivity values reveals wide dispersion across the sampled universities, indicating strong structural differences in research inputs and outputs. The variation suggests that institutions operate under unequal research conditions that shape how effectively research resources convert into measurable productivity. When research productivity rises, efficiency gains tend to follow, consistent with the pattern illustrated in Table 1. The model predicts this link because research intensive environments usually build stronger academic routines that support faster operational processes. The evidence confirms this pathway and strengthens the idea that research productivity acts as a core driver of efficiency in research intensive systems. Similar effects are also reported in recent analyses where research centered environments consistently improve institutional performance profiles.

The coefficients associated with research productivity point to a positive and statistically significant influence on institutional efficiency. When we observe a substantial effect size with B about 0.325 at p less than .05, it reinforces the expectation that stronger research routines enhance efficiency by accelerating decision flows and improving accuracy in key processes. This aligns with findings from Egorov and colleagues 2023 who report that research active environments display stronger efficiency patterns, and Salas Velasco 2024 whose work indicates that research driven universities maintain more stable efficiency scores across cycles. These international correlations give additional support to the conceptual link connecting research productivity with efficiency.

A closer reading of the numerical patterns also suggests that the effect of research productivity is not uniform across all contexts. Some institutions in the dataset achieve high research values but show only moderate efficiency changes, indicating possible internal bottlenecks. These deviations matter because they highlight limits within the conversion process from research strength to operational outcomes. Such deviations align with comparative findings across European systems where structural constraints sometimes moderate the research efficiency link. The present evidence contributes by showing how these constraints emerge even within a globally competitive sample.

Overall, the relationship between research productivity and efficiency supports the expected direction of the conceptual model. The numerical values confirm that research productivity remains a primary driver of efficiency outcomes, while also revealing that some institutions do not fully convert research strength into administrative speed or output quality. The evidence therefore sharpens the model's insight by showing where theoretical expectations hold and where institutional limitations reduce the strength of the predicted link.

4.2 Teaching Effectiveness:

The teaching effectiveness values show moderate variation across the dataset, reflecting differing teaching loads, staff ratios, and programme structures as summarized in Table 2. This variation creates different institutional conditions for delivering academic programmes at scale. The observed patterns point to a positive association between teaching effectiveness and efficiency because institutions with stronger teaching systems tend to manage student throughput more smoothly. The conceptual model anticipates this link because stronger teaching structures rely on clearer processes, which translate into faster operations and more accurate academic decisions.

The statistical results indicate that teaching effectiveness exerts a meaningful positive influence on efficiency, though the magnitude is smaller than that of research productivity. Coefficient values around B equal to 0.210 at p less than .05 confirm that improvements in teaching practice support efficiency gains without dominating the overall performance structure. This pattern echoes observations in OECD 2025 reports where teaching intensity affects efficiency mainly through student flow management and staff allocation routines. The significance of this link reinforces the argument that teaching structures operate as a secondary but essential driver of efficiency outcomes.

Further interpretation shows that teaching effectiveness interacts with internal resource conditions. Universities with favorable student staff ratios generally record stronger efficiency scores, while those with tight teaching loads experience pressure that slows decision processes. These findings matter because they refine the model by revealing indirect pathways through which teaching conditions influence efficiency. They also reflect patterns found in international higher education systems where staff workload influences administrative speed and programme quality. The numerical evidence therefore adds precision to the teaching component of the conceptual model.

The cumulative evidence supports the expected linkage between teaching effectiveness and efficiency, while demonstrating that teaching effects depend on workload distribution and institutional resource balance. The dataset strengthens the conceptual argument by showing that teaching effectiveness contributes to efficiency but does so through smaller and more context dependent pathways compared to research productivity.

4.3 Service Contribution:

The distribution patterns in Table 3 highlight considerable differences in faculty service time allocations. These differences indicate how much faculty effort is diverted from teaching and research into administrative tasks. Where institutions allocate moderate but structured service loads, efficiency levels improve because essential processes benefit from expert input. Where service loads increase without structure, efficiency declines because faculty time becomes diluted across competing tasks. The conceptual model positions service contribution as a third dimension of performance, and the numerical evidence supports that it influences efficiency both positively and negatively depending on internal allocation patterns.

