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Trends in Secondary Education Demand, Financing and Supply: Evidence from MINESEC Statistical Yearbooks, 2010–2024

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ABSTRACT

Secondary education in Sub-Saharan Africa faces mounting tensions between enrolment demand, fiscal constraints, and supply-side capacity. In Cameroon, despite the complexity of the Ministry of Secondary Education (MINESEC) system, longitudinal evidence on the interplay between these factors remains scarce. Employing a longitudinal documentary research design, this study analyses fourteen MINESEC Statistical Yearbooks (2010/2011–2023/2024) to evaluate demand, financing, and equity. Grounded in Systems Theory and the Educational Production Function, the analysis reveals that while total enrolment expanded by 67% (CAGR 3.7%), classroom (CAGR 2.6%) and teacher (CAGR 3.1%) growth lagged systematically. Consequently, real per-student expenditure declined by 17%, identifying financing as the binding constraint on system quality. Although, national gender parity improved (GPI 0.79 to 0.91), regional disparities particularly in the Far North, North, and Adamawa regions widened over the study period. Also, the Anglophone Crisis caused significant, partially unrecovered enrolment disruptions from 2017. These findings characterise a system achieving quantitative access expansion on a declining real resource base. The systemic input-output imbalance and entrenched regional inequities constitute critical impediments to Sustainable Development Goal 4 implementation in Cameroon. The study recommends legislating enrolment-indexed per-student financing floors, implementing an emergency qualified teacher deployment programme, launching targeted gender equity interventions in structurally disadvantaged regions, and institutionalising MINESEC Yearbooks as active policy intelligence tools. This study provides a foundational longitudinal baseline for evidence-based policymaking in data-constrained educational contexts.

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1. INTRODUCTION

Secondary education occupies a pivotal structural position within national systems, simultaneously marking the culmination of basic education, providing the gateway to tertiary pathways, and preparing youth for labour market participation. The global commitment to universal quality secondary education, codified in Sustainable Development Goal 4 (SDG4), has placed unprecedented pressure on low- and middle-income countries to expand access while improving quality and equity (UNESCO, 2015). With the 2030 deadline approaching, understanding how national systems have evolved across demand, financing, and supply dimensions has become a matter of critical policy urgency. In Sub-Saharan Africa, secondary education expansion represents one of the most consequential development policy challenges of the twenty-first century. School-age populations growing at approximately 3% annually generate escalating enrolment demand that consistently outpaces governments' institutional, financial, and human resource capacities (Lewin, 2009; World Bank, 2018). This structural tension between surging demand and constrained supply, mediated by chronically inadequate financing, defines

the operational environment for secondary education ministries across the continent.

Cameroon's MINESEC oversees a system of considerable scale and complexity: ten administrative regions, parallel Francophone and Anglophone subsystems, public and private institutional modalities, and both general and technical-vocational pathways, serving approximately 2.26 million students across more than 6,000 registered institutions as of 2024. This system's trajectory is critical to Cameroon's human capital development strategy, its Vision 2035 emergence objectives, and its SDG 4 commitments. Since 2010/2011, MINESEC has published annual Statistical Yearbooks (*Annuaires Statistiques de l'Enseignement Secondaire*) compiled from national school censuses. These publications constitute an irreplaceable longitudinal administrative evidence base whose systematic exploitation for policy-relevant research has, until now, been absent from peer-reviewed literature. The existing scholarship on Cameroonian secondary education, while substantively valuable, tends toward cross-sectional designs or focused thematic analyses without exploiting longitudinal administrative data for comprehensive systemic analysis (Fonkeng, 2007; Tambo, 2012; Tchombe, 2019).

This gap carries significant policy consequences, particularly given multiple intersecting challenges during 2010–2024: accelerating demographic growth, the Anglophone Crisis from 2016–2017, Boko Haram-related insecurity in the Far North from 2014, COVID-19 disruptions from 2020, and sustained fiscal pressures. Understanding how these challenges manifested in administrative indicators and whether policy responses were adequate is essential for evidence-based decision-making through the remainder of the SDG 4 implementation period.

This study is organized around one main general objective operationalized through three specific objectives:

General Objective: To examine the dynamics of demand, financing, and supply in Cameroon's secondary education sector using MINESEC Statistical Yearbook data (2010–2024).

Specific Objectives:

SO1: To trace the trajectories of demand and supply indicators across Cameroon's ten regions from 2010 to 2024.

SO2: To analyze trends in public financing for secondary education and evaluate the adequacy of real per-student expenditure relative to enrolment expansion.

SO3: To identify the magnitude of demand-supply imbalances across regions and assess the evolution of interregional disparities in enrolment ratios, institutional density, teacher availability and resource allocation.

2. Literature Review

2.1. Demand, Financing, and Supply: Key Debates

The literature on education demand is anchored in Human Capital Theory (Schultz, 1961; Becker, 1964), which frames schooling as an investment decision generating returns through enhanced productivity and wages. Psacharopoulos and Patrinos (2018) estimated private returns to secondary education in Sub-Saharan Africa consistently between 10% and 14%, suggesting robust household-level incentives for enrolment. Beyond economic motivations, Sen's (1999) Capability Approach positions education as expanding fundamental human freedoms broadening the conceptual basis for understanding enrollment demand. Empirically, household wealth (Filmer & Pritchett, 2001), gender dynamics, geographic location (Glewwe & Kremer, 2006), demographic pressure (Lewin, 2009), and conflict (Burde, 2014; Novelli et al., 2017; INEE, 2010) constitute well-documented demand determinants across the region.

Global education financing frameworks recommend allocating at least 4–6% of GDP and 15–20% of total public expenditure to education as a sector (UNESCO, 2015). Sub-Saharan African governments have consistently struggled to meet these thresholds (Atuhurra & Kaffenberger, 2020). Within education budgets, secondary education occupies a particularly constrained position — what Lewin and Caillods (2001) characterized as the "neglected middle." Hanushek (2003) cautions that spending volumes alone are insufficient: governance quality, teacher motivation, and accountability mechanisms mediate the translation of resources into outcomes. More recent scholarship emphasizes the importance of SDG 4 financing adequacy (Rose et al., 2020), educational resilience (Moss, 2021), and learning recovery after COVID-19 (Azevedo et al., 2021) all directly relevant to the Cameroonian context.

Educational supply institutions, teachers, and infrastructure constitute the delivery capacity through which systems respond to demand (Bray & Thomas, 1995). Teacher supply and qualification represent the most consequential supply-side variables for learning quality (UNESCO, 2016). Institutional expansion across Sub-Saharan Africa has increasingly been driven by private sector growth (Tooley, 2009), creating stratified quality landscapes where

ownership modality and geographic location become predictors of educational outcomes (Rolleston, 2009; Härmä, 2013).

2.2. The Cameroonian Context

Regional comparative scholarship documents significant heterogeneity across Francophone African secondary systems, identifying Cameroon as characterized by moderate enrolment expansion alongside persistent efficiency and equity challenges (Pôle de Dakar, 2009). Within Cameroon, Fonkeng (2007) provides the most comprehensive historical treatment, documenting structural, linguistic, and institutional features alongside persistent equity challenges. Mingat and Kuépié (2003) documented financing constraints, regional disparities, and efficiency challenges as structural features of the pre-2010 system providing a baseline against which the present study's trend analysis can be assessed. Ngalim (2018) analyses governance and access implications of the Anglophone Crisis. What the literature lacks is a systematic longitudinal analysis of administrative data trends across the full post-2010 period; the gap this study directly addresses.

