

Uganda Education Sector Report 2026

Learners, places, teachers, gaps, cost, allocation and outcomes across 135 districts: a needs-based analysis with the Education Planning and Resource Allocation System (EPRAS)

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Learners 2026: 12.59 million | Requirement 2026: UGX 4,128 bn | 81 result tables | 37 mapped layers

Run 6b2afcf6 · structure UGA-7-4-2-LSC2020 · norms UGA-EPRAS-2026-DRAFT · prices UGA-2026 · horizon 2026-2030

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About this report

This report answers six planning questions for Uganda's education sector: what the school-age population needs, what the system has, where the gaps are, what closing them costs, where additional resources could go and what they would achieve. Every figure is computed by the Education Planning and Resource Allocation System (EPRAS) from the evidence in its database, and every figure can be traced to its source, its year and its quality tier.

Item	Value
Author	John-Mary Matovu
Institution	Africa Institute for Climate, Trade and Economic Modelling
Plan run	6b2afcf6 — unconstrained requirement, with scenario allocations
Horizon	2026-2030; year Y is the financial year ending in Y (2026 = FY2025/26)
Geography	135 districts on UGA-UBOS-2022
Structure	UGA-7-4-2-LSC2020: 4 cycles, 16 grades
Norm version / prices	UGA-EPRAS-2026-DRAFT (draft) / UGA-2026
Targets	UGA-ESSP-PATH
Currency	Uganda shillings (UGX), constant base-year prices unless a table says nominal
Quality tiers	measured < normed < imputed < assumed; a result carries the worst tier of its inputs
Status	Exploratory draft: 9 of 11 pre-run gates pass and 2 are waived by name (G2, G9); the norm set is not yet approved
Rules	no composite index; cohorts flow, never population x coverage; teachers from curriculum periods and teaching load; capital always with its induced recurrent cost; every outcome with its interval; no scenario marked recommended
Reproduction	python scripts/rebuild_all.py; julia --pkgimages=no --project=. scripts/run_plan.jl; python report/build/collect.py; python report/build/figures.py; python report/build/render_equations.py; node report/build/build_docx.js

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Executive summary

This edition of the report rests on something no previous one could: a count. In May 2026 the Uganda Bureau of Statistics published the **Baseline Education Census 2025**, the first nationwide enumeration of every government and private school implementing the national curriculum (UBOS 2026). Until it appeared, the latest district-level school data in the country was the 2017 statistical abstract, and every figure in this report about what the system *has* was an eight-year extrapolation. It is now a measurement.

What the count changed is as important as what it confirmed. It confirmed that delivery capacity, not money, is the first constraint on Uganda's education plan. It changed the size of almost every quantity the plan turns on, and in two cases it reversed the direction of a conclusion.

The numbers below are computed by the Education Planning and Resource Allocation System (EPRAS) from the evidence in its database. The base year is 2026, meaning the financial year ending in 2026; the horizon is 2030; the geography is the 135 districts of the current district set.

What the census counted

	Pre-primary	Primary	Secondary
Schools	38,347	43,567	5,498
of which government	3,193 attached	12,557	1,484
Learners	2,374,674	9,118,314	2,008,133
Teachers	82,763	270,176	49,631
Classrooms	116,394	292,791	44,679
Latrine stances	102,825	214,569	50,885

Private provision is far larger than the 2017 shares implied. Private schools teach **42.8 per cent** of primary learners and outnumber government primary schools nearly three to one. The public system this plan finances is substantially smaller than previous editions modelled, and the government's bill falls with it.

What the population needs

12.59 million learners are projected in the base year across the four cycles, of whom **6.86 million** are the public system's to finance — against the 9.51 million the 2017-based projection implied. By 2030 the figure reaches 15.64 million on the target path.

Out-of-school children are the one quantity that got worse, and by a lot. The census measures attendance directly. Adjusted for children attending a level other than the one for their age — a necessary correction, because a child of primary age in a pre-primary class is in school — it puts **2.47 million primary-age children out of school**. The international survey series puts the same figure at 753,000. The two disagree by a factor of three, both are reported, and neither is averaged into the other; the report says exactly what each is conditional on.

727,000 children live beyond the three-kilometre walking norm. Nationally 94.6 per cent of settlements are within it, so the access problem is concentrated rather than general, and Karamoja holds most of it.

What the system has, and what binds it

Government primary schooling runs on **12,557 schools**, **104,465 usable classrooms** and **109,606 teachers in post**, supporting **4.69 million places**. The carried-forward estimates this replaces were materially wrong in a consistent

direction: they put government primary teachers at 158,229 against a counted 109,606, and classrooms at 123,575 against a counted 103,602.

The payroll now exceeds the count. The teacher count derived from the local-government wage bill is **137,247**, against **109,606** teachers the census found in post — a difference of 27,641 in the opposite direction to the previous edition's. The engine reports the two counts separately and does not reconcile them, because the difference is a finding and not a rounding: it is either posts funded but unfilled, or a wage bill supporting people the census did not find in a classroom. Resolving it needs a payroll extract, which this system does not hold.

The binding constraint has shifted. On carried-forward data, 104 districts were room-bound and 31 teacher-bound. On counted data the split is **69 room-bound and 66 teacher-bound** — roughly even. Secondary capacity, which was teacher-bound by construction because secondary classrooms had never been counted by district, now has a real constraint on both sides.

Where the gaps are, kept separate

Dimension	National gap
Places, public primary	1,194,733
Classrooms, public primary	47,657
Teachers, public primary	49,841 FTE
Latrine stances	55,605
Children beyond the walking norm	726,951
Primary-age children out of school	2,467,716

The place and classroom gaps are roughly **half** what the previous edition reported, because the public system turned out to be smaller than modelled. The out-of-school gap is three times larger. Both movements come from the same census, and both are improvements in knowledge rather than changes in the world.

The five dimensions are not added together, and no district is given a single score: across the five worst-twenty lists, different districts appear in each. Gap and surplus are also kept apart — a place gap of 1.19 million coexists with **297,000** surplus places sitting in districts a child elsewhere cannot walk to.

What closing them costs

The base-year requirement for the modelled services is **UGX 4,128 bn**. A normative public primary learner-year costs **UGX 363,969**, of which **68 per cent is salary** — which is why the teacher requirement, not the construction programme, decides whether this plan is affordable.

Closing the measured gaps costs **UGX 4,182 bn** in capital and first-year recurrent, down from 5,979 bn on the previous basis. Against that, the local-government education envelope is **UGX 2,442 bn**, of which **UGX 2,366 bn is already committed** to the existing wage bill and capitation. **The discretionary space is UGX 75.9 bn — 3.1 per cent of the envelope.** That number did not move, and it remains the single most important fact about education finance in Uganda.

Delivery is still the first constraint

At the rate the local-government development grant actually finances classrooms — about **864 a year** — the primary classroom gap takes **55 years** to close. At the assumed college output and absorption, the teacher gap takes **15 years**. Both are roughly half the previous edition's estimates, because both gaps are smaller on counted data. Neither is a forecast: they are the gap divided by the current delivery rate, and the right reading is still that the rate is wrong by an order of magnitude.

What this implies. The question for the next plan period is not "how much more money for education?" but "what would raise the number of classrooms Uganda can actually build and the number of teachers it can actually train, deploy and pay in a year?" The census has made the target clearer and smaller. It has not made the delivery rate adequate.

What the options buy

Six rule-based scenarios and two optimiser objectives are computed under one envelope and reported side by side. New places range from **zero to 416,901**, and the share reaching the worst-served fifth of districts varies by an order of magnitude depending on the rule chosen. **No option is marked recommended.** The comparison is the product of this analysis; the choice is a political one that the numbers should inform and cannot make.

The cheapest thing available

Redeploying the teachers already in post — **no hiring at all** — would move **14,722 teachers** between districts and sharply reduce the spread of district pupil–teacher ratios. It costs no new wage bill, and it is the hardest item on this list to execute for reasons that are not financial.

What else the count revealed, and what it cannot yet cost

The census measured seven things this engine has no standard or price to turn into a requirement, and the right response is to report them rather than quietly leave them out.

What the census counted	Figure	Why it is not in the cost
Government primary schools with no hand-washing facility	2,795 (22.3%)	no published norm for one
Government primary schools on un-improved drinking water	2,410 (19.2%)	no published norm for one
Government primary schools disposing of waste properly	156 of 12,557 (1.2%)	no published norm for one
Government primary schools taking boarders	590 (4.7%)	unit costs are for day provision
Primary learners reported with a difficulty	770,995 (8.7%)	no special-needs norm; sub-region only
Non-Ugandan learners, all levels	329,170	published by sub-region, not district
Non-teaching staff in government schools	27,835	the teacher requirement covers teachers

Two of these change how a reader should hold the cost figures. **Boarding at government primary level is a Karamoja institution** — 70 per cent of government primary schools in Kotido take boarders, 61 per cent in Amudat, 57 in Napak — and this report costs them as day schools, so it understates what it costs to school a child precisely where participation is weakest. And the **public payroll supports a workforce about a fifth larger than the teaching establishment costed here** — 27,835 bursars, cooks, matrons and guards against 131,756 teachers in post — because support staff fall outside a teacher requirement built from the timetable.

The rest is reported evidence. Water, hand-washing and waste are now countable by district the moment a standard exists, which is a different position from having no count at all. None of them is folded into the five gap dimensions, none is scored, and none is averaged with anything.

How much to trust these numbers

The supply, the school counts, the attendance rates and the public–private split are now **counted**. The projection is seeded from 2025 and rolled one year to the base year, rather than extrapolated across nine. Nine of eleven pre-run data-quality gates pass and two are waived by name.

What the census counted but this engine cannot yet price is listed above, and is excluded from every cost rather than estimated into one.

What is still soft: the grade profile within a cycle and the repetition, promotion and dropout rates still come from the 2016 and 2017 abstracts, because a single-year census cannot produce them; classrooms and latrine stances are derived from the census's published ratios rather than counted directly; **64 of 99 norm coefficients are flagged 'assumed'**, which keeps the norm set in draft and this run exploratory; accessibility is still straight-line distance; and district learning data is still a decade old.

What would most improve the next edition

1. **A second census, or an annual return built on this one.** The census is a baseline; its value compounds only if there is a second observation.
2. **Learners by grade and district**, which the census publishes nationally but not by district, and which would retire the last use of the 2017 profile.
3. **A payroll or teacher-management extract**, to close the gap between the counted teachers in post and the payroll derived from the wage bill.
4. **Walking-time access on the road network**, replacing straight-line distance — the data to do it already exists in the AICTEM estate.
5. **A published standard for school water, hand-washing and waste, and a boarding unit cost.** The census has made all four countable; without a norm and a price, four measured deficiencies stay outside every cost in this report.
6. **The expert review of the 64 assumed coefficients**, after which the norm set can be approved and runs can leave draft status.

CHAPTER 1

1 Introduction

Uganda teaches more children than at any point in its history, in a country whose school-age population is still growing, and it does so on a public envelope that has not grown in step. A ministry planning in that position needs an arithmetic that begins with children and arrives at money, rather than one that begins with last year's budget and asks what it can buy. This report is that arithmetic, carried out for the financial year 2025/26 and the four years after it, district by district and grade by grade.

1.1 What this report is, and what it is not

The report is a **needs-based analysis** of Uganda's education sector. It asks how many learning places the population requires, in which grades and which districts; what delivering those places takes in teachers, classrooms, materials and services; what the country already has; where the two do not meet; what the difference would cost; and what can be done with the money actually available.

Those quantities are not written by hand. They are computed by the Education Planning and Resource Allocation System — EPRAS — an engine of ten modules that runs as a single chain, from population at one end to a programme budget and an MTEF at the other. Figure 1.1 is the chain, and its shape is the report's central discipline: the first seven modules compute an **unconstrained requirement**, and money appears only at EM-08, where a fixed envelope becomes a binding constraint. The engine cannot be run the other way round. There is no screen, table or code path in which a planner enters a budget and receives a requirement scaled to fit it.

The chain: needs first, money last



Figure 1.1: The chain EM-01 to EM-10: the requirement is computed before the envelope appears

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

This report is therefore not a policy document, and nothing in it is a recommendation. It contains no preferred scenario, no ranking of districts by "need", and no statement that any sum of money should be spent. Where the engine compares options it reports what each one buys — children enrolled, places created, completion gained — and stops there. The choice between reaching the last children outside the system and raising learning for those already inside it is political, and the engine's job is to make it legible, not to pre-empt it.

What the report does insist on is **traceability**. Every figure in the chapters that follow can be decomposed into the factors that produced it — this cohort, these flow rates, this participation target, this norm, this price — and every factor carries a source, a source year and a quality tier. The tiers are measured, normed, imputed and assumed, in that order of confidence, and a computed result inherits the **worst** tier among its inputs. The discipline is

uncomfortable by design: of the 99 norm coefficients this run uses, 64 are tiered assumed, and the 26 unit prices come from a named price vintage.

The run reported here is identified as run 6b2afc6, created on 22 September

1. It is pinned to base year **2026** — meaning FY2025/26, the financial year that ends in 2026 — with a horizon of 2026–2030, the education structure version UGA-7-4-2-LSC2020, the geography version UGA-UBOS-2022 and its 135 districts, the norm set UGA-EPRAS-2026-DRAFT, the price vintage UGA-2026 and the target set UGA-ESSP-PATH. The whole chain executes in 64.6 seconds from a fixed seed, which means any figure in this report can be regenerated exactly. Its status is **draft** and **exploratory**: of eleven release gates, nine pass and two — G2 and G9 — are waived, and the run is marked non-compliant for that reason. The report is a demonstration of a working planning engine on the best data publicly available for Uganda, not a certified sector plan.

The readers it is written for are officials in the Ministry of Education and Sports and the Ministry of Finance, Planning and Economic Development, analysts at the National Planning Authority, district education officers, and development partners who finance parts of the system.

1.2 Uganda's education system in outline

Every quantity in this report is pinned to a formal description of the education system — the cycles, their entry ages, their durations and their terminal examinations. That description is data, versioned and citable, never a constant buried in code, and Table 1.1 sets out the version this run uses.

Table 1.1: The education structure this run is pinned to

Cycle Code	Cycle Name	Isced Level	Entry Age	N Grades	Compulsory	Fee Free Policy	Terminal Exam
PRE	Pre-primary	0	3	3	0	0	
PRI	Primary	1	6	7	1	1	PLE
LSE	Lower secondary	2	13	4	0	1	UCE
USE	Upper secondary	3	17	2	0	0	UACE

Structure version UGA-7-4-2-LSC2020. Grades, entry ages and durations are data, never code. Source: EPRAS run 6b2afc6 (report/build/data/t_structure.csv).

The structure is **7-4-2**, with a pre-primary cycle in front of it. Pre-primary runs three grades from age 3. Primary runs seven grades from age 6, so the official primary ages are 6 to 12, and it ends in the Primary Leaving Examination. Lower secondary runs four grades from age 13 and ends in the Uganda Certificate of Education; upper secondary runs two grades from age 17 and ends in the Uganda Advanced Certificate of Education. Sixteen grades in four cycles: that is the frame on which every cohort, class, teacher post and textbook in the report is computed, and a change to it changes every downstream number.

Two policy facts are carried in the structure table itself. Primary is the only **compulsory** cycle. Primary and lower secondary are both flagged as carrying a **fee-free policy** — Universal Primary Education and Universal Secondary Education — while pre-primary and upper secondary are not. A fee-free policy at lower secondary places the transition out of primary inside the publicly financed system, so improvements in primary survival arrive as a lower-secondary requirement two or three years later rather than dissipating at the gate. It also means the two cycles where the government has accepted a universal obligation are precisely the two where the requirement computed in this report is a claim on public money rather than a description of what households might buy.

They are not, however, the whole system. In the base year the engine carries **12.56 million learners**, of whom **9.51 million** are in government provision: 75.7 per cent. The remainder — a little over three million children — is in private, community and faith-based schools. The split is very uneven by cycle: primary alone accounts for **10.42 million** learners, of whom 8.32 million sit in government schools, so the non-state sector is proportionally much larger above primary than within it. The engine therefore models **total** provision and then states which part the

public budget finances, and every requirement, class, teacher and room downstream is computed on the public column with the total reported beside it. Conflating the two would quietly assume that private provision will absorb growth, which is how a plan discovers a three-million-learner hole in five years.