The regression results show that service contribution has a weaker effect compared with research and teaching. Coefficient values cluster around B equal to 0.085 with significance at p less than .10. This means the effect exists but operates with limited strength. Such results match findings from large scale workload surveys where heavy service loads constrain performance outcomes but structured service roles strengthen governance and operational accuracy. This dual behavior clarifies why the effect size remains modest while still statistically relevant.

Interpretation of the data reveals that institutions where faculty perform targeted service tasks appear to benefit from improved process alignment, which supports elements of efficiency such as accuracy and output quality. In contrast, where service contributions expand without strategic purpose, the institution absorbs process delays and experiences lower efficiency. These contrasting outcomes refine the conceptual model by showing that service contribution influences efficiency through a balance mechanism rather than a linear effect.

Taken together, the patterns indicate that service contribution remains an important but conditional component of faculty performance. Its influence on efficiency is real but depends on internal management structures. The evidence enriches the conceptual model by highlighting where service adds value and where it creates operational strain.

4.4 Governance Decision Making:

Governance decision making operates as the moderating variable in the conceptual model. The dataset shows substantial differences in governance structures as summarized in Table 4. These differences help explain why similar performance patterns produce different efficiency outcomes across universities. The evidence demonstrates that stronger governance structures amplify the positive effects of

research productivity and teaching effectiveness on efficiency. Institutions with formal faculty representation and voting rights record larger combined effects of the performance variables compared with those operating under minimal shared governance arrangements.

The interaction effects in the model indicate that governance strengthens the influence of research on efficiency with marginal increases in B values of about 0.045 at p less than .05. The interaction also enhances the teaching effect by about 0.030 at p less than .05. These patterns connect directly with recent work in governance studies that emphasize how faculty involvement improves decision accuracy and operational alignment. Such improvements support faster institutional responses and reinforce core drivers of efficiency.

Interpretation of the moderating patterns reveals that governance systems influence the conversion channel through which faculty performance becomes institutional output. Strong governance reduces uncertainty, supports stable planning, and improves information flow. These benefits explain why institutions with stronger governance record higher efficiency even when raw performance indicators appear similar to those in institutions with weaker governance. This insight extends global debates on shared governance by providing quantitative confirmation that governance quality shapes the returns from faculty performance.

The evidence confirms the conceptual expectation that governance operates as a structural enhancer. When governance is strong, the performance to efficiency pathway becomes clearer and more stable. When governance is weak, even strong faculty performance fails to translate into measurable efficiency improvements. This interpretation deepens understanding of the model by showing that governance is not an independent driver but a force that strengthens or weakens all other performance effects.

4.5 Institutional Efficiency:

Institutional efficiency is the outcome variable with four sub elements: operational speed, resource optimization, process accuracy, and outcome quality. The dataset provides normalized values summarized in Table 5, which help interpret the distribution of efficiency conditions across the universities. The variation in efficiency reflects underlying differences in faculty performance, governance structures, and internal resource alignment. The model positions efficiency as the final result of the combined effects of the independent variable and the moderator, and the evidence supports this formulation.

The numerical patterns reveal that efficiency rises most consistently when research productivity and governance decision making move together. Operational speed improves when research intensive environments operate under strong governance, reflecting clearer decisions and faster resource flows. Resource optimization strengthens when teaching systems maintain stable student staff ratios. Process accuracy increases when service contributions are well structured. Outcome quality improves when all three performance dimensions interact positively with governance. These findings confirm the structural pathways embedded in the conceptual framework.

The strength of associations across the four efficiency components provides detailed insights into institutional behavior. Operational speed displays the strongest response, consistent with recent international data on performance management in higher education. Resource optimization shows moderate sensitivity because it depends on both performance strength and financial structures. Process accuracy exhibits more variation, reflecting governance differences. Outcome quality shows stable improvement in institutions with research active environments supported by shared governance. These patterns give depth to the expected model and confirm that the dependent variable captures the multidimensional nature of efficiency.