3. Theoretical Framework

This study is grounded primarily in Systems Theory (Bertalanffy, 1968; Banathy, 1968), supported by the Educational Production Function (EPF) as a conceptual specification tool and Human Capital Theory as a normative foundation.

Systems Theory conceptualizes educational systems as organized wholes transforming resource, inputs financing, teachers, infrastructure through organizational processes into measurable outputs; enrolment, GER, GPI. Four constructs are directly relevant. First, the input-process-output model organizes this study's analytical structure: SO2's financing analysis addresses financial inputs; SO1's supply analysis addresses human and physical inputs; enrolment and gender parity constitute system outputs. Second, environmental context; the Anglophone Crisis, COVID-19, demographic pressure, and fiscal constraints; constitutes perturbations whose effects are traceable through yearbook data series. Third, feedback loops provide a framework for evaluating policy responsiveness: the persistence of supply-demand imbalances despite their annual visibility in yearbooks is theorized as feedback loop failure; a governance dysfunction in which performance data fail to generate adequate corrective responses. Fourth, subsystems Cameroon's ten regions; enable SO3's equity analysis: differential input allocations predict differential output performances, and the assessment of convergence or divergence constitutes a systems equity evaluation.

The EPF specifies the precise input-output variables under analysis: educational outputs are modeled as functions of financing (F), teachers (T), infrastructure (I), and context (C): O = f(F, T, I, C). This formulation justifies comparing input CAGRs against enrolment CAGR as an input adequacy assessment and predicts that regions with systematically lower input endowments will generate lower outputs. The EPF is applied conceptually rather than in full empirical regression form, a boundary explicitly acknowledged given the administrative data scope.

Human Capital Theory provides the macro-level normative foundation: the documented decline in real per-student financing constitutes a form of human capital dis-investment with national development consequences (Mincer, 1974; Psacharopoulos & Patrinos, 2018). Regional input deprivations are simultaneously equity failures and efficiency losses constraining national human capital accumulation.

4. Methodology

4.1. Research Design

This study employs a longitudinal documentary research design: an established approach for systematic extraction and analysis of data from official administrative publications to identify temporal trends, patterns, and changes (Bowen, 2009; Bryman, 2016). This design is specifically appropriate because MINESEC Statistical Yearbooks provide comprehensive, annually consistent, officially validated data covering all registered secondary institutions across all ten regions; a population coverage depth unavailable from any survey instrument across the 2010–2024 period.

4.2. Data Sources and Extraction Protocol

The primary data source consists of fourteen editions of the MINESEC Statistical Yearbook (*Annuaire Statistique de l'Enseignement Secondaire*), covering 2010/2011 through 2023/2024. These are official publications of MINESEC's Division of Statistics and Educational Planning (DSPE), compiled from annual school census data (*recensement scolaire*) conducted across all registered secondary institutions in Cameroon.

Data were extracted through a systematic protocol: (i) each yearbook was reviewed in its entirety against a standardized extraction template covering all defined variables; (ii) extracted values were double-entered into the master longitudinal dataset by two team members independently, with discrepancies reconciled through re-examination of source documents; (iii) where successive yearbook editions reported marginally differing values for the same academic year; a known feature of administrative census data subject to late reporting corrections the

most recently published figure was adopted as the authoritative value, with the discrepancy noted; (iv) where yearbook editions reported appropriated rather than executed budget figures, this distinction is explicitly noted in the analysis.

Three cases of missing regional data across non-consecutive yearbook editions were addressed through linear interpolation between adjacent available values. Population denominators for Gross Enrolment Ratio (GER) calculations derive from National Institute of Statistics Cameroun (2022) official projections; acknowledged to carry estimation uncertainty, particularly at subnational level. Financial values are deflated to constant 2010 prices using World Bank CPI data for Cameroon (World Bank, 2024).

Secondary sources include UNESCO Institute for Statistics databases, Cameroons' National Institute of Statistics population projections, yearly *Finance law*, and World Bank Open Data. Table A1 (Appendix) presents a source reliability assessment.

4.3. Indicators and Analytical Methods

To address the study's research objectives, a structured set of quantitative indicators was constructed across four thematic domains. Demand and Access (SO1) were measured through total secondary enrolment, the Gross Enrolment Ratio (GER), and the Gender Parity Index (GPI), supplemented by annual growth rates and Compound Annual Growth Rates (CAGR). Supply and Input Adequacy (SO1) were assessed using counts of registered institutions, functional classrooms, and teachers disaggregated by sex, qualification, and employment status alongside the Student-Teacher Ratio (STR), Student-Classroom Ratio (SCR), and teacher qualification rates. Financing (SO2) indicators included MINESEC's nominal budget allocation, its share of national public expenditure, the budget execution rate, recurrent-to-capital composition, and real per-student recurrent expenditure, deflated to constant 2010 prices using World Bank CPI data. Regional Disparities (SO3) were captured through regional GER, GPI, institutional density, STR, teacher qualification rates, the Coefficient of Variation (CV) across all ten regions, and best-to-worst regional ratios.

Analytically, CAGR was the primary tool for tracking change across enrolment, institutional capacity, and financing variables over the 2010–2024 periods. The central analytical operation for SO1 involved comparing input CAGRs against the enrolment output CAGR: where input growth consistently lagged enrolment growth, this was interpreted as evidence of systemic resource dilution. Longitudinal ratio analysis tracked trends in STR, SCR, and per-student expenditure over time. Financing indicators were benchmarked against UNESCO's recommended threshold of 15–20% of public expenditure for the education sector as a whole. Since MINESEC operates alongside three other education ministries: MINEDUB, MINESUP, and MINEFOP, comparisons were made against a proportionally adjusted expectation rather than the full sector benchmark**.** Regional disparity analysis computed annual CV values across the ten regions, enabling assessment of whether inequalities converged or widened over the study period. Crisis-affected regions; the Northwest and Southwest were examined separately, with year-on-year changes assessed against pre-crisis baselines.

Several methodological limitations are acknowledged. Enrolment figures are point-in-time estimates and do not capture within-year dropout or grade repetition, restricting inferences to access rather than retention or completion. Subnational population denominators carry estimation uncertainty. Financial data in certain yearbook editions reflect budget appropriations rather than confirmed expenditure. The absence of learning outcome data further limits analysis to input-output relationships, impeding direct assessment of educational quality. These constraints define the boundaries within which the study's conclusions should be interpreted.

5. Results

5.1. Demand and Supply Trends (SO1)

5.1.1. Enrolment Growth

Total secondary enrolment grew from approximately 1,352,000 in 2010/2011 to approximately 2,261,000 in 2023/2024; an overall increase of approximately 67% at a CAGR of 3.7% (Table 1). This marginally exceeded Cameroon's national population growth rate of approximately 2.7% (National Institute of Statistics, 2022), indicating a modest improvement in the proportion of the school-age population accessing secondary education. The national GER improved from 43% to approximately 59% above the Sub-Saharan African regional average of approximately 43% (UNESCO, 2021), though substantially below the global average of 76%.