Government primary schools

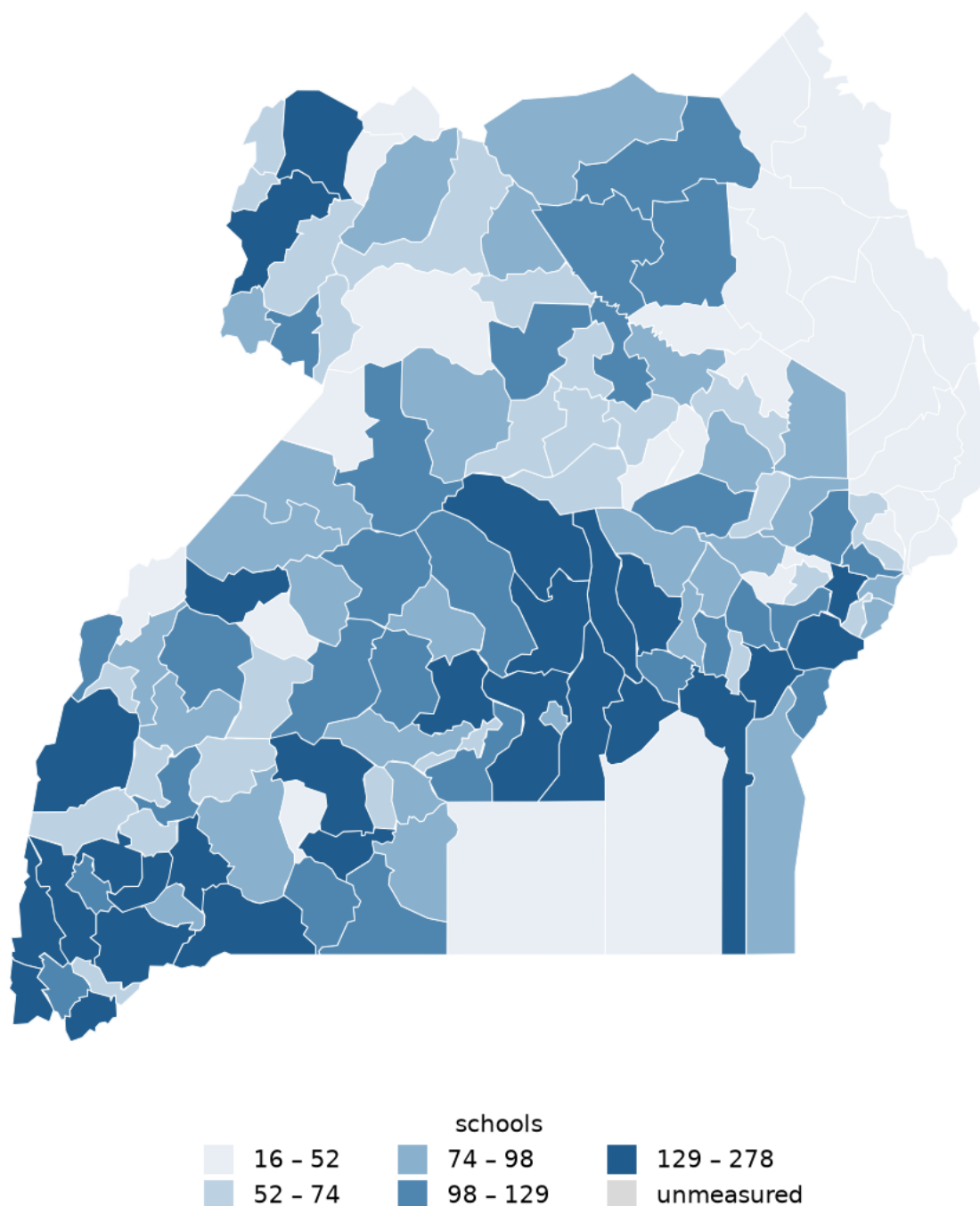


Figure 1.2: Government primary schools by district, from the 2017 register carried forward

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 1.2 maps the government primary estate the plan works with: 12,036 government primary schools across the 135 districts, the backbone of the whole supply side. Against that register the engine also holds 34,646 located school points from the OpenStreetMap education layer, which say where schools are but carry no enrolment, classroom or teacher count, and which therefore enter the access calculation rather than the capacity calculation.

The last structural fact is fiscal, and it shapes the whole report. **Local governments finance and manage primary schooling.** The money that pays primary and secondary teachers, funds capitation and builds classrooms reaches schools as local-government conditional grants, not as spending by the ministry's own vote. In FY2025/26 those approved grant lines are the primary wage grant of 1,029.8 bn UGX, the secondary wage grant of 870.3 bn, primary non-wage of 292.9 bn, secondary non-wage of 173.1 bn and the primary development grant of 75.9 bn — **2,441.9 bn UGX** in total, and the envelope that EM-08 allocates. Note the proportions: the development grant is 3.1 per cent of the total, and everything else is payroll and capitation already committed before any planning begins.

1.3 The long run: what the international series show

It is worth setting out first what the published record says about the last quarter century. Table 1.2 reports the World Bank's World Development Indicators for Uganda at roughly three-year intervals, and Figure 1.3 plots the series in full.

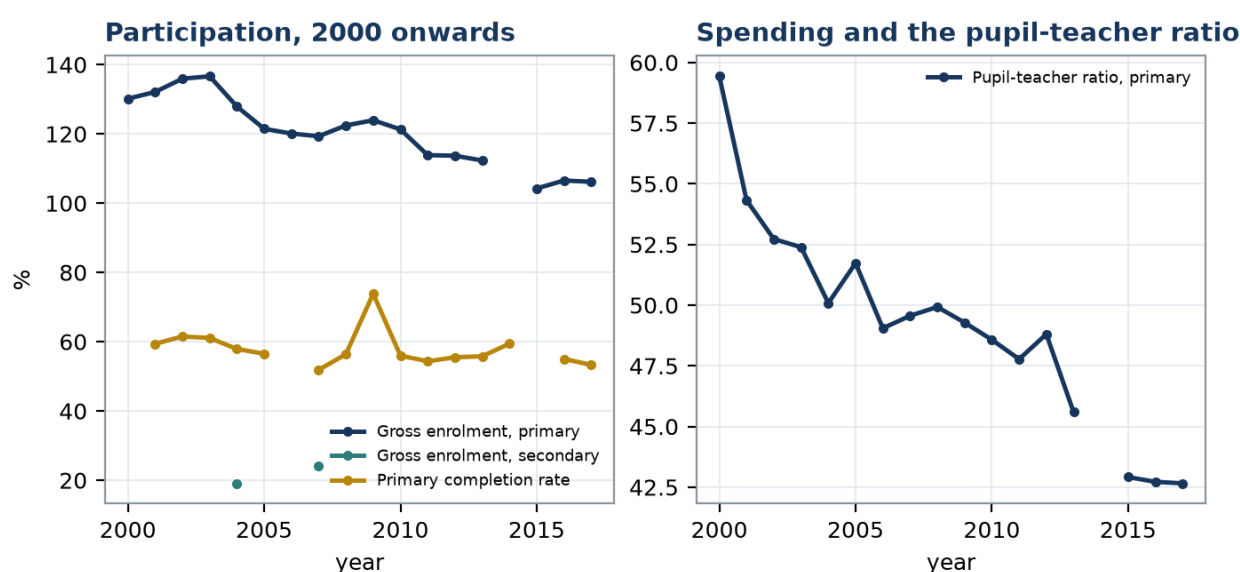


Figure 1.3: ch wdi trend

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 1.2: Uganda education indicators, World Development Indicators

Year	Gender Parity Index, Primary	Gross Enrolment, Primary (%)	Gross Enrolment, Secondary (%)	Primary Completion Rate (%)	Pupil-Teacher Ratio, Primary
2000	0.93	130			59.43
2003	0.97	137		61.08	52.39
2006	0.99	120			49.05
2009	1	124		73.85	49.28
2012	1.01	114		55.51	48.8
2015	1.02	104			42.92
2017	1.03	106		53.31	42.66

World Bank WDI, edition 2026-06-30 (CC-BY-4.0). Gaps are years the WDI does not publish for Uganda. Source: EPRAS run 6b2afcf6 (report/build/data/t_wdi_trend.csv).

Three movements stand out. **Gender parity closed and then reversed.** The primary gender parity index was 0.93 in 2000, reached 1.00 in 2009 and stood at 1.03 in 2017: girls are now the majority of primary enrolment. **Gross enrolment fell from a very high base.** The primary gross enrolment ratio was 130 per cent in 2000, stood at 137 per cent in 2003 and had fallen to 106 per cent by 2017. A ratio above 100 measures over-age and repeating children rather than over-provision, so the decline is most naturally read as a system slowly normalising its age-

in-grade distribution, not as a collapse in participation — though the two cannot be separated from these series alone, which is one reason the engine reconstructs enrolment from a cohort flow model instead of reading it off a ratio. **The pupil–teacher ratio improved steadily**, from 59.43 in 2000 to 42.66 in 2017, a gain of roughly seventeen pupils per teacher over the period.

The fourth series is less comfortable. The primary **completion rate** was 61.08 per cent in 2003, rose to 73.85 per cent in 2009 and was **53.31 per cent in 2017** — below where it stood fourteen years earlier. Whatever the system gained in access and in staffing over those years, it did not convert into more children finishing primary. That single observation is the strongest argument in this report for planning on flows rather than on coverage, and it is the problem the participation and demand chapters take up.

The gaps in Table 1.2 matter as much as the values. The WDI (World Bank 2026) publishes **no secondary gross enrolment ratio for Uganda in any of the seven years shown**, and **no primary completion rate for 2000, 2006 or 2015**. The extract held for this run spans eighteen years, 2000 to 2017, and then stops: the international series ends where Uganda's published district EMIS ends. Nor does the extract carry an education-spending series at all, which is why the money question in the next section is answered from the national budget rather than from the WDI. Quoting a trend from a series with holes of this size requires saying where the holes are, and Figure 1.3 draws them as breaks rather than interpolating across them.

1.4 Public spending on education

Table 1.3 assembles nine financial years of Uganda's approved budget, from FY2015/16 to FY2026/27, and Figure 1.4 plots the level and the share.

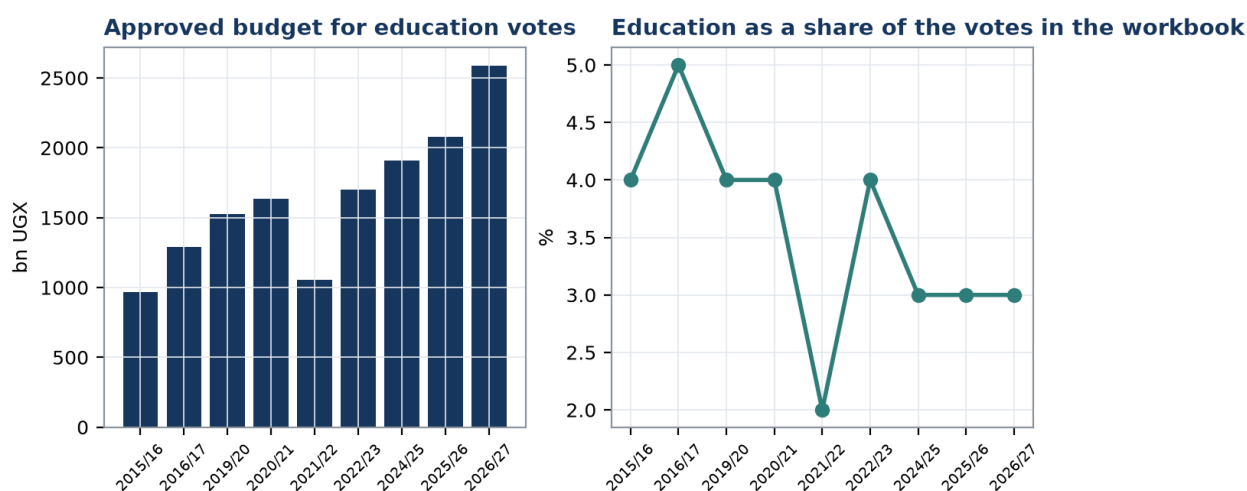


Figure 1.4: ch budget series

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 1.3: The approved budget for education votes, by financial year

Financial Year	Education Votes	Education Bn	All Votes Bn	Education Share
2015/16	10	969	23,972	0.04
2016/17	13	1,288	26,360	0.05
2019/20	13	1,526	40,488	0.04
2020/21	13	1,633	45,494	0.04
2021/22	13	1,056	42,467	0.02
2022/23	14	1,699	43,096	0.04
2024/25	14	1,910	72,126	0.03
2025/26	14	2,079	70,976	0.03
2026/27	14	2,587	84,392	0.03

MoFPED approved-budget workbooks (AICTEM data estate). Education is the sum over central-government votes whose name identifies an education institution - the ministry, the public universities, the examinations board and the training institutions - across every funding line in the workbook. It is therefore a central-government total and does NOT include the local-government education grants that finance most of primary schooling; those are the envelope the plan allocates. The FY2021/22 workbook carries a narrower set of funding lines than its neighbours, which is why its total dips; read the series as a trend, not as nine audited outturns. Source: EPRAS run 6b2afcf6 (report/build/data/t_budget_series.csv).

The level rises throughout. The approved budget for education votes was 969 bn UGX in FY2015/16, spread over ten votes, and is 2,587 bn UGX in FY2026/27 across fourteen votes — nominally more than double over eleven years. The share moves the other way. Education was about 4 per cent of the votes in the workbook in FY2015/16 and is **3.1 per cent** in FY2026/27, because total approved spending in the same workbooks grew from 23,972 bn to 84,392 bn UGX across the same period. Education's budget grew; the budget grew faster.

The caveat printed under the table is not a footnote, it is a condition on reading the series at all. This is a **central-government** total: the sum over votes whose name identifies an education institution — the ministry, the public universities, the examinations board, the training institutions — across every funding line in the workbook. It **excludes the local-government education grants**, which is to say it excludes most of what Uganda spends on primary schooling. The 2,441.9 bn UGX of grants described in the previous section sits outside Table 1.3 and is roughly as large again as the central-government education total. Read the two together, or neither of them correctly. Further, the FY2021/22 workbook carries a narrower set of funding lines than its neighbours, which is why its total dips to 1,056 bn UGX between 1,633 bn and 1,699 bn on either side; that dip is a document artefact, not a cut. The series is a trend, not nine audited outturns.

1.5 The six questions the engine answers

EPRAS exists to answer six planning questions, and they are also the report's table of contents in disguise.

1. **What are the education needs?** — school-age population, out-of-school children, required places by grade and district. Chapters 4 and 5.
2. **What do we currently have?** — schools, classrooms, teachers, materials, WASH, capacity, and where that capacity sits idle. Chapter 7.
3. **Where are the gaps?** — access, places, teachers in number *and* subject, materials, quality. Chapter 8, with the requirement it is measured against in chapter 6.
4. **What will it cost?** — recurrent, capital, total, the multi-year requirement and the wage-bill trajectory. Chapters 9 and 10.
5. **Where should resources go?** — by district, level, programme, school and intervention. Chapter 11.
6. **What will we achieve?** — enrolment, completion, learning, equity, fiscal impact. Chapters 12 and 13.

If a reader cannot obtain a defensible answer to all six from this document, the engine has not done its job, whatever else it has computed.

1.6 Scope and boundaries

The engine **plans**. It computes requirements from cohorts and norms, compares them with supply, costs the difference and allocates a constrained envelope against it. Five boundaries are worth stating plainly.

It does **not estimate behaviour**. It does not decide how much dropout falls when a school is built nearer, or how much learning rises per additional textbook. Those elasticities are asked of the estimation library, applied in EM-09 and reported with their source and their interval; where an elasticity does not exist, EM-09 says so rather than inventing one. Dropout hazards, learning production functions, survey estimation and impact evaluation all live in the existing EducationModelling system, not here.

It does **not set prices**. Unit costs for construction, materials and services arrive from the unit-cost system and from the ministry's own planning and budgeting guidelines, with a vintage attached; the engine consumes them and never estimates them from procurement or contract data.

It does **not acquire school data**. It reads the school census, the register and the point layer that exist, and it reports what they do not contain rather than filling the space. School timetabling, individual teacher posting and payroll execution are outside the system entirely, as are curriculum design and the development of assessment instruments.

It does **not model the macro-economy**. The fiscal envelope is determined elsewhere — by the macro-fiscal framework — and enters EM-08 as a given. In this run that interface is stubbed: the envelope is built from the FY2025/26 approved grant lines and grown at an assumed real rate, flagged *assumed* on every row it touches.

What the report **does** cover is the ten modules of the chain: population (EM-01), participation (EM-02), demand (EM-03), supply (EM-04), gaps (EM-05), costing (EM-06), investment (EM-07), allocation (EM-08), outcomes (EM-09) and the programme budget and MTEF (EM-10), together with the equity and geography atlas, the cross-checks against the estimation library, and the validation and gate results.