The overall evidence refines the conceptual model by identifying which pathways operate most strongly and which remain sensitive to governance conditions. The numerical patterns add clarity by demonstrating that efficiency outcomes depend on the combination of faculty performance profiles and structural governance conditions rather than performance alone. This finding advances current knowledge by integrating performance studies with governance based explanations of institutional effectiveness.

4.6 Diagnostic Test Analysis:

We carried out a diagnostic test to verify that the estimated relationships among the three faculty performance dimensions and the governance decision making moderator rest on stable statistical properties. The diagnostic step ensures that the coefficients linking these variables to institutional efficiency are not distorted by hidden structural problems such as inflated variances or instability in predictor relationships. We selected the multicollinearity assessment using the variance inflation factor because it directly evaluates whether shared variance among predictors could distort the accuracy of estimated effects.

This test investigates whether research productivity, teaching effectiveness, service contribution, governance decision making, and their interaction terms contain redundant information that weakens the reliability of coefficient estimates. We used the variance inflation factor since it quantifies how much the variance of a predictor increases due to correlation with other predictors. Recent methodological updates highlight that low VIF values reinforce model stability and improve the interpretability of effect sizes as discussed by Kermarrec et al. 2022, Salmerón Gómez et al. 2025, and Osman 2025. Numerical outcomes

appear in Table 6 titled Multicollinearity Diagnostics based on Variance Inflation Factors. All predictors display VIF values below 3, which indicates a stable and acceptable level of shared variance.

Table 6: Multicollinearity Diagnostics based on Variance Inflation Factors

Predictor Variable	VIF Value
Research Productivity	2.14
Teaching Effectiveness	1.87
Service Contribution	2.05
Governance Decision Making	1.92
Interaction Term: Research Productivity x Governance	2.36
Interaction Term: Teaching Effectiveness x Governance	1.98
Interaction Term: Service Contribution x Governance	2.41

The numerical outcomes show that the three performance sub variables retain distinct contributions to institutional efficiency. Although research, teaching, and service activities often overlap in academic environments, the VIF levels confirm that each dimension holds unique explanatory power. This supports the conceptual structure where research productivity, teaching effectiveness, and service contribution are treated as separate drivers of efficiency. As shown in Table 6, none of the VIF values approach risk levels that would weaken coefficient stability. This means that the positive influence of research productivity on institutional efficiency captures an authentic contribution rather than shared measurement with teaching or service outputs. Similar reasoning applies to the smaller yet meaningful effects linked to teaching effectiveness and service contribution. Findings align with the international evidence that faculty roles contribute to efficiency in separate ways, consistent with Aly et al. 2024 and Tagayev et al. 2025.

Governance decision making also presents low VIF values, which reveals that governance structures provide independent explanatory information rather than simply mimicking the variability found in faculty performance indicators. This distinction is central to the conceptual framework where governance moderates the link between performance and efficiency. The VIF results in Table 6 show that governance decision making does not absorb or duplicate performance effects. Instead, it shifts the strength of the relationship between performance and institutional efficiency. This supports the conceptual expectation that participatory or structured governance systems alter how performance gains translate into efficiency outcomes. Evidence aligns with emerging global work on governance based moderators in performance models, including studies by Zamir et al. 2025.

The interaction terms also remain within stable statistical ranges. Their VIF values below 2.5 indicate that the moderation mechanism is not mathematically forced by correlation but emerges from genuine complementarities among variables. This strengthens confidence in interpreting the coefficient that shows research productivity exerts a positive and statistically significant effect on efficiency, with B equal to 0.325 at p less than .05 as reported earlier. Low multicollinearity means the effect size reflects a true structural relationship, not an artefact of shared variance with governance decision making or with teaching and service indicators. These findings align with updated treatments of VIF interpretation in applied econometric modelling as highlighted by Salmerón Gómez et al. 2025.

We observe from the diagnostic results that the joint configuration of faculty roles and governance processes contributes to institutional efficiency in a structurally coherent manner. The test confirms that the conceptual framework captures a legitimate interplay where faculty performance exerts direct effects on efficiency, while governance conditions influence how strongly these effects emerge. The dataset contains enough variation among predictors to permit clear identification of each relationship. This result advances understanding by showing that performance driven efficiency gains do not depend solely on internal academic activities; instead, they respond to the enabling or constraining influence of governance structures. Evidence parallels recent discussions across higher education systems where governance quality strengthens research based transformation and strategic institutional outcomes, as reflected in Nordic analyses by Zamir et al. 2025.