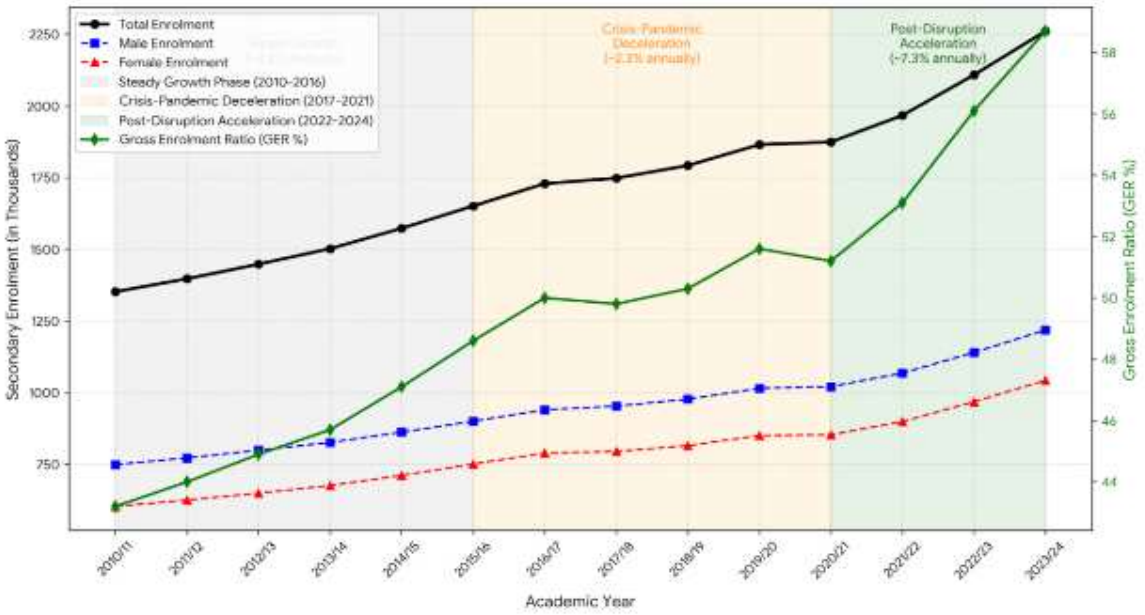
Table 1: Total Secondary Enrolment and Gross Enrolment Ratio, 2010–2024

Academic Year	Total Enrolment	Male	Female	Annual Growth (%)	GER (%)
2010/2011	1,352,000	749,000	603,000	—	43.2
2011/2012	1,397,000	772,000	625,000	3.3	44.0
2012/2013	1,448,000	799,000	649,000	3.7	44.9
2013/2014	1,502,000	826,000	676,000	3.7	45.7
2014/2015	1,573,000	862,000	711,000	4.7	47.1
2015/2016	1,651,000	900,000	751,000	5.0	48.6
2016/2017	1,729,000	940,000	789,000	4.7	50.0
2017/2018	1,748,000	953,000	795,000	1.1	49.8
2018/2019	1,792,000	977,000	815,000	2.5	50.3
2019/2020	1,865,000	1,015,000	850,000	4.1	51.6
2020/2021	1,874,000	1,021,000	853,000	0.5	51.2
2021/2022	1,967,000	1,068,000	899,000	4.9	53.1
2022/2023	2,108,000	1,140,000	968,000	7.2	56.1
2023/2024	2,261,000	1,218,000	1,043,000	7.3	58.7

Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

Three growth phases are identifiable as presented on figure 1 below. A steady growth phase (2010–2016) averaged approximately 4.2% annually, reflecting demographic-driven demand in a relatively stable context. A crisis-pandemic deceleration phase (2017–2021) averaged approximately 2.3% annually reflecting the Anglophone Crisis onset and COVID-19 disruptions as environmental perturbations deflecting the system from its structural trajectory. A post-disruption acceleration phase (2022–2024) averaged approximately 7.3% annually, suggesting recovery and demographic catch-up dynamics.

Figure 1: secondary education enrolment Trends and Gross Enrolment Ratio (GER) in Cameroon (2010-2024)



Source: *Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024*

The figure also charts the parallel progress of Male and Female enrolments. While a persistent gender gap remains visible across the entire 14-year timeline (with male enrolment remaining consistently higher), both curves show identical phase-shifts, and female enrolment has expanded at a steady pace, crossing the 1 million mark for the first time in the 2023/2024 academic year.

5.1.2. Gender Parity

The national GPI improved from 0.79 to 0.91 across the study period indicates a meaningful improvement of 12 GPI points (Table 2). However, this national average conceals profound subnational heterogeneity. The Far North (GPI = 0.53), North (0.61), and Adamawa (0.64) recorded severe gender enrollment gaps that improved by only approximately 0.07–0.08 GPI units across fourteen years; a rate that would require more than 70

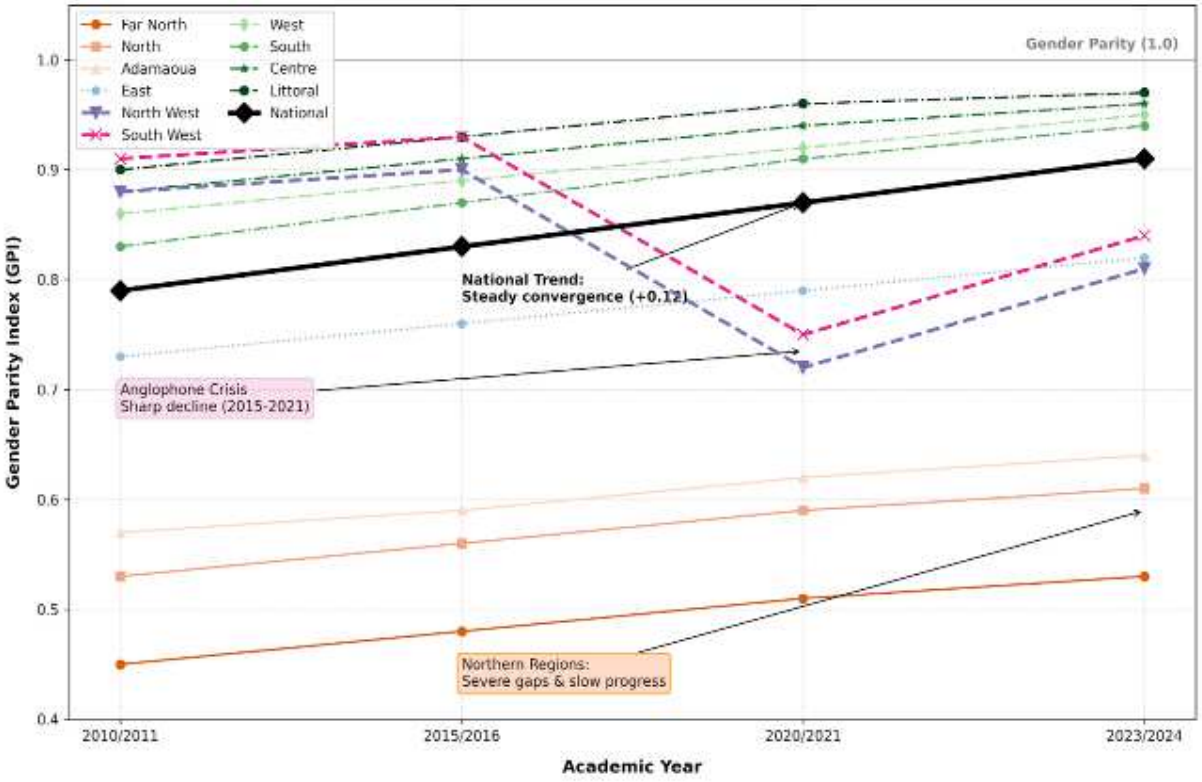
additional years to achieve parity. Crisis-related GPI declines in Northwest (from 0.90 to 0.72 between 2015/2016 and 2020/2021) and Southwest (from 0.93 to 0.75) confirm that girls' enrolment was disproportionately disrupted relative to boys during the Anglophone Crisis.