The scope of "education" here is the basic block and upper secondary: pre-primary, primary, lower secondary and general upper secondary, built to full norms. **TVET, teacher training colleges and tertiary education are phase-2 items** and are out of scope for this report; they exist in the data model but their norms are thin, and no costing of them is presented. Non-formal and alternative provision — accelerated education, adult literacy, refugee learning centres — is treated in the design as a *modality* attached to a level rather than as a separate block, but the detail is not built in phase 1 and no non-formal requirement is reported here.

1.7 How to read this report

Six conventions run through every chapter, and a reader who holds them will not be surprised by anything that follows.

Quality tiers are stated, not implied. *measured* is an administrative or survey observation for that district and that year; *normed* is a standard or guideline value applied; *imputed* is derived from a related observation, another year or a similar district; *assumed* is planner judgement with no empirical basis. Results inherit the worst tier among their inputs, so a single assumed coefficient makes the total that depends on it assumed.

Gap and surplus are never netted. A district with spare places does not offset a district that is short, because a child cannot sit in a classroom in another district. Formally, for district d :

$$G_d = \max(E_d - K_d, 0) \quad , \quad S_d = \max(K_d - E_d, 0) \quad (1.1)$$

where

- E_d is required places in district d ;
- K_d is existing capacity in that district, also measured in places;
- G_d is the place gap and S_d the place surplus.

Both are reported; their difference never is.

Capital always carries its induced recurrent cost. A classroom built without a funded teacher post and a capitation line is a building, not a place. Every construction figure in this report appears with the recurrent tail it creates, and the engine refuses to report one without the other.

No scenario is recommended. Scenarios are described by what they buy. The optimiser's output is "the allocation that maximises new places on its stated objective", never the best, preferred or optimal plan.

Every outcome carries its interval, and an interval that spans zero is reported as "no detectable effect at this evidence base" rather than as a small positive number.

And the base year is a projection. This is the one thing a reader must carry into every chapter.

The honest position on the data. Uganda now has a count. The Baseline Education Census 2025 (UBOS 2026) enumerated every government and private school in the country, and this edition takes its supply, its public-private split, its attendance rates and the seed of its projection from it. The base year is one year forward from that count rather than nine years forward from the 2017 abstracts, and the quantities the census measured are tiered *measured* rather than *imputed*. What the census cannot give is a rate of change: repetition, promotion and dropout still come from the 2016 and 2017 abstracts, because a single year cannot produce them, and the grade profile within each cycle comes from the same place. Those are now the oldest load-bearing parts of this report, and they are labelled wherever they are used. The same honesty applies to what is missing entirely: age within grade is not collected, so over-age analysis cannot be done from administrative data; teacher payroll and secondary subject qualification are not published by district; desk and textbook stock are not published at all, so material gaps are reported as requirement-only; and district learning assessment exists only for a single small-sample survey. Where a quantity cannot be measured, the report says it is unmeasured rather than supplying a number for it.

1.8 A guide to the rest of the document

Chapter 2 sets out the engine: the chain EM-01 to EM-10, the planning identity that links the modules, the quality tiers, the release gates and how a run is reproduced. Chapter 3 documents the data estate — every source, its vintage, its licence and its known defects — and should be read by anyone who intends to dispute a number.

Chapters 4 to 13 are the modules in order. Chapter 4 builds the population by single year of age and district. Chapter 5 reconstructs participation, the flow rates and the out-of-school children. Chapter 6 turns cohorts into required places, classes, teachers and a bill of materials, and chapter 7 measures what exists against them. Chapter 8 reports the five gaps separately — access, places, teachers, materials, quality — and never averages them into a score. Chapter 9 prices the requirement; chapter 10 turns the capital share into a construction, siting and teacher-pipeline programme with its recurrent tail attached. Chapter 11 introduces the envelope and the scenarios, chapter 12 traces what the money buys through to completion and learning with intervals attached, and chapter 13 expresses the result as a programme budget and a medium-term framework.

Chapters 14 to 17 step back from the chain. Chapter 14 is the geographic atlas, where the district patterns are easiest to see. Chapter 15 cross-checks the planning chain against the independent estimation library on the same base year. Chapter 16 reports calibration, validation, sensitivity and the gate results, including the two waived gates. Chapter 17 draws the conclusions, states the limitations plainly and sets out what would have to change — in data first of all — for the next run to be better than this one. Four annexes follow: the formula compendium, the reference catalogues and norms, the district statistical tables, and the glossary and abbreviations.

A reader with an hour should take this chapter, chapter 8 on the gaps, chapter 11 on the envelope and chapter 17. A reader who intends to use the numbers should start with chapter 3.

CHAPTER 2

2 The engine: how these numbers are made

Every figure in this report comes out of one computation, run once on 22 September 2026 under run id 6b2afc6f6-7e70-4347-bbed-bf018f4a5808. This chapter describes that computation. It comes early because the first question to ask of a costing is not whether the number is big but where it comes from, and what would have to be true for it to be wrong — and a planning engine earns its place in a budget negotiation only if that question has an answer for every cell.

The description has five parts: **one identity**, applied per grade, district and year; **one chain of ten modules**, ordered so that need precedes money; a **norm tier** holding every country coefficient as cited data, which stops the run rather than guessing when one is missing; a **run object** pinning every choice, so that identical pins reproduce identical numbers; and **gates** that refuse to compute a plan on a base known to be incomplete — two of which were waived by name here, the most important caveat in the report.

The run covers 135 districts on geography version UGA-UBOS-2022, 16 grades in four cycles on structure version UGA-7-4-2-LSC2020 (Table 1.1), a base year of 2026 — FY2025/26 — and a horizon to 2030.

2.1 The planning identity

The identity is the whole system: a feature that does not supply one of its terms, compare a term with what exists, or choose between feasible versions of it under a budget does not belong in the engine. It begins with children, not with money. For the first grade of a cycle, required enrolment is the entry-age population times an intake rate, plus those repeating:

$$E_{1,d,t}^* = P_{d,t}^a \cdot \text{GIR}_{d,t} + \rho_{1,d,t-1} \cdot E_{1,d,t-1}^* \quad (2.1)$$

and for every interior grade it is what is promoted in from below plus what repeats:

$$E_{g,d,t}^* = \pi_{g-1,d,t-1} \cdot E_{g-1,d,t-1}^* + \rho_{g,d,t-1} \cdot E_{g,d,t-1}^* \quad (2.2)$$

where E^* is required enrolment in places, g a grade, d a district, t a year, P^a the population at the official entry age a , GIR the gross intake rate on the path being run, ρ the repetition rate and π the promotion rate out of the grade below. At a cycle boundary the promoted mass is redistributed by a transition rate τ over the destinations the structure allows.

Note what Equation (2.2) does not contain: population multiplied by a coverage target, the shortcut that principle P3 of `docs/00_SCOPE_AND_PRINCIPLES.md` bans. With 2017 gross intake at 1.536 against a gross enrolment ratio of 1.038, Uganda's P1 holds far more children than there are six-year-olds. Only pre-primary is costed on a coverage rate, flagged wherever it is used.

Classes are whole — a grade of 58 against a norm of 53 is two classes, not 1.09 — and where only district totals exist the per-school ceiling is approximated by a small-school correction:

$$C_{g,d,t} = \text{ceil}\left(\frac{E_{g,d,t}^*}{\kappa_{g,d}} + n_d \cdot \varepsilon_c\right) \cdot m_{g,d} \quad (2.3)$$

where C is classes formed, κ the class-size norm for the service, n the government schools in the district, ε a per-school allowance and m the multigrade factor.

Teachers come from the timetable, never from a pupil–teacher ratio:

$$T_{j,g,d,t} = \frac{C_{g,d,t} \cdot h_{j,g} \cdot s_{j,g}}{L_{j,c}} \cdot \frac{1 + a_{j,c}}{1 - u_{j,c}} \quad (2.4)$$

where T is teacher requirement in full-time equivalents, j a subject, h the curriculum periods per week of subject j in grade g, s the practical-subject group split (a class of 60 in a laboratory built for 30 is two teaching groups), L the contractual teaching load per FTE, a the planned absence allowance and u the administrative release of head teachers. It is the only method that exposes a subject-mix shortage.

Every other input is driven off places by a norm line:

$$R_{r,g,d,t} = E_{g,d,t}^* \cdot q_r \cdot \sigma_r \cdot \frac{1 + \omega_r}{\lambda_r} \quad (2.5)$$

where R is the required annual quantity of input r, q the quantity per unit of service, σ the share of learners receiving it, ω the wastage rate and λ the lifespan in years, 1 for consumables. A shared input — laboratory apparatus, a library — is driven off rooms, classes or schools instead of learners.

Only at the end does money appear:

$$X_{g,d,t} = \sum_r R_{r,g,d,t} \cdot p_{r,d,t} + \sum_j T_{j,g,d,t} \cdot w_{j,d,t} \quad (2.6)$$

where X is cost in constant base-year UGX, p the unit price of input r from the pinned price vintage and w the cost per FTE-year of a teacher of cadre j. The gap in dimension k is then a difference of like quantities, never netted across dimensions or against surpluses:

$$G_{k,d,t} = \max(0, \text{req}_{k,d,t} - \text{avail}_{k,d,t}) \quad (2.7)$$

with the surplus as its mirror term, reported beside it.

2.2 The chain: EM-01 to EM-10

Figure 2.1 shows the ten modules in the order they run. That order is the argument, not an implementation convenience.

The chain: needs first, money last



Figure 2.1: ch chain

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

EM-01 Population takes the 2022 census (UBOS 2023) and produces single-year-of-age population by district and year — single years, because grade-age analysis and intake rates collapse if ages are banded. **EM-02 Participation** takes the most recent school census and household surveys and produces the flow rates ρ , π , δ and τ and the out-of-school count. **EM-03 Demand** takes those rates, the population and the norm set and produces required places,

classes, teacher FTE by subject and the bill of materials — equations Equation (2.1) to Equation (2.5). **EM-04 Supply** takes the school register, the estate and the staff records and produces what exists, in the same units. **EM-05 Gaps** differences the two, Equation (2.7), in five separate dimensions, and **EM-06 Costing** applies prices, Equation (2.6). **EM-07 Investment** turns the capital gap into a construction, equipment and training programme, attaching to every classroom its induced recurrent cost. **EM-08 Allocation** is the first module in which a budget appears: it rations the requirement against the envelope under payroll, pipeline, construction and absorption constraints. **EM-09 Outcomes** reports what the constrained plan buys, and **EM-10** emits the programme budget and MTEF.

The dependency rule is strict: EM-*n* may read the results of EM-*m* for *m* < *n* and the norm tables, never downstream results. That is what makes EM-01 to EM-07 the **unconstrained requirement** — what the country needs — and EM-08 onward the **constrained plan**. Both are retained, and the difference between them is the financing gap. Reverse the order, as a spreadsheet built from last year's wage bill does, and that gap becomes definitionally zero: you can no longer see what you are not doing.

2.3 Norms are data, not code

No equation in `src/` contains a Ugandan coefficient. Class sizes, teaching loads, curriculum periods, textbook and desk ratios, latrine stances, capitation rates and classroom areas live in versioned norm tables, each with a source, a year and a quality tier — which is what lets a ministry change a standard and see the consequence as a number rather than a code change.

The design is a **header plus lines**, because one wide table with a column per input fails on contact with a real system: a lower-secondary place needs two subject teachers, eight textbooks each on its own replacement cycle, a share of a classroom, a desk, a latrine stance and a capitation transfer. The unit being normed is an **education service** (Table B.2): six in this run, five `place` services — pre-primary, lower and upper primary, lower and upper secondary — and one `system` service covering inspection, monitoring and the fixed per-school capitation grant. System services do not scale with learners, and omitting them is a standard reason executed budgets exceed planned ones.

The **header** (Table B.3) carries what the class itself is: class size, shifts, multigrade factor, weeks and periods per year, period length. Primary and lower secondary take the MoES *Local Government Planning Guidelines 2022* figures of 53 and 60 learners per class; the pre-primary 40 and upper-secondary 45 could not be sourced to a written norm and are flagged `assumed` in the table.

The **lines** (Table 6.7) are the bill of materials — 20 of them, four flagged `assumed`, each with its own source, year and tier. The effective annual quantity of a line per unit of service is

$$\text{effective} = \frac{q \cdot \sigma \cdot (1 + \omega)}{\max(\lambda, 1)} \quad (2.8)$$

with symbols as in Equation (2.5). Four upper primary textbooks at 5 per cent wastage on a three-year replacement cycle are 1.400 copies per learner-year; a three-seat desk at 0.333 per learner, 2 per cent wastage and a ten-year life is 0.034 desks. Wastage sits on the input and never on the learner count — you do not lose teacher periods to damage, you lose textbooks — and lifespan sits on the *line*, because the same classroom carries a different annualised share under double shifting. A line with a lifespan above one enters the capital view as a stock and the recurrent view as an annualised charge. Every input and cadre named in a line must also be priced in the pinned vintage: UGA-2026 holds 26 prices, 17 for inputs and 9 for cadres, in constant 2026 UGX.

2.3.1 The resolution order, and the failure at step eight

A norm lookup resolves in a fixed order, first match wins, and the level at which it matched is written into the factor trace: (1) a district-specific override in the pinned norm version; (2) a locality-specific value, urban or rural; (3) a modality-specific value; (4) a grade-specific value; (5) a cycle-level default; (6) the national default in the

pinned version; (7) the parent norm version, inherited; and (8) **fail**. There is no ninth step. This norm set carries national defaults per service, so lookups here resolve at step six, but the path is the contract: a missing norm raises `NormNotFound` naming the service, the input and the path attempted; a missing price raises `PriceNotFound`.

Silently costing a missing norm at zero is the failure that destroys trust. A zero is not a small number; it is a claim that the item is free. Cost a missing textbook coefficient at nothing and the total still looks plausible — right order of magnitude, right shape across districts — and it will survive a review meeting. It is simply wrong, and nothing in the output says so. The first time a head teacher points out that the plan contains no books, the engine loses the argument and every other number it produced goes with it. That is why the resolution order ends in a deliberate exception rather than a default: a data gap is reported as a data gap, and the run stops until someone writes the coefficient down with a source.

Across headers, lines, curriculum and teaching load this run carries 99 coefficients, of which **64 are flagged ‘assumed’** — unsourceable to a published document, most of them curriculum periods, where no machine-readable national timetable was located. The norm review sheet is produced on every run so that the expert review of `docs/15_CALIBRATION_AND_VALIDATION.md` §15.4 has a document to work from; until it is held, the norm version stays in draft.

2.4 The run: what is pinned, and why it must reproduce

Everything the system computes belongs to a **plan run**, whose pins are its identity. This one pins the country (UGA), the base year (2026), the horizon (2026–2030), the structure version (UGA-7-4-2-LSC2020), the geography version (UGA-UBOS-2022), the norm set (UGA-EPRAS-2026-DRAFT), the price vintage (UGA-2026), the target trajectory (UGA-ESSP-PATH), the scenario (A), the ranking criterion (`oosc_primary`), the random seed (6b2afcf6) and the solver settings — a MIP gap of 0.005 and a time limit of 600 seconds on HiGHS via JuMP.

Each is pinned for a reason. Structure and geography change — Uganda has created districts steadily and a curriculum reform moves grades between cycles — so a total on one boundary set is not comparable with one on another. The ranking criterion is pinned because the engine reports no composite index of need, so any ordering of districts must be an explicit choice travelling with the run rather than a default buried in a screen. The seed is pinned because EM-09's Monte Carlo would otherwise differ between runs for no substantive reason, and the solver gap and time limit because a programme stopped at a different optimality tolerance is a different answer.

Two runs with identical pins must produce identical numbers — bit-identical, not approximately equal. This is the reproducibility contract, and it is a test, not an aspiration. What it buys is attribution: if this year's requirement differs from last year's, the difference is caused by exactly one of the pins, and the engine can say which. Without it, every re-run is a negotiation about whether the model changed. The non-determinism it forces out is specific: dictionary iteration order, unseeded draws, parallel reduction order, solver threads, timestamps leaking into results.

2.5 Quality tiers and the factor trace

Every input datum carries one of four tiers: `measured`, an observation for this district and year; `normed`, a standard applied; `imputed`, derived from another year or district; and `assumed`, planner judgment with no empirical basis. The tiers are ordered, and a result inherits the **worst** among its inputs:

$$\text{tier}(y) = \max_i \text{tier}(x_i) \quad (2.9)$$

The maximum, not the average: a cost built from a measured enrolment, a normed class size and an assumed teaching load is an assumed number. Because the last district EMIS Uganda publishes is 2017, base-year enrolment here is imputed by construction, and everything derived from it inherits that.