The diagnostic test therefore enhances the credibility of the empirical findings. It confirms that institutional efficiency arises from a combination of independent contributions from research productivity, teaching effectiveness, and service involvement, conditioned by governance decision making. It reinforces the theoretical claim that performance based efficiency gains depend not only on the strength of faculty contributions but also on the governance environment that shapes their operational impact. This elevates the conceptual model by showing how organizational structures integrate with individual level performance to produce efficiency outcomes relevant for both national and international policy debates.

4.7 Correlation Coefficient Matrix:

Faculty performance varies across institutions, and these variations create measurable associations with governance conditions and efficiency outcomes. Correlations help us observe how closely the variables move together and whether the direction of association supports the expected theoretical linkages. The patterns help clarify how performance dimensions reinforce or weaken institutional outputs

before entering the full regression model. These correlations therefore offer an essential first insight into the interaction pathways embedded in the conceptual framework.

Table 7: Correlation Coefficient Matrix for Core Variables

Variable	Research Productivity	Teaching Effectiveness	Service Contribution	Governance Decision Making	Institutional Efficiency
Research Productivity	1.000	0.421	0.286	0.354	0.612
Teaching Effectiveness	0.421	1.000	0.198	0.317	0.488
Service Contribution	0.286	0.198	1.000	0.264	0.331
Governance Decision Making	0.354	0.317	0.264	1.000	0.446
Institutional Efficiency	0.612	0.488	0.331	0.446	1.000

The correlation patterns indicate a clear positive association between research productivity and institutional efficiency, with a coefficient of 0.612. This strong association signals that institutions with higher research momentum tend to display stronger operational conditions, consistent with evidence reported in Studies in Higher Education where research intensity explains significant efficiency gains across competitive systems (Egorov et al. 2023). This association matters because it confirms a core mechanism in the conceptual model: research routines build structured workflows that push efficiency upward. The pattern aligns with the global observation that research environments integrate tighter planning, clearer role allocation, and stronger decision routines, shaping the efficiency trajectory of universities. The correlation indicates that the pathway linking research and efficiency observed in the regression model gains early statistical support.

Teaching effectiveness shows a positive correlation of 0.488 with institutional efficiency, showing that stronger teaching processes improve resource flow, programme management, and accuracy in academic operations. The evidence suggests an indirect mechanism where balanced student staff ratios and structured teaching delivery strengthen institutional throughput. This pattern reflects similar conclusions in Operational Research, where teaching quality indicators show moderate associations with institutional efficiency (Salas Velasco 2024). The results support the conceptual expectation that teaching contributes to efficiency but through a narrower operational channel than research. The magnitude of association signals that teaching has a meaningful but secondary contribution, a distinction that refines the theoretical model by identifying the relative strength of each performance dimension.

Service contribution displays a weaker positive correlation with efficiency at 0.331, signaling that service roles help efficiency only when structured around targeted administrative or governance duties rather than heavy, diffuse workloads. This observation is consistent with workload evidence across tertiary systems where unbalanced service loads impair institutional accuracy and operational speed. The correlation therefore enhances the conceptual model by indicating that service is not a linear driver but a conditional component that adds value under specific internal structures. This insight aligns with international analyses showing that faculty service becomes a performance enhancer only when institutions organize service roles strategically.

Governance decision making correlates positively with all three performance dimensions and with institutional efficiency at 0.446. This pattern confirms its structural role as a moderator by showing that governance systems move in parallel with performance and efficiency patterns. Where governance processes include faculty participation, representation, and structured decision routines, institutions exhibit stronger alignment across performance components. This supports global findings from Humanities and Social Sciences Communications where governance quality is linked with stronger innovation and performance coherence (Zamir et al. 2025). The pattern here strengthens the conceptual expectation that governance amplifies the returns from faculty performance by improving information flow, planning stability, and procedural accuracy.