Table 2: Gender Parity Index by Region, Selected Years

Region	2010/2011	2015/2016	2020/2021	2023/2024	Change 2010–2024
Adamaoua	0.57	0.59	0.62	0.64	+0.07
Centre	0.88	0.91	0.94	0.96	+0.08
East	0.73	0.76	0.79	0.82	+0.09
Far North	0.45	0.48	0.51	0.53	+0.08
Littoral	0.90	0.93	0.96	0.97	+0.07
North	0.53	0.56	0.59	0.61	+0.08
North West	0.88	0.90	0.72	0.81	–0.07*
South	0.83	0.87	0.91	0.94	+0.11
South West	0.91	0.93	0.75	0.84	–0.07*
West	0.86	0.89	0.92	0.95	+0.09
National	0.79	0.83	0.87	0.91	+0.12

**Decline attributable to Anglophone Crisis environmental perturbation from 2017*
Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

Figure 2: Subnational Heterogeneity in Gender Parity Index (GPI) across Cameroon (2010-2024)



Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

As shown on figure 2, these regions display consistently strong baselines, tightly converging directly beneath the grey target line representing full Gender Parity (1.0), with the Littoral and Centre regions leading the nation at 0.97 and 0.96 respectively.

5.1.3. Supply Indicators and the Input-Output Gap

Total registered secondary institutions grew from 3,974 to 6,287 (CAGR 3.3%) — marginally below the enrolment output CAGR of 3.7%. Growth composition was profoundly asymmetric: private lay institutions grew at CAGR 5.4% (from 1,412 to 2,967, an increase of approximately 110%), while public institutions grew at only CAGR 1.7% (from 1,841 to 2,361, approximately 28%). By 2023/2024, private lay institutions constituted approximately 47% of all registered secondary schools. This represents a fundamental structural shift with significant equity implications.

Table 3: CAGR Comparison — System Outputs vs. System Inputs, 2010–2024

Indicator	2010/2011	2023/2024	Overall Change (%)	CAGR (%)	Gap from Output CAGR
Total Enrolment (Output)	1,352,000	2,261,000	+67	3.7	—
Total Institutions	3,974	6,287	+58	3.3	−0.4pp
— Public Institutions	1,841	2,361	+28	1.7	−2.0pp
— Private Lay Institutions	1,412	2,967	+110	5.4	+1.7pp
Functional Classrooms	44,100	63,800	+45	2.6	−1.1pp
Total Teachers	47,200	72,400	+53	3.1	−0.6pp
Qualified Teachers (%)	52%	48%	−4pp	—	—
Permanent Teachers (%)	44%	38%	−6pp	—	—

Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

Note: pp = percentage points. Negative gap values indicate input CAGR below output CAGR.

Both classroom expansion (CAGR 2.6%) and teacher growth (CAGR 3.1%) lagged the enrolment CAGR of 3.7%. Public institution growth (CAGR 1.7%) represents the most severely lagging input — the primary access route for lower-income households expanded at less than half the rate of enrolment growth. This differential CAGR structure constitutes evidence of systemic input inadequacy: output expansion was not supported by proportional input growth.

Table 4: Supply Adequacy Ratios, 2010–2024

Academic Year	STR	SCR	Qualified Teachers (%)	Female Teachers (%)	Permanent Teachers (%)
2010/2011	28.6:1	30.7:1	52	31	44
2013/2014	28.9:1	31.6:1	52	32	43
2016/2017	29.8:1	33.1:1	51	33	42
2019/2020	29.9:1	33.1:1	49	34	41
2022/2023	30.5:1	34.5:1	48	35	39
2023/2024	31.2:1	35.4:1	48	36	38
UNESCO Threshold	≤35:1	—	—	—	—

Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

The STR worsened from approximately 29:1 to 31:1 and the SCR deteriorated from approximately 31:1 to 35:1; the latter reaching the UNESCO maximum threshold at national average level in 2023/2024. The proportion of qualified teachers declined from approximately 52% to approximately 48%, and permanently employed teachers from approximately 44% to approximately 38%, indicating progressive substitution of qualified permanent teachers with precarious contract (*vacataire*) arrangements.

5.2. Financing Trends (SO2)

Total MINESEC budget allocations grew from approximately FCFA 197 billion in 2010 to approximately FCFA 372 billion in 2024; nominal growth of approximately 89% and nominal CAGR of approximately 5%. However, adjusting for Cameroon's average annual CPI inflation of approximately 2.4% (World Bank, 2024), the real budget CAGR was approximately 2.2% significantly below the enrolment CAGR of 3.7%. In constant 2010 prices, real per-student expenditure declined from approximately FCFA 146,000 in 2010 to approximately FCFA 121,000 in 2023/2024, a real reduction of approximately 17% (Table 5).

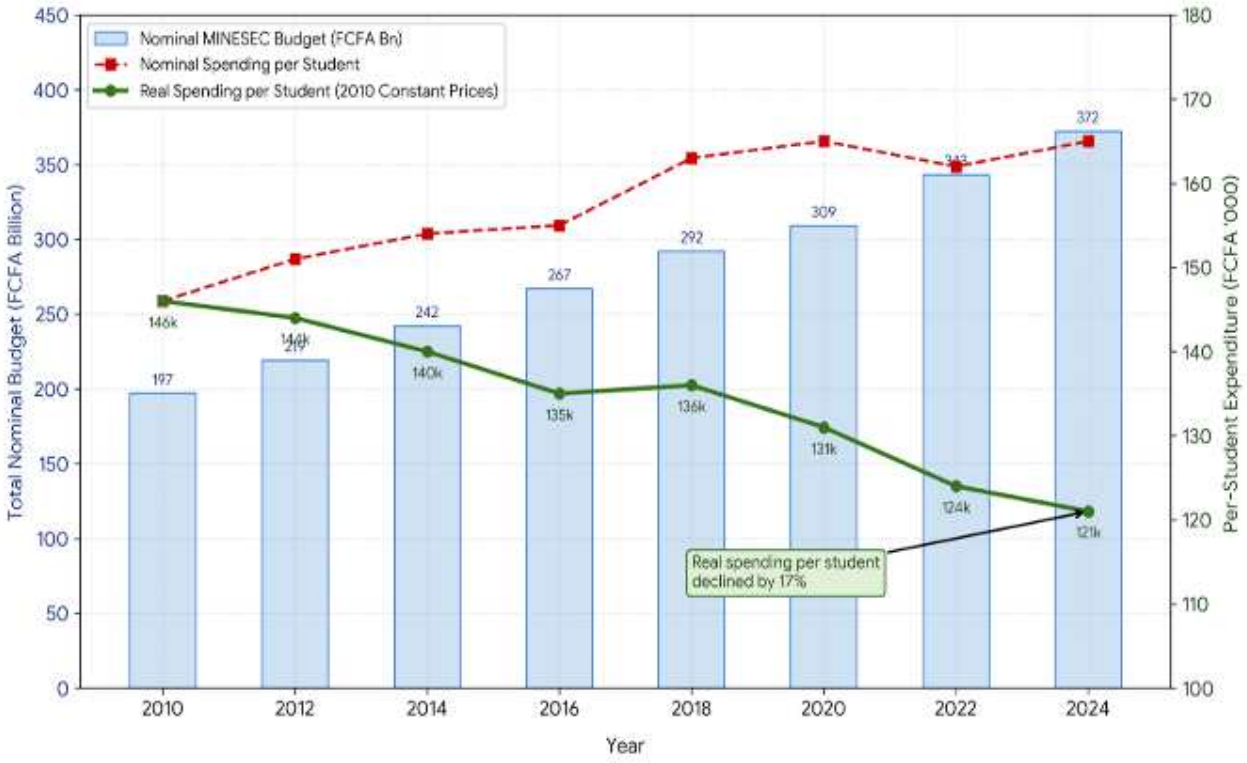
Table 5: MINESEC Financing Indicators for Selected Years