Beneath the tiers sits the factor trace. Every result row emits, alongside itself, the factors that produced it — name, value, unit, source, source year and tier — and `explain()` returns that decomposition for any cell. National primary capacity in 2026 reads back as six factors: classrooms in 2017 (imputed, MoES Abstract), classrooms added since (assumed, a development grant divided by a unit price), the class-size norm of 53 and a utilisation target of 0.9 (both normed), teachers in post (imputed) and a teaching load of 36 periods (assumed). Read that list and you can see which factor to attack: the number is weak not because the arithmetic is weak but because two of its six factors are assumptions about a decade of change. It cannot be retrofitted — a module that did not emit its factors cannot reconstruct them — which is why it is a first-class feature and not a documentation exercise.

2.6 The gates

Before the chain computes anything the run passes a set of data-quality gates; two more are evaluated once results exist, because they need results to check. Table 2.1 gives all eleven with what each found.

Table 2.1: Pre-run data-quality gates, and what each one found

Gate	Requirement	State	Detail
G0	geography version resolves to districts	pass	135 districts in UGA-UBOS-2022
G1	population present for every district	pass	135 of 135 districts carry a population base
G2	EMIS response rate recorded per district and at least 0.80	waived	not recorded on any of 7020 enrolment cells - the abstracts publish no response rate
G3	every district has supply carrying a quality tier	pass	135 of 135 districts carry a tiered supply observation
G4	every norm line priced in the run vintage	pass	20 lines and 4 cadres priced
G5	education structure version validates	pass	UGA-7-4-2-LSC2020: 16 grades
G6	population, enrolment and schools on the pinned geography	pass	enrolment 135, supply 135, districts 135
G7	every service with required places has a resolvable norm	pass	16 grades resolved to place services
G9	norm version approved	waived	UGA-EPRAS-2026-DRAFT is draft; the ch.15 review has not been held
G8	seed-year reconciliation within 2% of the counted enrolment	pass	flow-model grades 11126447 against the Baseline Education Census 2025 11126447: 0.0%
G10	no NaN or Inf in any result table	pass	61 tables swept

A gate that the published data cannot satisfy is waived by name on an exploratory run, never skipped. Source: EPRAS run 6b2afcf6 (report/build/data/t_gates.csv).

They check the base the chain will stand on: that the geography resolves to districts (135), each carrying a population base and a tiered supply observation rather than a silent zero; that the EMIS response rate is recorded and at least 80 per cent; that every norm line and curriculum cadre is priced (20 lines and 4 cadres); that the structure validates, yielding 16 grades; that one geography spans population, enrolment and schools; that every grade resolves to a place service with a bill of materials; and that the norm version is approved. Afterwards: that the flow model reproduces 2017 enrolment within 2 per cent, and that nothing holds a NaN or an Inf.

A failing gate aborts the run. It does not warn and continue: the chain is never computed on a base known to be incomplete, because a plan built on a silent hole is worse than no plan. The one relaxation is that a gate the published data cannot satisfy may be **waived by name** on a run marked exploratory. The waiver is recorded in the gate report, carried into the run manifest and printed on every export, and such a run can never leave draft.

Nine of the eleven passed. The base-year reconciliation passed exactly — the flow model reproduces 10,211,172 learners against 10,211,172 in the 2017 EMIS, 0.0 per cent apart across the grades EMIS publishes — and the finiteness sweep found no non-finite value in any of 50 result tables. Two were waived:

- **G2, the EMIS response rate.** No response rate is recorded on any of the 7,020 enrolment cells, because the MoES abstracts do not publish one. Where a district reports low enrolment the engine cannot tell schools that are genuinely small from schools that did not return their forms: non-response looks like absence, and biases need downward in the districts least able to complain.
- **G9, the norm version.** UGA-EPRAS-2026-DRAFT is a draft: the \$15.4 review has not been held and 64 of the 99 coefficients are flagged *assumed*. The requirement is stated against a *proposed* standard, not one the ministry has adopted, and the coefficients that move the total most — class size and teaching load — are among those awaiting review.

The results are therefore a traceable computation on a pinned and published set of coefficients, and the right basis for asking where the gaps are and what drives them. They are **not** an approved costing. The run carries a non-compliance flag for that reason, and no figure here should enter a budget document until an EMIS extract with response rates and an approved norm set have replaced the two waived gates.

2.7 Performance and reproduction

The chain runs in **64.6 seconds** end to end, against a specification target of under three minutes for a country of this size. Table 2.2 gives the split.

Table 2.2: Time taken by each step of the chain (seconds)

Step	Seconds
gates	1.8
EM-01 population	5.8
EM-02 participation	5
EM-03 demand	14.2
EM-04 supply	3.5
EM-05 gaps	3.4
EM-06 costing	1.9
EM-07 investment	14.3
EM-08 allocation	4.5
EM-09 outcomes	9
EM-10 budget & MTEF	1.3

Measured on the run that produced this report. Source: EPRAS run 6b2afcf6 (report/build/data/t_timing.csv).

The expensive steps are EM-07 investment at 64.6 seconds, EM-03 demand at 11.7 and EM-09 outcomes at 11.4 — the two that iterate over 135 districts by 16 grades by five years, and the one that runs a Monte Carlo. The gates cost 64.6 seconds, the cheapest insurance in the system. The headroom means a six-scenario comparison, a sensitivity sweep and a re-run under a revised norm set are interactive-time operations — the engine is usable in a planning workshop, not overnight.

Reproduction is five stages: rebuild the data pack, run the plan, collect the report's tables and facts, render figures and equations, build the document.

```
`` python scripts/rebuild_all.py julia --pkgimages=no --project=. scripts/run_plan.jl python
report/build/collect.py python report/build/figures.py python report/build/render_equations.py
node report/build/build_docx.js ``
```

On this host `./run.ps1 data` and `./run.ps1 run` wrap the first two, and `--pkgimages=no` is mandatory because Windows Application Control blocks unsigned Julia cache DLLs. The same line is printed in the report's front matter.

2.8 The boundary: what the engine does not do

The engine's credibility rests partly on the questions it refuses. It does not estimate behaviour: how much dropout falls when a school is built nearer, or how much learning a textbook buys. It asks the estimation library for that elasticity, applies it in EM-09 and reports it with its source and interval; where the elasticity does not exist, EM-09 says so rather than inventing one. Hazard models, learning production functions, survey estimation and impact evaluation belong to EducationModelling, which is why this report's cross-checks against that library are a separate chapter.

It does not estimate prices: unit costs for construction, furniture, textbooks and salaries come from the unit-cost system and published policy rates, and the engine consumes a pinned vintage rather than inferring one. It does not acquire school data: the register, the estate survey and staff records are the ministry's instruments, and where they are stale — as the 2017 EMIS is — the engine carries that forward as an *imputed* tier. It does not determine the macro-fiscal envelope, which comes from the finance ministry's framework; EM-08 takes it as given and can iterate with it in a bounded loop. And it does not do timetabling, teacher posting or payroll execution, nor curriculum design or assessment development, which belong to the curriculum centre and the examinations body. An engine that quietly estimated its own elasticities and imputed its own school census would be unfalsifiable; keeping the boundary means every contested coefficient has an owner who can be asked to defend it.

2.9 Implications for planning

The first implication is procedural. The most valuable thing a ministry can do with this engine in the next twelve months is not to commission another scenario; it is to close the two waived gates. Publishing an EMIS response rate per district — one column in an existing return — converts the largest unknown in this report into a measurable quantity. Holding the norm review of §15.4 — the planning department, teacher management, the construction unit, the examinations body and two serving head teachers in one room — converts 64 assumed coefficients into sourced norms or agreed planning assumptions. Neither needs new money, and together they let this run's numbers enter a budget document.

The second is about where analytical effort pays. Because the identity is multiplicative, the coefficients appearing earliest and most often dominate. Class size and teaching load together set how many classes form and how many teachers they demand, and the teacher wage bill is the largest single block of recurrent spending. No procurement reform can match that leverage: the negotiation between the class-size norm and the teaching load *is* the education budget negotiation, and it should be conducted with the requirement recomputed both ways.

The third is that reproducibility is an institutional asset, not a technical one. Pinning a run means next year's plan can be compared with this year's and the difference attributed — so much to population, so much to revised flow rates, so much to a changed norm, so much to a different envelope. That is the difference between a planning system and an annual argument, and only an organisation that keeps its pins, manifests and factor traces has it. They are small files. Archive them with the budget.

CHAPTER 3

3 Data: what exists, what was used, and what is missing

A planning engine is only as honest as its account of its own inputs. The chapters that follow compute a requirement, measure a supply, difference the two and price the result, and each of those operations inherits the silences of the files described here.

For three editions that account opened with an apology: the latest district-level count of Uganda's schools in the public domain was the 2017 school census, so every district quantity was a projection and every participation rate a ratio of two estimates. That apology is withdrawn. In May 2026 the Uganda Bureau of Statistics published the Baseline Education Census 2025 (UBOS 2026), the first nationwide census of Uganda's formal education system, and this edition takes its supply, its public–private split, its attendance rates and its projection seed from it. Everything below was verified on this host on 2026-09-22, the date of this run (geography UGA-UBOS-2022, prices UGA-2026, norms UGA-EPRAS-2026-DRAFT); the acquisition record is `data/SOURCES.md`.

3.1 The census: a complete count of government and private schools

The census was conducted by the Uganda Bureau of Statistics with reference year 2025 and published in May 2026 in 276 pages. It is a census and not a return: it enumerated every institution in the formal system — pre-primary, primary, secondary and non-tertiary — in the government and the private sector alike, not the forms that happened to come back. For each it recorded ownership, learners by sex and by age within class, teaching staff, the pupil–teacher, pupil–classroom and pupil–stance ratios, net and gross attendance, disability, nationality, boarding status and WASH provision, by district and city.

Table 3.1 carries the headline counts. Primary education runs on 43,567 schools, 12,557 government and 31,010 private, holding 5,211,732 government and 3,906,582 private learners against 270,176 teachers, 292,791 classrooms and 214,569 latrine stances. Secondary runs on 5,498 schools — 1,484 government, 4,014 private — with 903,996 and 1,104,137 learners, 49,631 teachers, 44,679 classrooms and 50,885 stances. Beside them sit 830 non-tertiary institutions with 74,024 learners (UBOS 2026).

Two of those figures change what this report can say. First, 42.8 per cent of primary learners and a majority of secondary learners are in private schools, which no administrative return can see: a private proprietor has no conditional grant and no reporting obligation to the district education office. A plan that sizes a requirement against the whole school-age population and a supply against government schools alone overstates the gap by the size of the private estate — and overstates it most where private provision is densest, which is where the state's own gap is smallest. Second, 31,010 private primary schools hold fewer learners than 12,557 government ones: private provision is a very large number of very small institutions, not a parallel system of comparable ones.

The census is accordingly the measured supply of this run (Table 3.2): reference year 2025, all 135 districts, complete enumeration, tier **measured**.

Table 3.1: What the Baseline Education Census 2025 counted

Cycle Code	Schools Gov	Schools Private	Learners Gov	Learners Private	Teachers	Classrooms	Stances
PRE	3193	35154	205339	2169335	82,763	116,394	102,825
PRI	12557	31010	5211732	3906582	270,176	292,791	214,569
SEC	1484	4014	903996	1104137	49,631	44,679	50,885

UBOS Baseline Education Census 2025. Every column reconciles exactly with the totals printed in the census report; classrooms and stances are derived from its published ratios and raked to those totals. Source: EPRAS run 6b2afc6 (report/build/data/t_census_national.csv).

Table 3.2: The source of the measured supply in this run

Year	Source	Districts	Basis	Quality
2025	UBOS Baseline Education Census 2025	135	complete enumeration of government and private schools	measured

The engine uses the most recent count of schools it has. Source: EPRAS run 6b2afcf6 (report/build/data/t_supply_vintage.csv).

3.2 How the annex tables were read

The district detail is published as annex tables inside a PDF, and an extraction is where errors enter silently. `scripts/extract_bec2025.py` reads them with `pdfplumber` under the discipline that licenses the tier.

A row is accepted only at the exact column count. Each table is declared with its column names, the modal numeric width of its candidate rows is checked against that declaration, and a line is admitted only when it yields exactly as many numeric fields as there are columns: one field short is not padded, one long is not truncated. Rows labelled `National`, `Total` or a sub-region are not districts.

Every rejection is logged, to `rejected_rows.csv`, with table, page, label, line and reason. Thirty rows were rejected across the twenty-six district annex tables read. Twenty-six of them are the census's own national summary lines, one per table, correctly refused as district rows. The remaining four are data rows one field short of their declared width, all in Table 4.A6, the secondary quality-indicator annex: Karenga, Kwania, Nabilatuk and Nakapiripirit. They are not repaired, and the reason is a principle rather than an omission — a table of *ratios* has no additive identity against which a restored cell could be tested, so a reconstruction there would be a guess with no check on it. Coverage is therefore 146 of the 146 census units in every table of counts, and 142 for the secondary ratios.

Only the repairs the tables' own arithmetic proves were made. Sixteen rows were repaired, all logged in `repaired_rows.csv`, and every one of them in a table whose rows must satisfy arithmetic identities. Three are in ownership-block tables, which must satisfy six identities at once: government plus private equals all, and male plus female equals the total, in each of the government, private and all-schools blocks. Two layout variants defeat a naive reader. The first is an **omitted all-zero ownership block**: where a district has no private provision of a level, the annex prints the government and all-schools blocks and omits the private one, and a single zero cell is dropped the same way. Pallisa in Table 2.A2 (pre-primary learners, page 157) and Karenga in Table 4.A3 (secondary learners, page 231) each emerge with six numbers whose first three equal the last three; both readings satisfy every identity, so neither is assumed — the row is flagged ambiguous and resolved against the published national ownership split. Karenga in Table 3.A5 (primary teachers, page 205) is simpler: exactly one of the nine positions into which a zero could be inserted satisfies all six identities, so the zero is restored at column five. The second variant is a **row whose numbers the PDF placed above its name**, which the extractor re-joins — safely, because neither line is a valid row alone and the joined row faces the same column-count test as every other. The third is the same accident in reverse: a long unit name wrapped, leaving "Fort Portal" on one line and "City" with the numbers on the next. A label that is only the tail of a name would quietly create a district that does not exist, so the two pieces are joined only when together they name a unit the census has already been seen to print — and never on the tail alone, because ten of the census's units end in "City".

The other twelve repairs are in the tables that classify *schools* — by drinking-water source and by hand-washing facility — where the same reasoning generalises. Each such row is a set of blocks: within a block the category columns sum to the block total, and across blocks the government and private columns sum to the all-schools column. Where a row arrives one or two fields short, every position into which the missing zeros could be inserted is tried, and the repair is accepted only when **exactly one** placement satisfies all of those identities; the surviving numbers keep their order, which is what usually makes even a two-gap row determinate. Eight rows in Table 3.A8 and four in Table 3.A9 were restored this way, and each is named in `repaired_rows.csv` with the identity that placed it. Where more than one placement fits, nothing is chosen — the row is rejected and logged.

The sixteenth repair uses a different kind of evidence and is worth naming. In Table 4.7A, learners by country of origin, the row for Dubai reached the extractor with two numbers where the table has three. The table prints its own total row, so the residual between that total and every row that did parse says exactly what the missing row must contain; of the three positions the missing cell could occupy, only one reproduces that residual and also satisfies male plus female equals total. The row is restored as 0, 2, 2 — two girls and no boys — and after the repair the country rows sum to the printed total in all three columns. Without it, two learners would have gone missing out of 2,008,133, which is immaterial to every figure in this report and is repaired anyway, because the alternative is a reconciliation that does not close and a reader who cannot tell why.

These tables are then checked against each other. Two independent checks run after the read, and both are recorded in the manifest. The first is that a table which classifies schools must classify all of them: the row total of every water and hand-washing annex is compared with the school count for the same district and level from Tables 3.A1 and 4.A1, and all 146 units agree in all five tables. The second exploits a redundancy in the census itself — Tables 4.A7 and 4.A10 report the same secondary water counts with the improved and un-improved columns in opposite order. They are read independently, as two separate tables, and compared: 146 of 146 districts agree. A transposition in either read would have shown up here.

Eleven further tables are read at the geography the census publishes them at. Learners with a difficulty, learners by nationality, non-teaching staff and secondary day/boarding status are published for the seventeen sub-regions, for urban and rural, and nationally — not by district. They are stored at that geography, and nothing is apportioned down to districts: splitting a sub-region total between its districts would require an assumption this census does not support, and §3.1's tier would not survive it. Each of these tables is checked against its own printed national row twice over, by summing urban plus rural and by summing the seventeen sub-regions. Ten of the eleven agree on both.