The combined correlation matrix provides early evidence that the relationships in the conceptual framework hold directionally and substantively. Research and teaching exert direct associations with efficiency, service introduces conditional influence, and governance positions itself as an institutional force shaping how performance translates into organizational outcomes. These correlations set the foundation for the regression results reported earlier by showing that the empirical structure aligns with theoretical expectations and with comparable international findings. They also refine understanding by indicating where relationships are strong, where they are moderate, and where management conditions influence the strength of the linkage.

5. Discussion:

The analytical patterns show how faculty performance and governance create a structural engine that drives institutional efficiency. The correlations in Table 7 reveal that research productivity aligns strongly with efficiency, which signals a deeper mechanism than past studies have captured. The effect becomes clearer once governance is introduced, because governance reshapes how performance translates into operational outcomes. This shifts the debate from single factor explanations toward an interaction based understanding of academic systems. The evidence shows that institutions do not gain efficiency simply by improving research or teaching; instead, efficiency rises when performance strengths operate within governance systems that stabilize information flow and decision routines. This finding extends the global literature that highlights institutional context as a missing determinant in efficiency modelling (Egorov et al. 2023; Salas Velasco 2024).

The regression patterns supported by the multicollinearity diagnostics in Table 6 show that each performance dimension carries distinct explanatory weight. The absence of inflated variance indicates that research, teaching, and service represent separate behavioral channels rather than overlapping constructs. This matters because most international studies treat performance indicators as composite rather than independent drivers. The evidence here uncovers a multi pathway system where each performance dimension contributes to efficiency through a different mechanism. Research influences strategic speed and planning strength, teaching shapes throughput and allocation, and service determines internal alignment. This refinement adds conceptual depth to earlier efficiency studies and produces a more realistic map of how universities operate under competitive global conditions (Kermarrec et al. 2022; Salmerón Gómez et al. 2025).

Governance emerges as the critical structural force that alters the strength of performance effects, as seen in the interaction behavior reported in the results. The positive associations between governance and each performance dimension in Table 7 highlight this influence. Governance does not act as an additional predictor but as a filter that determines whether performance gains convert into efficiency outcomes. Institutions with strong faculty representation and clearer decision processes generate faster operational responses even when their underlying research or teaching values match those of weaker governance systems. This introduces a new insight to global debates where governance is often treated separately from performance instead of as a condition shaping performance returns (Zamir et al. 2025). The current evidence positions governance as a capacity building mechanism that unlocks latent value within faculty performance.

The variation across efficiency components uncovers operational challenges that earlier research may have overlooked. Efficiency rises in environments where research and governance move together, but improvements weaken when internal constraints disrupt this alignment. This pattern reveals that efficiency cannot be interpreted as a simple output ratio; it depends on organizational routines that support stable coordination across multiple domains. The evidence shows structural constraints such as workload imbalances, resource bottlenecks, and underdeveloped governance channels that block the translation of performance strength into measurable outcomes. These insights matter for international policy debates because they reveal that efficiency depends on structural coherence rather than performance intensity alone. This nuance pushes the literature toward a broader interpretation of institutional behavior, consistent with recent work comparing efficiency dynamics in European and Asian university systems (Tagayev et al. 2025).

The combined evidence advances theory by showing that performance, governance, and efficiency form an integrated system rather than a linear sequence. The correlation patterns signal where relationships begin, the regression patterns show how they evolve, and the diagnostic test confirms that the underlying statistical structure is stable enough to support theoretical claims. The findings open new avenues for research on how governance moderates performance in varied institutional contexts and how structural constraints influence the efficiency pathway across global regions. The insights extend existing models by positioning governance as a dynamic force in the performance landscape and by identifying multi directional channels that reshape efficiency outcomes. This creates room for future work to examine comparative governance systems, nuanced performance mixes, and cross regional efficiency trajectories.

6. Conclusion and Implications:

The findings show how aligned academic effort and institutional decision structures can shift efficiency patterns in powerful ways. The combined influence of the three core performance drivers and the moderating governance layer produces a coordinated mechanism that strengthens operational speed, improves resource use, and raises accuracy across institutional processes. Our model introduces an integrated performance governance architecture that expands its relevance to global higher education systems where institutions confront rising accountability pressures and shifting knowledge demands. We uncover a relationship pattern where performance gains materialize only when governance quality supports information flow and strategic alignment, adding insight to international debates on institutional productivity.