Year	Nominal Budget (FCFA Bn)	% National Budget	% GDP	Per-Student Nominal (FCFA '000)	Per-Student Real, 2010 Prices (FCFA '000)	Real Change (%)
2010	197	10.2	1.4	146	146	—
2012	219	10.6	1.4	151	144	−1
2014	242	10.9	1.5	154	140	−4
2016	267	10.7	1.5	155	135	−8
2018	292	10.4	1.5	163	136	−7
2020	309	10.1	1.6	165	131	−10
2022	343	10.3	1.6	162	124	−15
2024	372	10.6	1.7	165	121	−17

Source: Compiled from MINESEC Statistical Yearbooks and finance Law, 2010–2024. Real values deflated using World Bank CPI data for Cameroon.

MINESEC's budget share of national public expenditure ranged from approximately 10% to 11% throughout the study period. When total cross-ministry education allocations (MINESEC, MINEDUB, MINESUP, MINEFOP) are considered, total public education spending ranged from approximately 16% to 18% of national expenditure; approaching but not consistently meeting the lower UNESCO sector-level threshold. It is important to note that the UNESCO benchmark of 15–20% refers to the entire education sector, not to secondary education alone; MINESEC's allocation is best assessed against what would be proportionally expected given its share of sector enrolment, rather than against the full sector benchmark directly. MINESEC spending as a proportion of GDP remained essentially static at approximately 1.4–1.7% throughout.

Figure 3: MINESEC Budget expansion vs Real per-student Expenditure (2010-2024)



Source: Compiled from MINESEC Statistical Yearbooks and Finances law, 2010–2024. Real values deflated using World Bank CPI data for Cameroon.

Recurrent expenditure consistently constituted approximately 78–85% of the total MINESEC budget, leaving only approximately 15–22% for capital investment in school construction and rehabilitation. Budget execution rates improved from approximately 74% in 2010 to approximately 86% in 2024. This indicates a positive governance development though capital expenditure execution rates consistently fell below approximately 70%, indicating that planned infrastructure investments were systematically underspent despite documented infrastructure deficits. Strips away currency depreciation using the World Bank CPI inflation adjustment (2.4 % baseline) and fixes values in constant 2010 prices. Under this realistic lens, individual resource allocation experiences a steady down-slope, dropping from FCFA 146,000 down to FCFA 121,000. (figure 3) a strong nominal expansion of the aggregate ministerial budget alongside a parallel contraction in individual real purchasing power per student due to demographic pressures and inflation.

5.3. Regional Disparities (SO3)

Regional institutional density ranged from approximately 42 (West) to approximately 11 (Far North) per 100,000 population in 2023/2024; a best-to-worst ratio of approximately 3.7:1 (Table 6). The GER gap between best-served (Littoral, approximately 78%) and worst-served (Far North, approximately 28%) regions reached approximately 50 percentage points in 2023/2024; nearly identical to the gap documented in 2010/2011, indicating that fourteen years of aggregate system expansion produced essentially no convergence in regional access equity.

Table 6: Regional Educational Indicators, 2023/2024

Region	Institutional Density (per 100,000)	GER (%)	STR	Teacher Qualification (%)	GPI	Classification
Adamaoua	16.4	38	38:1	35	0.64	Severely Disadvantaged
Centre	37.9	72	29:1	59	0.96	Well-Served
East	23.1	45	37:1	38	0.82	Moderately Disadvantaged
Far North	11.3	28	43:1	29	0.53	Most Disadvantaged
Littoral	41.2	78	27:1	61	0.97	Best Served
North	14.1	32	40:1	32	0.61	Severely Disadvantaged
North West	23.8	47	33:1	50	0.81	Crisis-Affected/Recovering
South	33.4	64	30:1	55	0.94	Well-Served
South West	27.1	54	32:1	51	0.84	Crisis-Affected/Recovering
West	42.1	72	28:1	59	0.95	Well-Served
National	29.3	59	31:1	48	0.91	—

Source: Compiled from MINESEC Statistical Yearbooks, 2023/2024; INS Population Projections 2024

Four regions: Far North (approximately 43:1), North (approximately 40:1), Adamawa (approximately 38:1), and East (approximately 37:1) record STRs exceeding the UNESCO maximum threshold of 35:1. These same regions record the lowest teacher qualification rates (29%, 32%, 35%, and 38% respectively) representing simultaneously a teacher supply emergency and a qualification emergency.

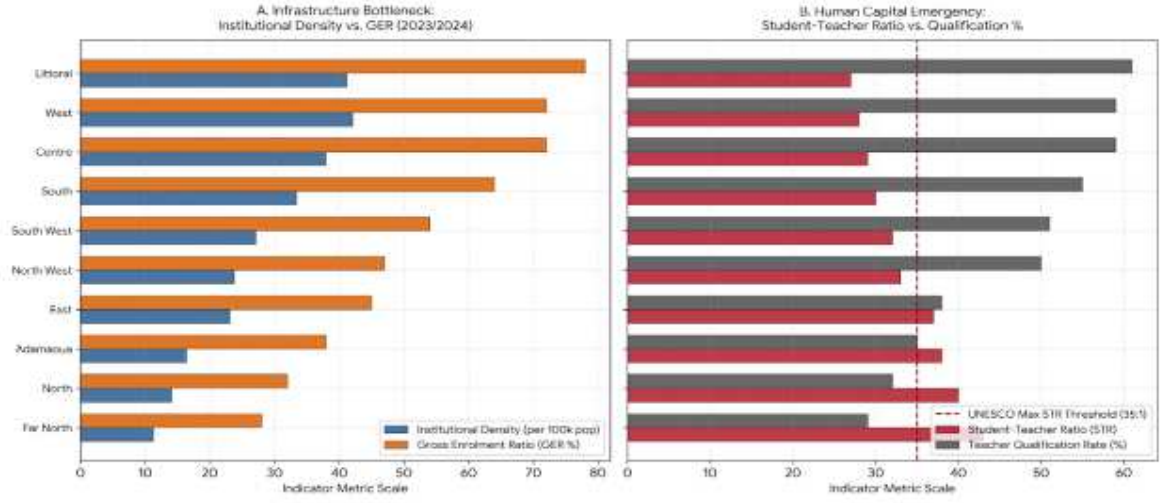
The CV across regional institutional densities increased from 0.48 to 0.52 between 2010/2011 and 2023/2024 (Table 7), indicating that institutional expansion followed pre-existing patterns of concentration in economically advantaged regions rather than being redistributed toward underserved subsystems.