The eleventh does not, and the disagreement is the census's own. In Table 3.2, primary schools by day/boarding status, the printed national row puts three more private schools in "day only" and three fewer in "day and boarding" than either of its own partitions. Urban plus rural and the seventeen sub-regions agree with each other exactly, and every total agrees, so the national row is the outlier in a cell of three schools out of 31,010. It is reported as published and not corrected, under SRC_BEC_T32_INTERNAL. It is recorded here for the same reason the rejections are: a reader who re-adds these tables should find the same small inconsistency and know it was seen.

Every extracted column reconciles exactly. Summing each extracted column across all district rows against the figure printed in the census's own Key Findings gives forty checks, and all forty agree to the unit — 40 of 40 exact, recorded in `data/interim/bec2025/manifest.json`: no row was lost, duplicated or misread anywhere in 146 district rows.

3.3 Geography: 146 census units onto 135 pinned districts

The census reports 146 units where the pinned boundary set UGA-UBOS-2022 carries 135 districts. The difference is ten city authorities carved out of their parents, Terego, created from Arua in 2019 and not a separate unit in the boundary file, and two spelling variants. Thirteen rules close the gap (Table 3.3): eleven units fold into a parent and two are renamed, which is why 146 units resolve to exactly 135 districts. Every unit's rule is written to the database as data, so the fold can be audited or reversed. Counts fold by summation and rates by learner-weighted averaging:

$$x_d = \sum_{u \in U(d)} x_u \quad (3.1)$$

$$r_d = \frac{\sum_{u \in U(d)} r_u L_u}{\sum_{u \in U(d)} L_u} \quad (3.2)$$

where x_u is a counted quantity for census unit u , $U(d)$ the set of units folded into pinned district d , r_u a published rate for that unit and L_u its learners.

This improves quality, not merely tidiness. The 2017 abstract had to be carried onto the current geography by *splitting* parents among their descendants in proportion to population, and a split produces an *imputed* cell however good the parent. The fold runs the other way, and a sum of measured counts is measured: not one district in this run needs a population split to obtain its schools, learners or teachers. The rule is recorded as SRC_BEC_CITY_FOLD (Table 3.16).

Table 3.3: Census units folded into the districts of the pinned geography

Bec Unit	District ID	Rule
Arua City	Arua	city carved from its district; the pinned boundary set has no city units
Fort Portal City	Kabarole	city carved from Kabarole
Gulu City	Gulu	city carved from Gulu
Hoima City	Hoima	city carved from Hoima
Jinja City	Jinja	city carved from Jinja
Lira City	Lira	city carved from Lira
Luweero	Luweero	spelling variant
Madi-Okollo	Madi Okollo	spelling variant
Masaka City	Masaka	city carved from Masaka
Mbale City	Mbale	city carved from Mbale
Mbarara City	Mbarara	city carved from Mbarara
Soroti City	Soroti	city carved from Soroti
Terego	Arua	district created from Arua in 2019; not a separate unit in UGA-UBOS-2022

Ten cities and Terego are reported separately by the census and do not exist as units in the boundary set this plan is pinned to. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_crosswalk.csv).

3.4 What the census measures that nothing before it did

Secondary classrooms and stances by district. Previous editions reported secondary capacity as teacher-bound only, classrooms being unmeasured. The census publishes the student–classroom and student–stance ratios for every unit, so capacity is now the minimum of a room-bound and a teacher-bound figure and which binds is a finding rather than an artefact. A ratio cannot be summed, so counts are recovered per census unit *before* aggregation,

$$k_u = \frac{L_u}{\rho_u} \quad (3.3)$$

then raked to the national total the census prints,

$$f = \frac{K}{\sum_u k_u} \quad (3.4)$$

where k_u is the derived count in unit u , L_u its learners, ρ_u the published ratio, K the published national total and f the raking factor, needed because the published ratios are rounded to whole numbers. The factor is stored on every row, and because these are measured quantities recovered through a rounded ratio they are tiered **imputed**, under SRC_BEC_RATIO_DERIVED. The four districts whose secondary ratio row was rejected carry no derived classrooms or stances, the raking distributing the published totals across the units that do.

Net and gross attendance by district. Table 3.4 gives the district means: primary net attendance of 68.4 per cent, 66.5 for boys and 70.7 for girls, against a gross rate of 96.0; secondary 18.7 per cent net, 16.3 and 21.3, against 25.2 gross. A gross primary rate near one hundred with a net rate near seventy means the primary system is close to full in *volume* and far from full in *the right children*. And girls are above boys on all six measures: Uganda's primary participation problem is no longer a gender problem but an age problem.

Table 3.5 ranks the fifteen lowest districts, and the pattern is unmistakable. Seven of the lowest eight are in Karamoja — Amudat at 5.4 per cent net and 7.8 gross, then Nabilatuk, Kaabong, Kotido, Karenga, Napak and Nakapiripirit — with Yumbe at 23.9 and Moroto at 27.5, then the island districts, Buvuma at 39.8 and Kalangala at 46.6. No plan built on national averages will reach these districts.

Age within class. The census publishes learners by age band within class, nationally: the column without which no net rate and no over-age analysis can be computed from administrative data at all.

Pre-primary, and what is held but unread. Table 3.6 is pre-primary counted for the first time: 38,347 institutions, of which only 3,193 are attached to a government school and 35,154 are private, holding 2,374,674 learners. Pre-primary is to a first approximation a private system, so it sits almost entirely outside the government plan this report costs; and it is the one level where the engine still projects enrolment from population and coverage rather than from a cohort flow, a flagged fallback, because the census gives a stock and no transition into P1. The census also enumerated disability, nationality, boarding and WASH; the boarding and WASH annexes are extracted but are *not* read by `scripts/load_bec2025.py`.

Table 3.4: Net and gross attendance measured by the census, mean across districts

Cycle Code	Nar Male	Nar Female	Nar Total	Gar Male	Gar Female	Gar Total
PRI	66.5	70.7	68.4	93.7	98.7	96
SEC	16.3	21.3	18.7	23.8	26.7	25.2

UBOS Baseline Education Census 2025, district annex. The net rate is attendance at the level of the age group; the gross rate counts attendance at that level at any age. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_attendance.csv).

Table 3.5: The fifteen districts with the lowest primary net attendance

District ID	Nar Total	Gar Total
Amudat	5.4	7.8
Nabilatuk	9.6	13.8
Kaabong	10.8	14.7
Kotido	12.3	17.2
Karenga	15	22.5
Napak	18.1	25.5
Nakapiripirit	23.4	31.6
Yumbe	23.9	33.4
Moroto	27.5	42.4
Buvuma	39.8	54.6
Nwoya	44.5	64.6
Abim	45.2	66.2
Kalangala	46.6	61.2
Bududa	50.9	75
Buliisa	50.9	71

Source: EPRAS run 6b2afcf6 (report/build/data/t_census_attendance_lowest.csv).

Table 3.6: Pre-primary, counted for the first time

Schools	Attached To Government	Private	Learners	Teachers	Classrooms	Stances
38347	3193	35154	2374674	82,763	116,394	102,825

The census enumerated pre-primary provision, which is overwhelmingly private and sits outside the government plan this report costs. Source: EPRAS run 6b2afcf6 (report/build/data/t_preprimary.csv).

3.5 A net attendance rate is not an in-school rate

Why a net attendance rate must be adjusted before it becomes an in-school rate. A *net* rate counts children of a level's official age who attend **that level**. A child of primary age in a pre-primary class, and one who has already reached a secondary class, are both in school; the net primary rate counts neither. A child of secondary age still in a primary class is in school; the net secondary rate counts them as out of it. One minus a net attendance rate is therefore not an out-of-school rate, and in Uganda the difference is not a rounding adjustment.

Table 3.7 quantifies it from the census's own age-by-class tables. At primary the factor is **1.0831**: 6,589,436 children of primary age attend primary and a further 547,585 of that age are in a pre-primary or a secondary class. At secondary the factor is **2.5857**, and the reason it is so large is the single most important number in this chapter — the census counts **2,433,566** primary learners aged 13 and over, against 1,534,654 learners of secondary age in secondary school. More children of secondary age are in primary school than in secondary school. A net secondary rate of 18.7 per cent read as an in-school rate would place four-fifths of Uganda's adolescents outside education, which is false: most of them are in school and in the wrong grade.

The secondary factor is a **slight upper bound**, because the primary 13-and-over band includes learners aged 19 and over who are past secondary age; the engine uses it as published and flags it rather than trimming it by assumption.

Formally, for cycle c the adjustment and the out-of-school count are

$$\alpha_c = \frac{N_c + E_c}{N_c} \quad (3.5)$$

$$\text{OOSC}_c = P_c(1 - \alpha_c r_c) \quad (3.6)$$

where N_c is the number of children of cycle c 's official age attending cycle c , E_c the number of that age attending another level, α_c the adjustment factor, r_c the published net attendance rate, P_c the cycle's school-age population from the UBOS projection, and OOSC_c the children out of school. Applying α rather than ignoring it is the difference between a construction programme and a repetition-and-progression programme, and over-age enrolment is not solved by building classrooms.

Table 3.7: Turning a net attendance rate into an in-school rate

Level	In Level	In Other Levels	Adjustment	Note
PRI	6,589,436	547,585	1.083	children of primary age attending pre-primary or secondary are in school; the net rate counts only those attending primary
SEC	1,534,654	2,433,566	2.586	children of secondary age still in primary are in school; the primary 13+ band includes some over-19s, so this factor is a slight upper bound

From the census's own age-by-class tables: a child of one level's age attending another level is in school, and a net attendance rate does not count them. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_adjustment.csv).

3.6 Two measures of out-of-school children that disagree

The census supports an out-of-school estimate built on counted attendance; the international series supports another, built on household surveys. They do not agree, and Table 3.8 reports both. At primary the census basis — one minus the adjusted net attendance rate — gives a rate of 0.226 and 2,467,716 children out of school; the UIS (UIS 2025) survey series, whose national rate the engine distributes by inverse participation, gives 0.069 and 753,482, a factor of more than three. At lower secondary the census basis gives 0.481 and 2,439,735 against the

survey's 0.192 and 974,315. At upper secondary the ordering reverses, the census giving 0.473 and 1,086,601 against the survey's higher 0.527 and 1,211,867.

Neither is averaged into the other, and neither is corrected towards it. The **census** measure is conditional on the census's own attendance question, on the age-by-class adjustment of Equation (3.5), and on the UBOS population projection as its denominator — the lower of two defensible denominators, the UBOS total of 46.2 million for 2022 sitting below the UIS and United Nations series, which reaches 50.7 million by 2025; a rate whose numerator is counted and whose denominator is projected inherits the projection's error. The **survey** measure is conditional on a sampled household's report rather than an enrolled learner's record, on the modelling UIS applies to produce a current-year rate from rounds of different years, and at district level on the assumption that out-of-school children are distributed in inverse proportion to participation.

The divergence is recorded as SRC_OOSC_DIVERGENCE, a **warning** and not a note, in Table 3.16, and both figures appear wherever an out-of-school number is used. A planner who takes 2.47 million at face value and one who takes 753,000 will not design the same programme, and the data does not say which is right.

Table 3.8: Two measures of how many children are out of school, side by side

Cycle	Basis	Rate	Children
PRI	census: one minus adjusted net attendance	0.226	2,467,716
PRI	survey: national rate distributed by inverse participation	0.069	753,482
LSE	census: one minus adjusted net attendance	0.481	2,439,735
LSE	survey: national rate distributed by inverse participation	0.192	974,315
USE	census: one minus adjusted net attendance	0.473	1,086,601
USE	survey: national rate distributed by inverse participation	0.527	1,211,867

The census counts attendance; the international series models a rate from household surveys. They disagree, so both are reported and neither is averaged into the other. Source: EPRAS run 6b2afcf6 (report/build/data/t_oosc_sources.csv).

3.7 What the census replaced in this engine, and what it did not

Four things changed source. **Supply:** schools, learners, teachers, classrooms and stances by district and cycle now come from the census at 2025, measured for the counts and imputed for the two ratio-derived quantities. **The projection's seed year:** gate G8, which requires the flow model's seed-year grade totals to reconcile within two per cent of the counted enrolment, reconciles at 11,126,447 against 11,126,447 — 0.0 per cent (Table 3.17). **The public–private split:** previously carried from 2017 and, for secondary teachers, imputed by enrolment share; now counted at every level. **The out-of-school estimate:** previously anchored to the UIS national rate and distributed by inverse gross enrolment ratio; now computed from counted district attendance under Equation (3.5). Reaching that agreement required the district intake and transition rates to be recalibrated: the intake factor has a mean of 0.996 across the 135 districts, the transition factor a mean of 1.309.

Two things did **not** change, and the distinction is the heart of the revised data position. The census publishes learners by class nationally but not enrolment by grade and district: it gives the stock of a system, not its movement. So the **grade profile within a cycle** and the **flow rates** — intake, progression, repetition, dropout and re-entry — still come from the 2016 and 2017 Statistical Abstracts, extracted by `scripts/extract_emis_abstracts.py`, whose reconstructed national totals reproduce the UIS series exactly at 8,840,589 primary learners and 207,238 primary teachers in 2017, 8,655,924 primary learners in 2016 and 778,349 primary repeaters in 2017. A single-year census cannot produce a transition rate, because a transition is a comparison of two years. SRC_EMIS_VINTAGE, formerly this report's central warning, accordingly now reads *superseded*, scoped to exactly those two quantities (Table 3.16).

It follows that the base year remains a projection. The run's base year is 2026 and the census counted 2025, so base-year enrolment of 12,587,192 learners, of whom 6,856,121 are in government schools, is a one-year projection flagged imputed wherever it appears — not an observation of 2026.

3.8 The other sources, as supporting evidence

Sub-national population still comes from the UBOS dataset `cod-ps-uga` (reference year 2022), graduated to single years of age, projected by cohort component and raked with a maximum factor of 1.0369 — with supply counted, the weakest term in every rate here.

School point layers and the historical register. The Africa Education GIS Database supplies 34,652 school points from the OpenStreetMap education layer, 34,646 of them inside a district polygon, with 81,746 settlement points and the settlement-to-nearest-school links behind the access statistics; OCHA's boundaries supply the 135 district polygons and P-codes, and an independent HOTOSM (HOT 2026) export 26,496 points by amenity tag (Table 3.9). That the two OpenStreetMap-derived layers differ by some eight thousand points no longer matters, because neither is used as a count: the census counts the schools, the points locate them, and location is what EM-04's access calculation and EM-07's siting model need (Figure 3.1, Figure 3.2). The SDI register adds 21,193 records by ownership (Table 3.10); its `EMIS_DATA_` field reads 2004, so its capacity columns are never read as current supply.

Survey series. The indicator store holds 1,619 Uganda observations from four sources (Table 3.11). These are measured, but of a different object — a sampled household, not an enrolled learner — so they are reported beside the census and never merged into it, and the plan takes **aggregates** only, the DHS (DHS Program 1995-2025) terms of use forbidding redistribution of record-level files. Table 3.12 is the long view, and its lesson is that Uganda has not struggled to get children into P1 — gross primary enrolment has exceeded one hundred per cent throughout — but to keep them to P7, primary completion having fallen between 2003 and 2017. The census's 2,433,566 over-age primary learners are the mechanism.

Budget workbooks and prices. The FY2025/26 MoFPED workbook supplies the local-government education conditional grants at item level — primary wage 1,029.8 bn UGX, secondary wage 870.3 bn, the non-wage and development lines beside them — the envelope EM-08 allocates and the anchor for the payroll teacher count; nine workbooks give a longer central-government series, *excluding* those grants, whose education share ends at 3.1 per cent (Table 3.13, Figure 3.3). The price vintage UGA-2026 holds 26 published policy and engineering rates in constant UGX with source and page (Table 3.14), from the MoES Planning, Budgeting and Implementation Guidelines of 2022 and the Ministry of Public Service salary structure for FY2025/26; the tier is **normed**, the salary figures are flagged `transcribed_from_scan`, and capitation is nominal.

Household cost evidence. The plan's unit cost is 363,969 UGX per public primary learner-year in this run, 68 per cent of it salary: the state's share of a learner-year, not the learner-year. Table 3.15 and Figure 3.4 put the household's side beside it, from the Uganda National Panel Survey 2019/20 education module — reported cost per learner-year by questionnaire item, **by item code and not by what the item buys**, the codebook labelling each `h4q15*` item not being held here. Two items carry 82 per cent of the total, the larger of them at a mean of 470,441 UGX against the 17,000 UGX of capitation the guidelines set per learner-year. Those amounts are in 2019/20 survey prices and must not be differenced against a constant-2026 unit cost; but with 42.8 per cent of primary learners in fee-charging private schools, the household is the larger financier of the learner-year.