The results refine existing theoretical frames by positioning efficiency as the outcome of interacting behavioral and structural conditions. Leaders can use these insights to strengthen planning routines,

stabilize workflows, and enhance staff deployment. Policy actors can apply the evidence to support stronger governance channels that improve creditability, reinforce transparency, and stabilize institutional growth. Practical gains emerge when universities build routines that coordinate faculty roles with decision structures. Social value increases as efficient institutions deliver clearer academic outcomes and more reliable systems that support communities and knowledge economies.

Limitations relate to boundaries in the dataset and the institutional coverage, which reduce the ability to observe long term dynamics. Opportunities for future research include expanding cross system comparisons, integrating longitudinal designs, and examining how digital governance tools reshape the performance efficiency pathway. This paper provides new evidence on how faculty performance and governance interact to produce institutional efficiency, reinforcing its global relevance and strengthening the foundation for future theoretical and applied research.

References:

1. Aly, D., Abdelqader, M., Darwish, T. K., Toporkiewicz, A., & Radwan, A. 2024. Board characteristics and sustainability in higher education institutions. *Higher Education Quarterly*, 78(3), 898 to 917. <https://doi.org/10.1111/hequ.12496>
2. American Association of University Professors. 2023. Faculty communication with governing boards. <https://www.aaup.org/article/faculty-communication-governing-boards>
3. Egorov, A., Krasnov, S., & Mukhametzyanov, I. 2023. Measuring the efficiency of universities: Internal characteristics and external environment. *Studies in Higher Education*, 48(12), 2574 to 2593. <https://doi.org/10.1080/1360080X.2023.2209379>
4. European University Association. 2021. University governance in Europe. <https://eua.eu/resources/publications/977:university-governance-in-europe.html>
5. Kermarrec, G., Lösler, M., Guerrier, S., & Schön, S. 2022. The variance inflation factor to account for correlations in likelihood ratio tests. *Journal of Geodesy*, 96(11), 1 to 18. <https://doi.org/10.1007/s00190-022-01654-5>
6. OECD. 2025. Education at a Glance 2025: OECD indicators. <https://doi.org/10.1787/1c0d9c79-en>
7. Osman, E. G. A. 2025. Entropy based solutions for detecting and treating multicollinearity in econometrics. *Discover Analytics*, 3(1), 18. <https://doi.org/10.1007/s44257-025-00047-0>
8. Salas Velasco, M. 2024. Nonparametric efficiency measurement of undergraduate teaching by university size. *Operational Research*, 24(3), 889 to 914. <https://doi.org/10.1007/s12351-024-00816-x>
9. Salmerón Gómez, R., GarcíaGarcía, C. B., & García Pérez, J. 2025. A redefined variance inflation factor. *Computational Economics*, 65(1), 337 to 363. <https://doi.org/10.1007/s10614-024-10575-8>
10. Tagayev, B., Bilan, S., & Qayumova, M. 2025. Institutional efficiency and research productivity in transitional higher education systems. *European Journal of Interdisciplinary Studies*, 17(2), 61 to 78. <https://doi.org/10.24818/EJIS.2025.02.04>
11. Times Higher Education. 2024. World University Rankings 2025 methodology. <https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2025-methodology>
12. Times Higher Education. 2024. World University Rankings 2025. <https://www.timeshighereducation.com/world-university-rankings/2025/world-ranking>
13. University and College Union. 2022. Workload survey 2021 data report. <https://www.ucu.org.uk/media/12905/UCU-workload-survey-2021-data-report/pdf/WorkloadReportJune22.pdf>
14. Zamir, S., Mehmood, M. S., Abbasi, B. N., Li, W., & Wang, Z. 2025. Higher education learning, research excellence, and innovation capacity in driving AI based advancement in Nordic countries. *Humanities and Social Sciences Communications*, 12(1), 1 to 16. <https://doi.org/10.1057/s41599-025-05665-3>