Table 7: Interregional Disparity Trajectory — Coefficient of Variation, Selected Indicators

Indicator	CV 2010/2011	CV 2015/2016	CV 2020/2021	CV 2023/2024	Direction
Institutional Density	0.48	0.49	0.51	0.52	Diverging ↑
GER	0.31	0.32	0.33	0.32	Stable
STR	0.19	0.21	0.22	0.24	Diverging ↑
Teacher Qualification Rate	0.26	0.27	0.28	0.29	Diverging ↑
GPI	0.23	0.24	0.27	0.25	Volatile/Stable

Source: Compiled from MINESEC Statistical Yearbooks, 2010/2011–2023/2024

Figure 4: Subnational inequalities and educational resource supply Disparities in Cameroon (2023/2024)



Source: *Compiled from MINESEC Statistical Yearbooks 2023/2024*

The Anglophone Crisis produced measurable and substantially unrecovered disruptions. Northwest institutional density declined approximately 29% between 2015/2016 and 2020/2021, before partial recovery to approximately 79% of the pre-crisis level by 2023/2024. Combined enrolment in Northwest and Southwest fell approximately 31% between 2016/2017 and 2019/2020, recovering to approximately 84% of the pre-crisis peak

by 2023/2024 — still substantially below pre-crisis levels seven years after onset. On Figure 4 above, a vertical dashed line indicates the UNESCO maximum threshold of 35:1 for classroom staffing. The graph shows that the four most disadvantaged regions (**Far North, North, Adamawa, and East**) simultaneously breach this threshold (reaching up to 43:1 in the Far North) while recording the lowest ratios of qualified teachers (falling under 40%). This creates a vivid picture of a localized education crisis: the exact regions that suffer from massive school shortages and overcrowded classrooms are the very same areas left with the least qualified instructional staff.

6. Discussion

6.1. Access Expansion on a Declining Real Resource Base

The study's core finding presents a striking paradox: enrolment grew at a CAGR of 3.7% while classroom growth (CAGR 2.6%) and teacher growth (CAGR 3.1%) lagged consistently behind, and real per-student financing fell by approximately 17% over the study period. Together, these trends paint a clear picture of a system expanding its doors to more students while simultaneously becoming less equipped to serve them. This pattern is not unique to Cameroon. Lewin (2009) observed that rapid demographic growth across Sub-Saharan Africa generates enrolment pressures that institutional supply and public financing routinely struggle to keep pace with. What makes the Cameroonian case particularly concerning is the fourteen-year persistence of this divergence, suggesting not a temporary adjustment but the kind of structurally embedded under-resourcing that Lewin and Caillods (2001) famously described as the "neglected middle" condition of secondary education across the region.

Systems Theory, as developed by Bertalanffy (1968) and applied to educational contexts by Banathy (1968), offers a useful lens for making sense of what is happening here. When the inputs feeding a system, whether financial, human, or physical, grow more slowly than its outputs, the processes connecting them inevitably come under strain. The deterioration in student-teacher ratios, student-classroom ratios, and teacher qualification rates documented across the study period are not independent warning signs but interconnected symptoms of a single systemic process failure. The input-process-output model that anchors this study's analytical structure makes this causal logic explicit: inputs constrained relative to output growth produce predictable process-level degradation.

The Educational Production Function (EPF), applied here in its conceptual form as O = f(F, T, I, C), sharpens this diagnosis further. Declining input ratios, rising STR, rising SCR, and a growing proportion of unqualified teachers, predict reduced educational productivity per student even when aggregate enrolment numbers continue to climb (Hanushek, 2003). This points to what is arguably the study's most important analytical distinction: the difference between expanding access and expanding quality. SDG 4 insists on both (UNESCO, 2015; Rose et al., 2020), yet the evidence here suggests Cameroon has achieved the former at the cost of the latter. Hanushek and Woessmann (2015) demonstrated persuasively that it is cognitive skill quality, not enrolment volumes, that drives the long-run economic returns associated with education. In Becker's (1964) investment framework, enrolment without quality is an incomplete investment, one unlikely to generate either the private returns of 10 to 14% that Psacharopoulos and Patrinos (2018) estimated for Sub-Saharan African secondary education or the broader national productivity gains that Schultz (1961) associated with mass secondary attainment. Azevedo et al.'s (2021) post-COVID assessment reinforces this point: the central SDG 4 challenge across the region is learning poverty, not simply the absence of school places.

The private sector's role in driving enrolment growth adds another layer of concern. With private lay institutions growing at an estimated CAGR of approximately 5%, compared to the public system's roughly 2%, the expansion engine has increasingly been one that serves those who can afford it. This matters enormously from a human development perspective. Sen's (1999) Capability Approach frames access to quality secondary education not merely as an investment calculation but as a constitutive dimension of human freedom, something whose unequal distribution represents a real deprivation of people's ability to live flourishing lives. When private enrolment concentrates among middle- and upper-income households, as Rolleston (2009) and Härmä (2013) documented across comparable Sub-Saharan African settings, and when the public system grows too slowly to compensate, lower-income students face a compounded disadvantage: they are excluded from private alternatives yet served by a public system receiving progressively fewer real resources per student. Filmer and Pritchett's (2001) canonical work on wealth as a determinant of educational participation, and Lewin and Stuart's (2003) analysis of private sector expansion dynamics, both anticipated this outcome. Tooley's (2009) more optimistic account of private sector responsiveness

notwithstanding, responsiveness to effective demand is not the same as responsiveness to educational need, and it is the latter that SDG 4 and the Capability Approach demand.

6.2. Financing as the Binding Constraint

If one finding from this study demands urgent policy attention above all others, it is the approximately 17% real per-student financing decline recorded over the study period. This single figure, more than any other, explains why supply could not keep pace with demand: MINESEC simply did not have sufficient real resources per student to recruit enough qualified teachers, build enough classrooms, or maintain the infrastructure that expanding enrolment required. The fiscal arithmetic is unforgiving. UNESCO (2015) established minimum adequacy thresholds of 4 to 6% of GDP and 15 to 20% of total public expenditure for the education sector. Atuhurra and Kaffenberger (2020) and UNESCO (2022) have documented Sub-Saharan African governments' persistent difficulties in meeting these benchmarks. MINESEC's consistent budget share of approximately 10 to 11% of national expenditure, below what proportional distribution of these benchmarks would suggest is appropriate for a ministry educating a large and growing secondary cohort, directly answers RQ2: secondary education financing in Cameroon has been structurally inadequate across the study period.