Table 3.9: The independent OpenStreetMap school layer, by amenity tag

Amenity	Points
school	23865
kindergarten	2382
college	185
university	41
(not tagged)	23

HOTOSM Uganda education facilities, export of 2026-09-06 (ODbL, OpenStreetMap contributors): 26,496 points carrying district P-codes on the current district set. Source: EPRAS run 6b2afcf6 (report/build/data/t_hotosm_amenity.csv).

Table 3.10: The SDI school register by ownership

Ownership	N
Government	12388
Private	6567
Community	1989
Unknown	154
Other	95

Its capacity attributes date from 2004 and are loaded as a historical vintage, never as current supply. Source: EPRAS run 6b2afcf6 (report/build/data/t_sdi_register.csv).

Table 3.11: Survey and international series held for Uganda

Source Name	Indicators	Observations	First Year	Last Year
dhs_education	28	163	1995	2024
uis_sdg4	25	472	2000	2025
unicef_sdmx	20	110	2014	2018
worldbank_edstats	38	874	2000	2025

AEGDB indicator store: UIS SDG4, World Bank EdStats, DHS (aggregates only, never microdata) and UNICEF SDMX. Source: EPRAS run 6b2afcf6 (report/build/data/t_survey_sources.csv).

Table 3.12: Uganda education indicators, World Development Indicators

Year	Gender Parity Index, Primary	Gross Enrolment, Primary (%)	Gross Enrolment, Secondary (%)	Primary Completion Rate (%)	Pupil-Teacher Ratio, Primary
2000	0.93	130			59.43
2003	0.97	137		61.08	52.39
2006	0.99	120			49.05
2009	1	124		73.85	49.28
2012	1.01	114		55.51	48.8
2015	1.02	104			42.92
2017	1.03	106		53.31	42.66

World Bank WDI, edition 2026-06-30 (CC-BY-4.0). Gaps are years the WDI does not publish for Uganda. Source: EPRAS run 6b2afcf6 (report/build/data/t_wdi_trend.csv).

Table 3.13: The approved budget for education votes, by financial year

Financial Year	Education Votes	Education Bn	All Votes Bn	Education Share
2015/16	10	969	23,972	0.04
2016/17	13	1,288	26,360	0.05
2019/20	13	1,526	40,488	0.04
2020/21	13	1,633	45,494	0.04
2021/22	13	1,056	42,467	0.02
2022/23	14	1,699	43,096	0.04
2024/25	14	1,910	72,126	0.03
2025/26	14	2,079	70,976	0.03
2026/27	14	2,587	84,392	0.03

MoFPED approved-budget workbooks (AICTEM data estate). Education is the sum over central-government votes whose name identifies an education institution - the ministry, the public universities, the examinations board and the training institutions - across every funding line in the workbook. It is therefore a central-government total and does NOT include the local-government education grants that finance most of primary schooling; those are the envelope the plan allocates. The FY2021/22 workbook carries a narrower set of funding lines than its neighbours, which is why its total dips; read the series as a trend, not as nine audited outturns. Source: EPRAS run 6b2afcf6 (report/build/data/t_budget_series.csv).

Table 3.14: Prices in the pinned vintange

Input Code	Cadre Code	Unit	Price	Curr ency	Price Basis	Price Kind	Source
CAPITATION_UPE		learner_year	17,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_LEARNER)
CAPITATION_UPE_SCHOOL		school_year	1,350,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_SCHOOL)
CAPITATION_UPOLET		learner_year	270,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPOLET_GOV)
CAPITATION_USE		learner_year	175,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_USE_GOV)
CLASSROOM		room	52,711,605	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_CLASSROOM_2BLOCK)
CLASSROOM_SEC		room	82,021,551	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_CLASSROOM_2BLOCK_SEC)
DEO_FIXED		district_year	48,500,000	UGX	constant_2026	policy_rate	MoES LG Planning Guidelines 2022 p.19 (monitoring+inspection+top-up)
	DEPUTY_PRI	FTE_year	9,478,372	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	DEPUTY_SEC	FTE_year	22,253,682	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
DESK_3SEAT		desk	373,523	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_DESK_3SEAT)
FURN_SEC		place	390,124	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_CLASS_SET_SEC)
	HEAD_PRI	FTE_year	11,600,972	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	HEAD_SEC	FTE_year	30,498,494	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
INSPECT_SCHOOL		school_year	112,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_INSPECT_SCHOOL)
	LAB_TECH	FTE_year	29,040,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.17 midpoint x12 x(1+0.10 employer on-cost)
LATRINE_STANCE		stance	8,056,217	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25-26 (CAP_LATRINE_5)
MONITOR_SCHOOL		school_year	100,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_MONITOR_SCHOOL)
NEW_PRI_SCHOOL		school	842,625,718	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_PRIMARY_SCHOOL_NEW)
NEW_SEED_SCHOOL		school	1,065,207,900	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SEED_SCHOOL_PH1)
SCIENCE_BLOCK		unit	308,785,625	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SCIENCE_BLOCK)
TEACHER_HOUSE		unit	134,564,072	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_HOUSE_2UNIT_PRI)
	TEACH_PRE	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_PRI	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_ARTS	FTE_year	13,453,770	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_SCI	FTE_year	52,800,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
TEXTBOOK		copy	8,789	UGX	constant_2026	market_price	WB_P133780_PAD_2014 p.133 (MAT_TEXTBOOK_PRI)

Price vintage UGA-2026; all amounts constant. Source: EPRAS run 6b2afcf6 (report/build/data/t_prices.csv).

Table 3.15: What a household reports paying for one learner in a year, by cost variable

Variable	Households Reporting	Mean UGX Per Year	Share Of Total
h4q15g	6087	470,441	0.57
h4q15h	5572	203,791	0.25
h4q15c	5944	41,492	0.05
s4h15f	3526	41,003	0.05
h4q15e	632	21,120	0.03
h4q15d	1128	14,307	0.02
h4q15b	2850	13,788	0.02
h4q15j	3429	8,778	0.01
h4q15i	1573	7,544	0.01
h4q15k	12	113	0

Uganda National Panel Survey 2019/20 (LSMS-ISA), education module, individuals with a reported schooling cost. The variables are the questionnaire's own item codes (h4q15*): the codebook that names each item is not held on this system, so the items are not labelled here. This is the household's side of schooling, which the plan's normative unit cost does not include. Source: EPRAS run 6b2afcf6 (report/build/data/t_household_cost.csv).

Government primary schools

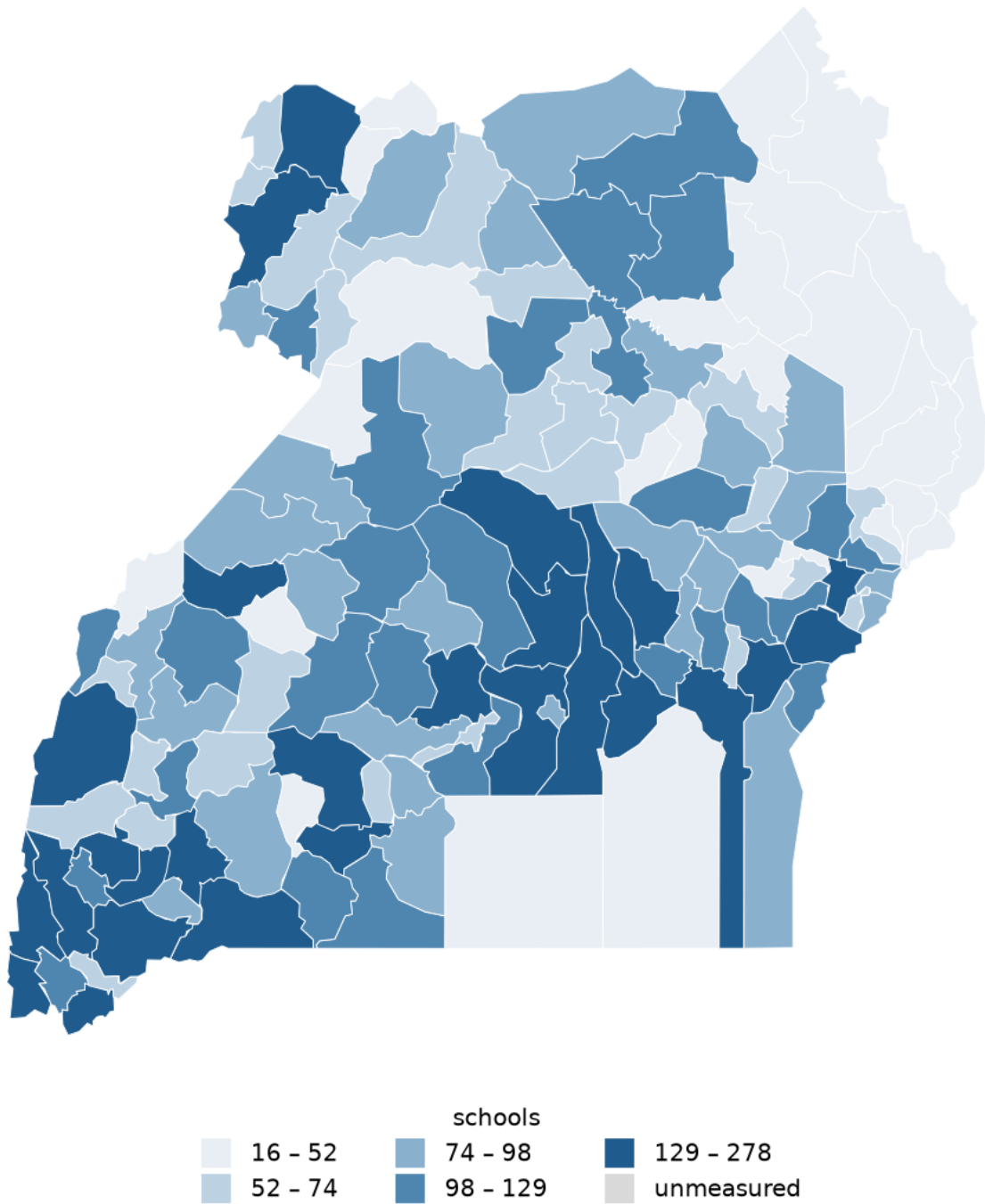


Figure 3.1: Government primary schools by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Children beyond the 3 km walking norm

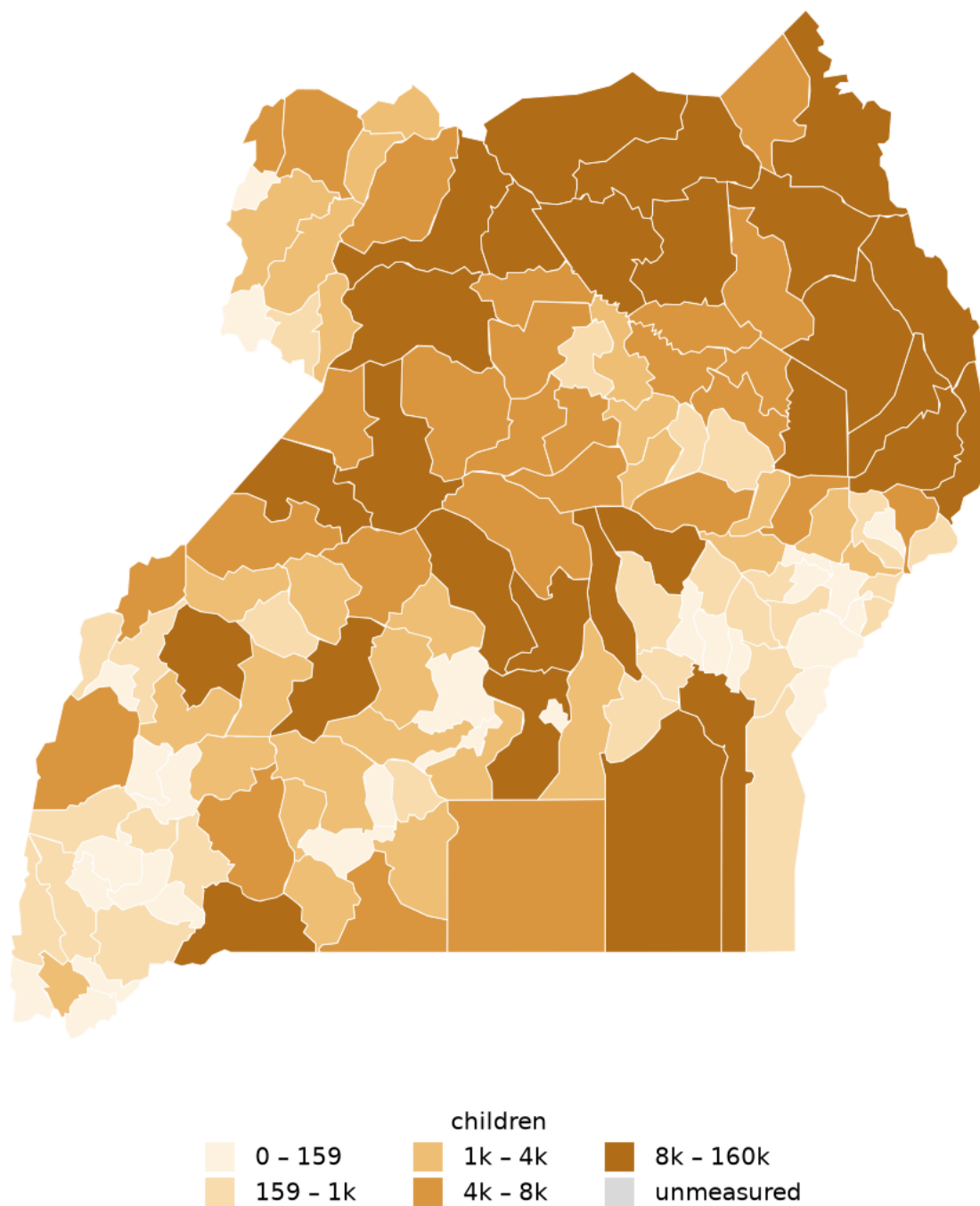


Figure 3.2: Children beyond the 3 km walking norm (children), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