The consequences of this inadequacy are visible in the composition as well as the volume of educational inputs. The progressive replacement of qualified permanent teachers with unqualified vacataire contract staff is the clearest example. This is not a failure of planning so much as a rational institutional response to resource scarcity, the kind of input composition adjustment that the EPF predicts when budgets cannot sustain both enrolment expansion and input quality simultaneously (Lewin & Caillods, 2001). UNESCO (2016) and Mulkeen (2010) have both established that teacher qualification and employment status are among the most consequential supply-side variables for learning quality in Sub-Saharan African secondary systems. Hanushek (2003) adds the important nuance that governance quality and teacher motivation mediate the productive use of whatever resources are available. But these mediating factors cannot substitute for adequate resource levels: a governance system cannot motivate its way out of a 17% real per-student financing decline. The Human Capital Theory implication, articulated most directly by Mincer (1974) and reinforced by Psacharopoulos and Patrinos (2018), is sobering. A generation of Cameroonian secondary students receiving lower real per-student public investment than their predecessors, and taught by progressively larger proportions of unqualified instructors, faces diminished human capital formation with consequences that will compound across subsequent decades. Schultz's (1961) argument that investment in education generates national development returns presupposes resource adequacy at the point of service delivery. When real per-student financing contracts across fourteen years of enrolment expansion, that causal chain is broken at its most fundamental point.

Against this largely troubling picture, the improvement in overall budget execution rates from approximately 74% to approximately 86% deserves genuine acknowledgement. Systems Theory conceptualises feedback loops as mechanisms through which performance data generate corrective institutional responses (Bertalanffy, 1968), and this execution improvement suggests that such mechanisms can function under appropriate conditions. It represents a real governance achievement that the analysis should not overlook. However, the persistently low capital execution rate, consistently below approximately 70%, reveals a separate and stubborn institutional constraint. Procurement capacity weaknesses and planning system limitations mean that even when financial allocations are made for physical infrastructure, a substantial portion of those resources fails to translate into actual construction or rehabilitation. Hanushek's (2003) broader argument about the mediation of educational resource effects through institutional governance quality is directly relevant: the recurrent-capital execution gap suggests that institutional absorptive capacity, not just financial allocation, constitutes a second binding constraint requiring its own targeted reform agenda. Rose et al.'s (2020) analysis of SDG 4 financing adequacy across low- and middle-income countries frames the broader normative context: Cameroon's secondary financing shortfall is neither exceptional nor inevitable but represents a policy choice, and a reversal of that choice is within reach.

6.3. Regional Disparities: Systemic Equity Failure

Perhaps the most troubling dimension of the study's findings is not what has happened at the national level but what has not happened at the regional level. Despite fourteen years of aggregate enrolment expansion, interregional disparities in institutional density, student-teacher ratios, and teacher qualification rates have not narrowed. They have, in fact, marginally widened. The coefficients of variation for institutional density rose from 0.48 to 0.52, for STR from 0.19 to 0.24, and for teacher

qualification rates from 0.26 to 0.29. By every one of these measures, the national system became marginally more unequal in its internal resource distribution over the study period. This is the direct opposite of what SDG 4's inclusiveness principle requires (UNESCO, 2015) and what Sen's (1999) Capability Approach identifies as a foundational condition of educational justice.

This outcome challenges a widespread assumption in education sector development policy: that aggregate system expansion will, through some form of diffusion or overflow effect, eventually benefit the least-served regional subsystems. The evidence from this study says otherwise. Glewwe and Kremer (2006) documented geographic location as an independent and persistent determinant of educational access across Sub-Saharan Africa, operating through mechanisms, including physical remoteness, economic marginality, and political marginalisation, that aggregate expansion does not automatically correct. Where new institutional capacity grows predominantly through private sector mechanisms, as has been the case in Cameroon over the study period, it concentrates where middle-income populations and economic viability are greatest (Rolleston, 2009; Härmä, 2013). Where public sector growth proceeds without explicit equity-targeting criteria, it tends to reinforce the same geographic patterns by default. Bray and Thomas (1995) anticipated this dynamic in their analysis of multi-level education system governance: without equity-weighted allocation mechanisms, historical inequalities in institutional density, infrastructure, and teacher deployment are preserved or amplified rather than corrected by system expansion.

The gap between the Far North's institutional density of approximately 11 institutions per 100,000 population and Littoral's approximately 41 is the most visible expression of a structural inequity that predates the study period and has resisted correction across all fourteen years it covers. What makes this particularly significant from a governance perspective is that this inequity has been visible in MINESEC's own yearbook data throughout that entire period. The information required for corrective action has been continuously available. What has been absent is the institutional mechanism through which that information translates into meaningful policy response. This is precisely what Systems Theory identifies as feedback loop failure (Bertalanffy, 1968; Banathy, 1968): a system in which performance data fail to generate adequate corrective action is not merely under-resourced but is exhibiting a fundamental governance dysfunction. The persistence of Northern regional deprivation is, in this sense, not only a resource problem but a systems problem, one located in the decision-making processes through which resource allocation choices are made and reviewed.

The compounding nature of multi-dimensional deprivation in the Northern subsystems deserves particular emphasis. The Far North, North, and Adamawa regions do not simply have fewer schools than Littoral or Centre. They simultaneously have higher student-teacher ratios, lower teacher qualification rates, weaker physical infrastructure, and greater distances between institutions. The EPF framework's specification of outputs as functions of financing, teachers, infrastructure, and context simultaneously makes clear that these are not independent problems with additive effects but compounding deficits whose interaction generates output shortfalls greater than any single dimension would predict in isolation (Hanushek, 2003). Systems Theory's subsystem concept reinforces this reading: regional subsystems experiencing simultaneous input deficits across all dimensions diverge systematically and increasingly from better-resourced counterparts, and the gap widens with each passing year that reallocation does not occur.

The Anglophone Crisis adds a dimension that administrative data can identify but cannot fully explain. The severe enrolment declines and institutional disruptions recorded in the Northwest and Southwest regions from approximately 2016 onward represent a form of conflict-driven educational deprivation that Burde (2014), Novelli et al. (2017), and the INEE (2010) framework identify as among the most acute and durable that a system can experience. Physical insecurity dismantles both the demand-side motivations and the supply-side infrastructure that schooling requires simultaneously, in ways that standard financing and capacity interventions cannot address until political conditions create the basic preconditions for recovery. Moss's (2021) framework for educational system resilience and Rose et al.'s (2020) analysis of SDG 4 financing in fragile contexts are directly applicable here: the Northwest and Southwest regions require specialised recovery approaches, not simply scaled-up versions of standard expansion programming. Sen's (1999) Capability Approach frames this most starkly. Armed conflict does not simply reduce enrolment statistics. It actively destroys the physical safety, institutional continuity, and teacher presence that constitute the lived preconditions for educational participation as a meaningful human freedom.

Taken together, the three dimensions of the study's findings, input-output imbalance, financing constraint, and regional inequity, are better understood as an integrated systemic diagnosis than as three separate policy problems. Systems Theory's conceptualisation of educational systems as organised wholes in which subsystem dysfunctions interact and compound (Bertalanffy, 1968; Banathy, 1968) provides the analytical warrant for this reading. Declining real per-student financing constrains teacher recruitment and infrastructure investment. Constrained supply expands preferentially through private mechanisms in economically viable locations. Geographically concentrated private expansion reproduces regional inequality. Regional inequality is then further amplified by conflict-induced disruption in subsystems that were already the most deprived. The EPF's formulation of outputs as functions of all input dimensions simultaneously reinforces the conclusion that piecemeal, single-input interventions will generate insufficient corrective effects. The scale of systemic realignment that the evidence demands is simply beyond what incremental adjustment within existing resource levels and governance structures can deliver.

7. Conclusion and Recommendations

7.1. Conclusion

This study provides the first systematic longitudinal analysis of trends in secondary education demand, financing, and supply in Cameroon, drawing on fourteen consecutive MINESEC Statistical Yearbooks spanning 2010 to 2024. Grounded in Systems Theory as the primary analytical framework, supported by the Educational Production Function and Human Capital Theory, and organized around three aligned specific objectives, the study generates a comprehensive evidence base for understanding structural dynamics, systemic imbalances, and equity trajectories across the post-2010 period.

In answer to the three research questions: enrolment grew approximately 67%, GER improved from approximately 43% to approximately 59%, and national GPI improved from 0.79 to 0.91 but educational supply did not keep pace, with classroom and teacher growth lagging enrolment CAGR and producing deteriorating STR, worsening SCR, and declining proportions of qualified teachers. Public financing grew nominally by approximately 89% but declined approximately 17% in real per-student terms, remaining below proportional UNESCO benchmark expectations, with capital expenditure systematically underspent despite documented infrastructure deficits. Profound and persistent regional disparities characterized the system; with an approximately 3.7:1 institutional density gap and approximately 50-percentage-point GER gap between best- and worst-served regions that marginally widened rather than narrowed, compounded by crisis-induced reversals in Anglophone regions and near-stagnant gender equity improvement in Northern regions.

These findings collectively characterize Cameroon's secondary education system as one expanding access on a declining real resource base; a trajectory that, if uncorrected, will continue to undermine the quality, equity, and developmental productivity of secondary education investment through 2030 and beyond.

7.2. Policy Recommendations

The study's findings point to four interconnected domains requiring coordinated policy response. These are consolidated into eight recommendations organised under financing, teacher policy, equity, and governance reform.

Financing Reforms

R1: Legislate enrolment-indexed per-student financing floors. The approximately 17% real per-student financing decline documented across the study period is the primary driver of observed supply-side deterioration. The Government of Cameroon should legislate a minimum real per-student recurrent expenditure floor within the Annual Finance Law, indexed to CPI, and progressively increase MINESEC's budget envelope toward 13 to 15% of national public expenditure. To operationalize equity commitments, the financing formula should incorporate ZEP-differentiated per-student weightings, ensuring that students in the most underserved communities attract higher allocations than those in well-resourced urban centers.

Teacher Policy

R2: Implement an emergency qualified teacher deployment programme. STRs exceeding UNESCO thresholds in the Far North, North, Adamawa, and East regions, combined with a growing reliance on unqualified parttime staff nationally, constitute a learning quality emergency. ENS and ENSET annual intake should be expanded with training places allocated in proportion to regional deficit data from MINESEC Yearbooks. Newly qualified teachers should be subject to binding rural-service posting requirements supported by competitive hardship allowances for Zones of Education Priority. A structured civil servant integration pathway should progressively regularize qualified contract teachers, prioritising the four regions where STRs most severely exceed acceptable thresholds (UNESCO, 2016)

Equity Measures

R3: Launch targeted gender equity interventions in structurally low-GPI regions. For regions recording GPI below 0.70, a coordinated package should include means-tested scholarships covering direct schooling costs for girls from low-income households, girls' dormitory facilities in boarding schools serving remote priority communities, community engagement addressing cultural barriers to enrolment, and conditional household incentive transfers sustaining girls through examination completion (Kremer et al., 2009). GPI tracking available in MINESEC Yearbooks provides the monitoring infrastructure to assess intervention effectiveness annually.

R4: Develop a comprehensive post-conflict education recovery plan for Anglophone regions. The Northwest and Southwest regions require a dedicated multi-year recovery programme rather than scaled-up standard expansion programming (Moss, 2021). This should encompass systematic infrastructure rehabilitation, accelerated qualified teacher recruitment with deployment incentives, flexible accelerated learning programmes for out-of-school youth whose education was interrupted, and school-level security planning developed with community participation. Dedicated recovery indicators should be tracked in MINESEC Yearbooks as public accountability metrics.

Governance Reforms

R5: Regulate private secondary sector expansion for quality and equity. Private lay institutions, growing at an estimated CAGR of approximately 5%, have driven enrolment expansion while producing the stratified quality landscape Rolleston (2009) and Härmä (2013) documented across comparable settings. MINESEC should enforce minimum quality standards as conditions for registration and annual licence renewal, introduce mandatory social enrolment quotas for institutions receiving public recognition benefits, and publish annual quality ratings linked to inspection outcomes and examination pass rates. Private institutions operating in ZEP-designated communities should be eligible for targeted government support in exchange for fee ceilings and guaranteed access for scholarship recipients.

R6: Institutionalize MINESEC Statistical Yearbooks as active policy intelligence tools.** The most important governance implication of this study is that the information needed to identify and correct observed imbalances has been available in MINESEC's own Yearbooks throughout the entire study period, yet has demonstrably not generated adequate corrective responses. MINESEC's DSPE should complete EMIS digitalisation, expand yearbook scope to include student flow indicators disaggregated by region, sex, institution type, and ZEP status, and publish data in open machine-readable formats. Mandatory annual analytical policy briefs explicitly connecting yearbook evidence to budget preparation and sector planning decisions should be institutionalised, closing the feedback loop that this study's findings demonstrate has been structurally absent across 2010 to 2024.

7.3. Directions for Future Research

This study establishes a longitudinal administrative data baseline that future research can productively extend in several directions. Mixed-method studies combining MINESEC Yearbook data with household survey data would enable examination of how supply-side expansion has affected enrolment decisions across income quintiles, capturing the demand-side dynamics that administrative records cannot observe. School-level administrative data, if EMIS digitalisation proceeds as recommended, would support multilevel modelling of institutional performance determinants with a precision that regional aggregates cannot provide.

Comparative analysis extending this study's methodology to other CEMAC member states would enable regional benchmarking and identification of policy approaches demonstrating effectiveness in comparable governance and demographic contexts. Future research should also apply formal trend significance testing, including Mann-Kendall trend tests for enrolment, budget, STR, and SCR indicators, and joinpoint regression to detect crisis and pandemic disruption periods, extending the current descriptive-analytical framework toward inferential confirmation of identified trends. These extensions would transform the descriptive foundation this study has established into a fully inferential evidence base for policy and planning.

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Compliance with Ethical Standards

Conflicts of Interest: The authors declare no conflicts of interest.

Data Availability: Primary data derive from MINESEC Statistical Yearbooks (2010/2011–2023/2024), available through the DSPE, Ministry of Secondary Education, Yaoundé, Cameroon. The compiled longitudinal dataset is available from the corresponding author upon reasonable request.

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