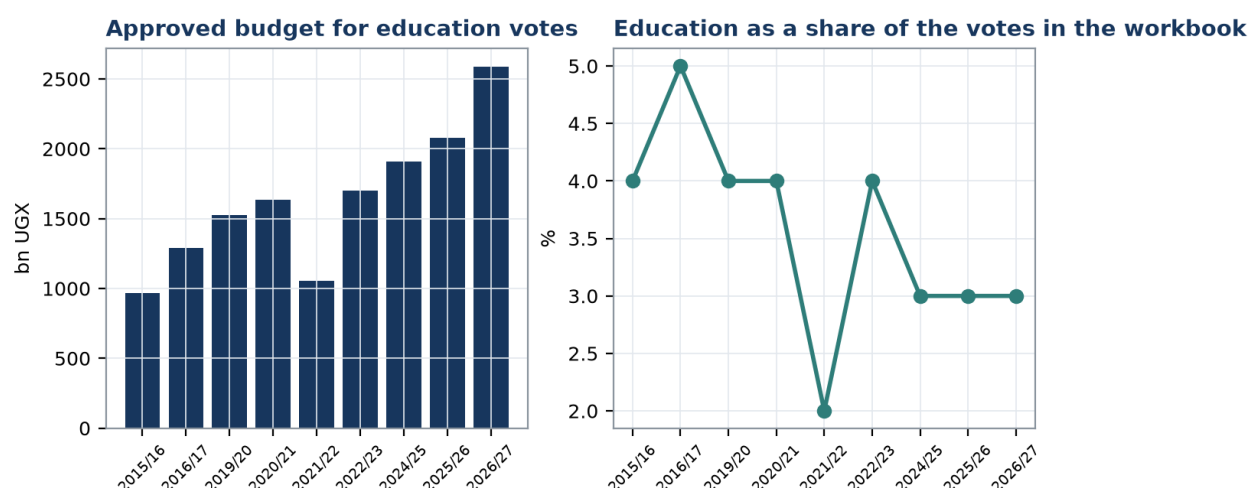


Figure 3.3: Approved budget for education votes, and its share

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

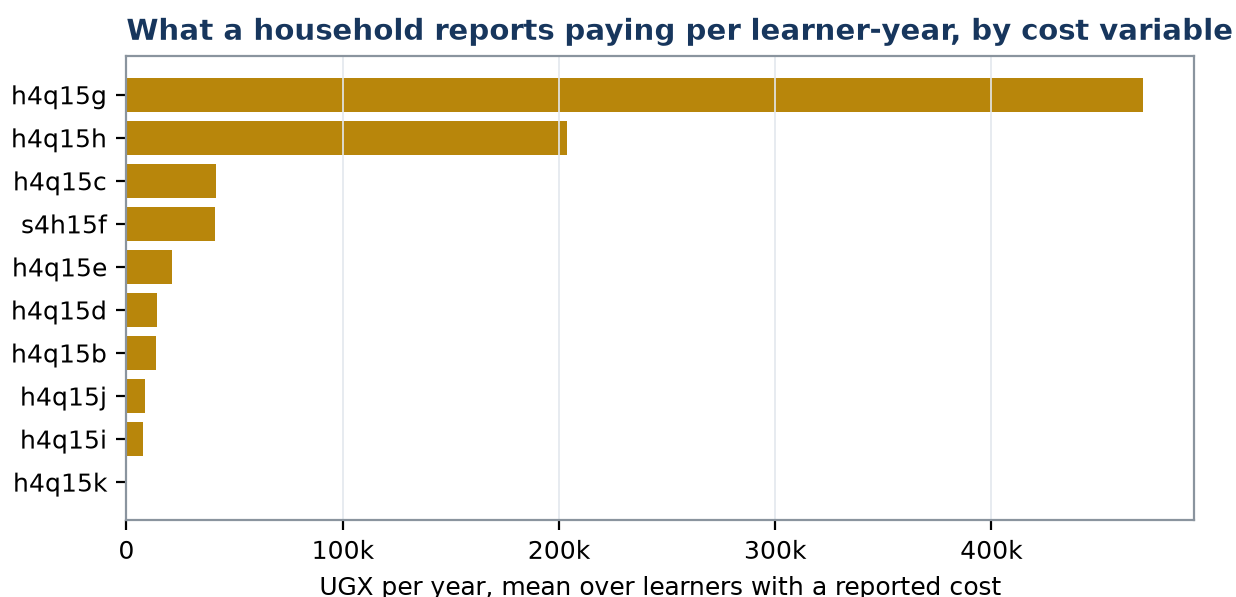


Figure 3.4: What a household reports paying per learner-year, by cost variable

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

3.9 Data quality and the gates

The `data_quality` table now holds eight findings (Table 3.16), four of them raised by the census. `SRC_EMIS_VINTAGE` survives as *superseded*, and `SRC_PTR_2017` as a rejection: the 2017 abstract's primary pupil–teacher ratio annex correlates 0.28 with the ratio implied by that abstract's own tables.

Eleven pre-run gates ran, nine passed and two were waived by name (Table 3.17). **G2** requires an EMIS response rate of at least 0.80 per district and is waived because none is recorded on any of the 7,020 enrolment cells — a census is an enumeration rather than a return, but it publishes no coverage diagnostic either, so the gate cannot be satisfied and is waived rather than redefined. **G9** is waived because UGA-EPRAS-2026-DRAFT is a draft whose review has not been held, 64 of its 99 coefficients being seeded *assumed*. The run carries the status *draft*.

Table 3.16: Data-quality findings recorded against this run

Check Code	Severity	Subject	Detail
SRC_PTR_2017	warning	MoES Abstract 2017, primary annex VIII PTR	published district PTR correlates 0.28 with enrolment/teacher-count tables and ranges 1-532; column rejected, teachers taken from the qualification annex (reconciles to UIS 207,238)
SRC_EMIS_VINTAGE	warning	EMIS district data	superseded: the Baseline Education Census 2025 now supplies district-level schools, learners, teachers and attendance. The 2016 and 2017 abstracts remain the only source for the grade profile within a cycle and for the flow rates, so those are still carried from 2017
SRC_ACCESS_EUCLID	warning	accessibility	straight-line settlement-to-school distance on OSM layers; no friction surface; settlement points unweighted by population for 98% of settlements
SRC_SEC_TEACHERS	note	secondary teachers 2017	grand total per district from the qualification annex; gov/private split by enrolment share
SRC_BEC_2025	note	UBOS Baseline Education Census 2025	first nationwide census of government and private schools, reference year 2025, published May 2026; supplies measured schools, learners, teachers, classrooms, stances and net attendance by district and supersedes the 2017 abstracts as the engine's supply and seed
SRC_BEC_RATIO_DERIVED	note	census classrooms and stances	published by district as pupil-classroom and pupil-stance ratios rather than counts; derived per census unit before aggregation and raked to the published national totals, so the counts are imputed from measured ratios
SRC_BEC_CITY_FOLD	note	census geography	the census reports 146 units; ten cities and Terego are folded into their parent districts to match UGA-UBOS-2022, and every unit's rule is recorded in bec_district_crosswalk
SRC_BEC_WASH	note	school water, hygiene and waste	the census counts schools by drinking-water source, by functional hand-washing facility and by waste disposal, at pre-primary, primary and secondary; these are loaded as counted into bec_facilities and reported, but no capital standard exists for them in this engine, so they are not costed and not part of any gap dimension
SRC_BEC_ORIGIN_INTERNAL	note	census table 3.5A, learners by country of origin	its split of primary learners by sex differs from annex 3.A4's by 4,612 while the grand total agrees exactly, so the origin detail is used only for the distribution across countries and never for a sex split. In table 4.7A one row (Dubai) reached the extractor a field short and was restored from the table's own total row, the residual placing the missing cell uniquely; after that repair the country rows sum to the printed total

Check Code	Severity	Subject	Detail
SRC_BEC_BOARDING_OWNERSHIP	note	census annex 3.A3, primary schools by day/boarding status	its government column totals 12,556 against the 12,557 of annex 3.A1: in Bunyangabu and Kileleshwa one school is government in 3.A1 and private in 3.A3, and in Kileleshwa the reverse. Every district total agrees in both annexes, so three schools are classified differently between two tables of the same census; the boarding shares are reported on 3.A3's own denominator and the difference is recorded rather than reconciled
SRC_BEC_T32_INTERNAL	note	census Table 3.2, primary schools by day/boarding status	the national row of that table allocates three private schools to 'day only' that both of its own partitions - urban plus rural, and the seventeen sub-regions - allocate to 'day and boarding'. The two partitions agree with each other and every total agrees, so the printed national row is the outlier; it is reported as published and not corrected
SRC_BEC_SUBREGION_ONLY	note	disability, nationality and support staff	learners with a disability, learners by nationality, non-teaching staff and secondary day/boarding status are published by sub-region and not by district; they are stored at that geography in bec_subregion and never apportioned to districts
SRC_OOSC_DIVERGENCE	warning	out-of-school children	the census attendance rates and the UIS survey series disagree materially at primary and lower secondary; both are reported, neither is averaged into the other, and each is labelled with what it is conditional on

Source: EPRAS run 6b2afcf6 (report/build/data/t_data_quality.csv).

Table 3.17: Pre-run data-quality gates, and what each one found

Gate	Requirement	State	Detail
G0	geography version resolves to districts	pass	135 districts in UGA-UBOS-2022
G1	population present for every district	pass	135 of 135 districts carry a population base
G2	EMIS response rate recorded per district and at least 0.80	waived	not recorded on any of 7020 enrolment cells - the abstracts publish no response rate
G3	every district has supply carrying a quality tier	pass	135 of 135 districts carry a tiered supply observation
G4	every norm line priced in the run vintage	pass	20 lines and 4 cadres priced
G5	education structure version validates	pass	UGA-7-4-2-LSC2020: 16 grades
G6	population, enrolment and schools on the pinned geography	pass	enrolment 135, supply 135, districts 135
G7	every service with required places has a resolvable norm	pass	16 grades resolved to place services
G9	norm version approved	waived	UGA-EPRAS-2026-DRAFT is draft; the ch.15 review has not been held
G8	seed-year reconciliation within 2% of the counted enrolment	pass	flow-model grades 11126447 against the Baseline Education Census 2025 11126447: 0.0%
G10	no NaN or Inf in any result table	pass	61 tables swept

A gate that the published data cannot satisfy is waived by name on an exploratory run, never skipped. Source: EPRAS run 6b2afcf6 (report/build/data/t_gates.csv).

3.10 The honest gaps, revised

The revised honest-gaps statement. The census closes three gaps this report has carried since its first edition. There is now a **district-level count of Uganda's schools after 2017**, government and private alike, so supply, the public–private split and the projection's seed year are measured rather than projected. **Age within class** is published, so net attendance, over-age analysis and an attendance-based out-of-school estimate come from the administrative source instead of a household survey. And **secondary classrooms by district** are recoverable from the published ratio, so secondary capacity is no longer teacher-bound by default.

Seven gaps remain, and in each the engine does something explicit, flags it, and reports the affected quantity as unmeasured rather than filling it from a norm. The reason is arithmetic: an engine that fills a missing classroom count from the classroom norm compares the requirement with itself and returns a gap of zero where the data is worst, which is where the gap is largest.

One sentence of the old statement still holds: no number here is an observation of 2026, the base year being a one-year projection from the 2025 count.

1. No grade-level enrolment by district. The census publishes learners by class nationally and by district only in cycle totals, so the grade distribution within a cycle, and the flow rates that move learners through it, still come from the 2016 and 2017 abstracts. Only two consecutive census rounds can close this.

2. No payroll or TMIS extract. Teachers in post are now counted — 109,606 in government primary schools — but the payroll count is still the wage bill divided by the average scale cost, giving 137,247, a difference of 27,641 (Figure 3.5). Both are reported side by side rather than reconciled, and established posts are reported **missing**. The census has reversed the sign of this finding: against the 2017 register the payroll count was the smaller, against a complete enumeration it is the larger — a finding about two data systems, not about the workforce.

3. Teacher qualification is not in the census. The 2017 abstract published primary teachers by qualification and the census does not, so the trained share is carried forward from 2017 as a *share* rather than a count and flagged on every row: a share moves far more slowly than a stock, and reporting nothing would delete the only evidence held on the qualification gap. Secondary subject qualification is in the same position, so that gap is requirement-only.

4. District learning data stops at 2013. No current district assessment is held, and the Uwezo (Uwezo 2013) 2013 district samples are small, so learning is modelled nationally from the UIS SDG 4.1.1 series for 2013 and no district is ranked on learning outcomes. The census counted institutions, learners and facilities; it did not test a child.

5. Straight-line accessibility. Walking distance is Euclidean settlement-to-nearest-school distance on OpenStreetMap layers, with no friction surface and settlement population missing for 98 per cent of points, so coverage is weighted by settlement count rather than by children. The result — 94.6 per cent of settlements within 3 km and 726,951 children beyond the norm (Figure 3.2) — is optimistic in hilly and poorly-roaded districts, under SRC_ACCESS_EUCLID.

6. Classrooms and stances are ratio-derived. They are the one part of the census supply that is not a count: recovered per unit from a rounded ratio, raked to the published national total, tiered *imputed*, and absent for the four districts whose secondary ratio row was rejected.

7. Desk and textbook stock, and land tenure. Stocks are not published by district, so the material gaps are **requirement-only**; the 26 sites EM-07 proposes are settlement centroids carrying the provenance string *land not verified*; and teacher college output is not held, so the pipeline runs on an assumed 12,000 graduates a year at 60 per cent public absorption.

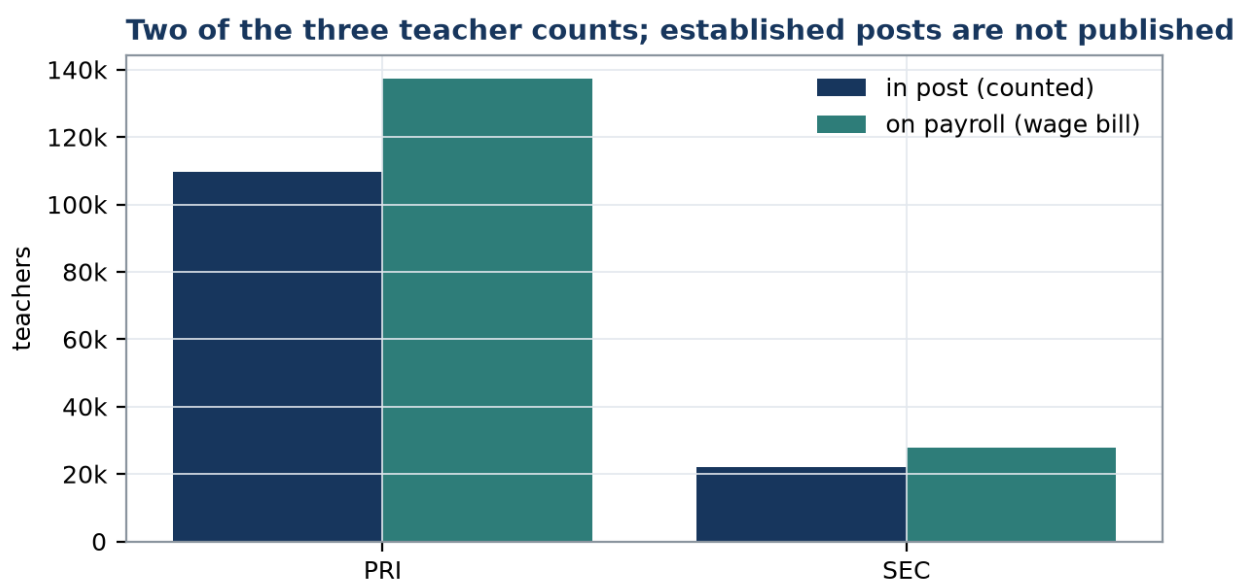


Figure 3.5: Two of the three teacher counts; established posts are not published

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

3.11 Implications for planning

A census is an expensive instrument and one round of it yields a stock. Its value multiplies on the second round, when the same instrument on the same frame yields every flow rate this engine still imports from 2017. The most valuable thing the Ministry and UBOS can do with this census is schedule the next one; the second is to publish the district-by-grade table it already holds, closing the first remaining gap with no new collection.

Over-age enrolment, not absence from school, is now demonstrably the central participation problem. The adjustment factor of 2.5857, and the 2,433,566 primary learners aged 13 and over behind it, say what Uganda's adolescents are doing. Classroom construction addresses children who cannot find a place; late entry, repetition and progression addresses these.

The quality tiers remain the instruction manual, and now say something different. Quantities resting on counted census data — schools, learners, teachers, the ownership split, district attendance — are sound for planning at district scale. Quantities resting on imputed derivation — classrooms and stances, single years of age, the projection to the base year, the district distribution of the survey out-of-school rate — are sound as magnitudes and unsound as counts: they support the statement that a district needs thousands of additional places, not a particular number. Quantities resting on assumed coefficients, 64 of the 99 in the norm set, support a comparison between scenarios and no individual decision until the norm review is held.

Last, the disagreement this chapter refuses to resolve. Two defensible measures put the number of primary-age children out of school at 2.47 million and at 753,000, which changes the size of the programme by a factor of three. Both are carried, labelled; the way to earn a single number is a coverage diagnostic and a current survey round, not a weighted average of two estimates on different populations. Every gap named here carries what the engine did instead and the flag it raised, and every flag is visible in the output tables.

CHAPTER 4

4 EM-01 Population and school-age cohorts

Every number in this report is, in the end, a multiple of a count of children. Places, classes, teachers, textbooks, classrooms, the recurrent bill and the capital programme all begin with how many people of a given single year of age live in a given district in a given year. EM-01 answers that question, and because it sits first in the chain an error here propagates undamped through the nine modules that follow. This chapter sets out where the population comes from, what the engine does to it, what the result says about Uganda's school-age cohorts, and what the engine does not know about them.

The demand education places on demography is sharp in one respect and narrow in another. Sharp, because a grade is an age and grade-age analysis cannot be done on five-year bands. Narrow, because the engine needs only the ages from two below the lowest entry age to five above the highest official age. EM-01 buys single years of age at the price of a graduation assumption, and says so on every cell it writes.

4.1 The census base

The base is the Uganda Bureau of Statistics sub-national population for the 2022 reference year, distributed through the OCHA Common Operational Dataset (`cod-ps-uga`) and recorded in `data/SOURCES.md` as `UGA_UBOS_CODPS_2022` under a CC-BY licence. It gives population by five-year age band, sex and district for the 135 districts of the pinned geography version `UGA-UBOS-2022`, in seventeen bands from 0–4 to an open band at 80 and over. Its national total, 46,210,758 persons, anchors the whole system.

That choice has a visible consequence. The UBOS 2022 total is below the UIS (2025)/UN series, which puts Uganda at 50.7 million in 2025 (`data/SOURCES.md`). The engine anchors to UBOS anyway, on the principle that a planning model which disagrees with the national statistics office's own published population is dismissed on sight. Every per-capita quantity here is therefore computed on a denominator conservative relative to the international series, and where the two are compared the difference is one of population estimate, not of education performance.

The rates that drive the roll-forward are a small pinned parameter set: a total fertility rate of 4.283 births per woman, an infant mortality rate of 0.0276 and national population growth of 2.75% a year, all from the UIS demographic series; a sex ratio at birth of 1.03 from UDHS 2016; age-specific fertility for the seven groups from 15–19 to 45–49, being the UDHS 2016 shape rescaled to the UIS total fertility rate; and survivorship as three broad coefficients normed against a model life table for a life expectancy of 68 years. Fertility, mortality and growth are tiered measured, the survivorship coefficients and the ASFR shape imputed.

4.2 Graduating banded counts to single years

Census tabulations published in five-year bands cannot be used as they stand. The engine graduates them with a monotone cubic Hermite interpolation (Fritsch–Carlson PCHIP) applied not to the band counts but to their cumulative sum, which guarantees a non-negative result:

$$C_b = \sum_{j < b} N_j \quad , \quad \hat{C}(a) = \text{PCHIP}(x, C) \quad (4.1)$$

$$P_a = \max(\hat{C}(a+1) - \hat{C}(a), 0) \quad , \quad a = 0, 1, \dots, 89 \quad (4.2)$$

where

- N_b is the published count in band b , for one sex in one district;
- x_b is the lower edge of band b ; the open band at 80 and over is closed at age 90, spreading its members across ages 80 to 89;
- C_b is the cumulative population below x_b , so C is non-decreasing;
- $\hat{C}$ is the monotone Hermite interpolant of that cumulative curve, evaluated at every integer age;
- P_a is the graduated count at single year of age a .

Monotonicity is the whole point: the first difference of a non-decreasing interpolant cannot be negative, so no age receives a negative population. The cost is that the graduated series is smooth by construction and cannot reproduce genuine irregularity in the single-year profile, because the information that would reveal it was destroyed when the bands were published. Check V6 — no single age exceeding the mean of its neighbours by more than 15% — therefore passes trivially, and is not evidence that the age structure is well behaved.

4.3 Age heaping, and why the index is close to 100 by construction

Age heaping at digits 0 and 5 is severe in census enumeration across the region and lands precisely on the entry age. The specification requires a Whipple index for the base year, a value above 110 raising a data-quality note. The engine computes it on the classical adult range, 23 to 62:

$$W = 100 \times \frac{5 \sum_{k=5}^{12} P_{5k}}{\sum_{a=23}^{62} P_a} \quad (4.3)$$

where

- P_a is the graduated population at single age a , both sexes, one district;
- the numerator takes the eight ages in the range divisible by five (25, 30, ..., 60) and scales them by five;
- $W = 100$ means no digit preference; $W > 100$ means heaping on 0 and 5.

Table 4.1 lists the fifteen highest district values and Figure 4.1 plots the twenty highest. The highest in the country is 100.0, in Kayunga, Kapchorwa, Buyende and Kaberamaido; the rest of the leading group sits at 99.9 or 99.8. Nothing exceeds 100, let alone the threshold of 110.

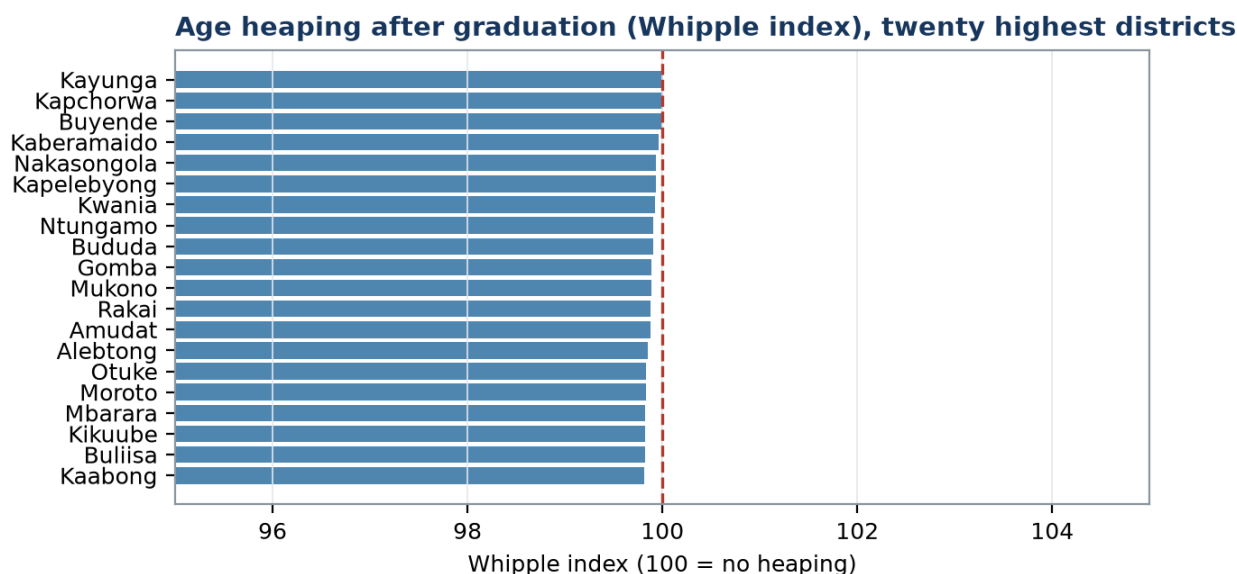


Figure 4.1: Whipple index of age heaping in the graduated single-year population, the twenty highest districts

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 4.1: Age heaping in the graduated population: the fifteen highest Whipple indices

District ID	Whipple
Kayunga	100
Kapchorwa	100
Buyende	100
Kaberamaido	100
Nakasongola	99.9
Kapelebyong	99.9
Kwania	99.9
Ntungamo	99.9
Bududa	99.9
Gomba	99.9
Mukono	99.9
Rakai	99.9
Amudat	99.9
Alebtong	99.8
Otuke	99.8

Whipple is computed on the graduated series; PCHIP graduation is monotone, so values near 100 are expected. Source: EPRAS run 6b2afcf6 (report/build/data/t_pop_heaping.csv).

This is not a finding about Uganda's census. It is an artefact, and the source code says so in the comment on the function: the index is computed on the already-graduated series, and PCHIP graduation is monotone, so values near 100 are expected. The UBOS file was published in bands, and the single-year heaping the index exists to detect was averaged away before the engine saw the data. Check V9 therefore passes without telling us anything, and even at face value the diagnostic covers ages 23 to 62, entirely outside the education band of 3 to

1. Age heaping in the school-age range has not been measured; it has not been found absent.

4.4 The cohort-component roll-forward

From the graduated 2022 base the engine ages each district's cohorts forward one single year of age at a time to the end of the horizon in 2030, and reverse-survives them back to 2017, the year of the school census that still supplies the grade profile and the flow rates. For district d , sex x and single age a :

$$P_{a+1, x, d, t+1} = P_{a, x, d, t} \cdot s(a) \quad , \quad P_{89, x, d, t+1} = P_{88, x, d, t} \cdot s(88) + P_{89, x, d, t} \cdot s(89) \quad (4.4)$$

$$B_{d, t} = \sum_{a=15}^{49} P_{a, F, d, t} \cdot f_{g(a)} \quad , \quad P_{0, F, d, t+1} = B_{d, t} \cdot \frac{1}{1+\sigma} \cdot (1 - 0.7 q_0) \quad (4.5)$$

where

- $s(a)$ is the one-year survivorship ratio: 1 – q_0 at age 0, 0.992 for ages 1–4, 0.997 for 5–24, 0.994 for 25–49, 0.985 for 50–69 and 0.93 above that;
- q_0 is the infant mortality rate, 0.0276;
- B is births in the district-year, f the age-specific fertility rate and $g(a)$ the fertility group containing age a ;
- σ is the sex ratio at birth, 1.03, so the female share of births is $1/(1+\sigma)$;
- the open group at 89 absorbs its own survivors; the backward step divides by the same $s(a)$.

Two properties of the implementation matter more than the algebra. The first is that the rates are national: the manual asks for district ASFR and survivorship shrunk towards the regional mean, but the engine applies one fertility and one survivorship schedule to all 135 districts. Every difference between districts in the projected series therefore comes from the shape of their 2022 age pyramid and from nothing else.

The second is that net internal migration is set to zero, by design and not by oversight. The factor trace records it explicitly — district migration = 0.0 persons, source "not modelled — weakest datum (manual ch.03)", tiered assumed — so that every district-year carries the note. This is the largest known weakness in EM-01, and it is education-specific: child movement is dominated by two flows a residual estimate handles badly, rural-to-urban family migration and children sent to relatives in order to attend a particular school. The latter is invisible in migration statistics and shows up only as an unexplained enrolment surplus in the receiving district, which EM-02 measures and EM-01 does not pretend to have predicted.

4.5 Reconciling district series to the national path

District projections must sum to the national projection. The engine builds that path from the census total compounded at the UIS growth rate and rakes the district series to it each year:

$$N_t = N_{t_0}(1 + g)^{t-t_0} \quad , \quad r_t = \frac{N_t}{\sum_d \sum_a \sum_x P_{a,x,d,t}} \quad (4.6)$$

$$P_{a,x,d,t}^* = r_t \cdot P_{a,x,d,t} \quad (4.7)$$

where

- $N_{\{t_0\}}$ is the 2022 census (UBOS 2023) total of 46,210,758 persons, t_0 being 2022;
- g is the national growth rate, 0.0275, and r_t the raking factor in year t ;
- P^* is the reconciled population written to the results table.

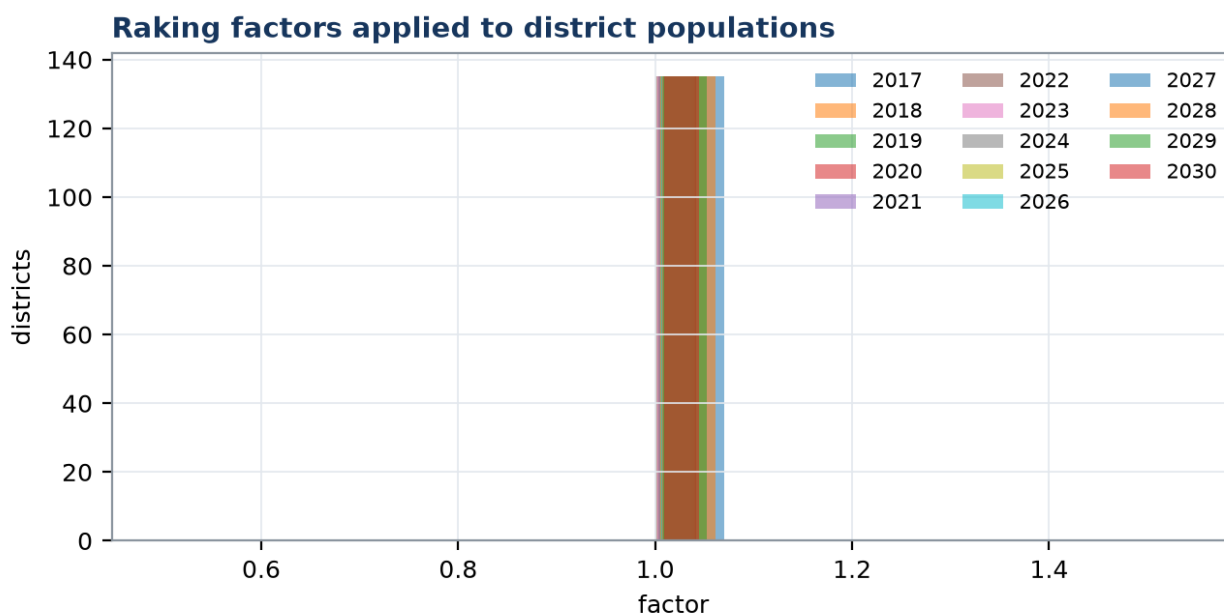


Figure 4.2: Raking factors applied to district populations, one national scalar per year

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 4.2: Raking factors applied to reconcile district population to the national projection

Year	Raking Factor
2017	1.037

Year	Raking Factor
2018	1.028
2019	1.019
2020	1.011
2021	1.004
2022	1
2023	1.002
2024	1.004
2025	1.005
2026	1.006
2027	1.007
2028	1.008
2029	1.008
2030	1.009

A factor far from 1.0 is a finding about the district series, not a correction to be hidden. Source: EPRAS run 6b2afcf6 (report/build/data/t_pop_raking.csv).

Table 4.2 reports the factor for every year and Figure 4.2 shows its distribution. It is 1.000 in the census year by construction, rises to 1.037 in the back-cast year 2017 — the largest in the run, recorded in the run facts as 1.0369 — and drifts upward through the projection from 1.002 in 2023 to 1.009 in 2030, all well inside the $\pm 5\%$ tolerance of check V8. The forward drift says that the component model, with these parameters and no international migration, generates natural increase slightly slower than the 2.75% headline rate.

Figure 4.2 looks odd, and the reason matters: it is a histogram of 135 districts per year, but in each year all 135 fall in one bin, so the chart is a single narrow column. The raking factor is a **single national scalar per year**, applied identically to every district, every single year of age and both sexes; it is not a per-district, per-age reconciliation. Check V1 as the manual states it — district sums equalling the national total for each single age — is therefore met only in aggregate, and each district's share stays frozen at the shape implied by its 2022 census pyramid. Factors near 1.0 tell us the national arithmetic is consistent; they say nothing about whether the district shares are right.

4.6 The planning groups

Education's planning groups are defined by the pinned education structure, not by a hard-coded list of ages.

Table 4.3: The education structure this run is pinned to

Cycle Code	Cycle Name	Isced Level	Entry Age	N Grades	Compulsory	Fee Free Policy	Terminal Exam
PRE	Pre-primary	0	3	3	0	0	
PRI	Primary	1	6	7	1	1	PLE
LSE	Lower secondary	2	13	4	0	1	UCE
USE	Upper secondary	3	17	2	0	0	UACE

Structure version UGA-7-4-2-LSC2020. Grades, entry ages and durations are data, never code. Source: EPRAS run 6b2afcf6 (report/build/data/t_structure.csv).

Table 4.3 sets out the structure this run uses, version UGA-7-4-2-LSC2020: pre-primary entering at age 3 with three grades, primary at 6 with seven, lower secondary at 13 with four and upper secondary at 17 with two. From it the engine derives the age ranges directly:

$$S_{c,d,t} = \sum_{a=e_c}^{e_c+n_c-1} P_{a,d,t}^* \quad , \quad E_{c,d,t} = P_{e_c,d,t}^* \quad (4.8)$$

where

- e_c is the entry age of cycle c and n_c its number of grades, both read from the structure table;
- S is the cycle's school-age population, the net enrolment rate denominator;
- E is the population at entry age, the intake denominator EM-03 uses to seed grade 1;
- P^* is summed over both sexes unless a sex is requested.

For Uganda this gives ages 3–5 for pre-primary, 6–12 for primary, 13–16 for lower secondary and 17–18 for upper secondary, and each of the sixteen grades takes its official age from the same two fields. The base-year totals, as reported in the out-of-school table, are 10,920,035 children of primary age, 5,074,559 of lower-secondary age and 2,299,557 of upper-secondary age; the 2017 denominators, reverse-survived to the EMIS year, are 8,513,671, 3,960,601 and 1,710,081.

Two groups the manual specifies are not built as named accessors: the over-age band, the four years above each cycle's official range from which late entrants are drawn, and the 15–24 youth group for TVET and literacy planning. This matters for EM-02, which must handle over-age entry without a pre-built denominator, and the scale of that is visible in the intake rate: the gross intake rate into P1 in 2017 was 1.536, half again the population at entry age, which measures late and repeated entry rather than over-enrolment.

4.7 Where the children are

Figure 4.3 maps the primary school-age population by district in the base year and Figure 4.4 ranks the twenty largest. The distribution is extremely skewed: the top class of the map runs from 105,000 to 716,000 children, the bottom class starts at 7,000. Wakiso alone carries about 716,000 children aged 6–12, more than twice the 313,000 in Kampala, the two together roughly a tenth of the national primary-age population. Below them sit Yumbe, Kasese and Arua in the 190,000–215,000 range, then Mukono, Isingiro, Mayuge and Mubende between 157,000 and 171,000; at the other end Obongi has about 7,000 children of primary age and Kalangala about 12,000.

Primary school-age population

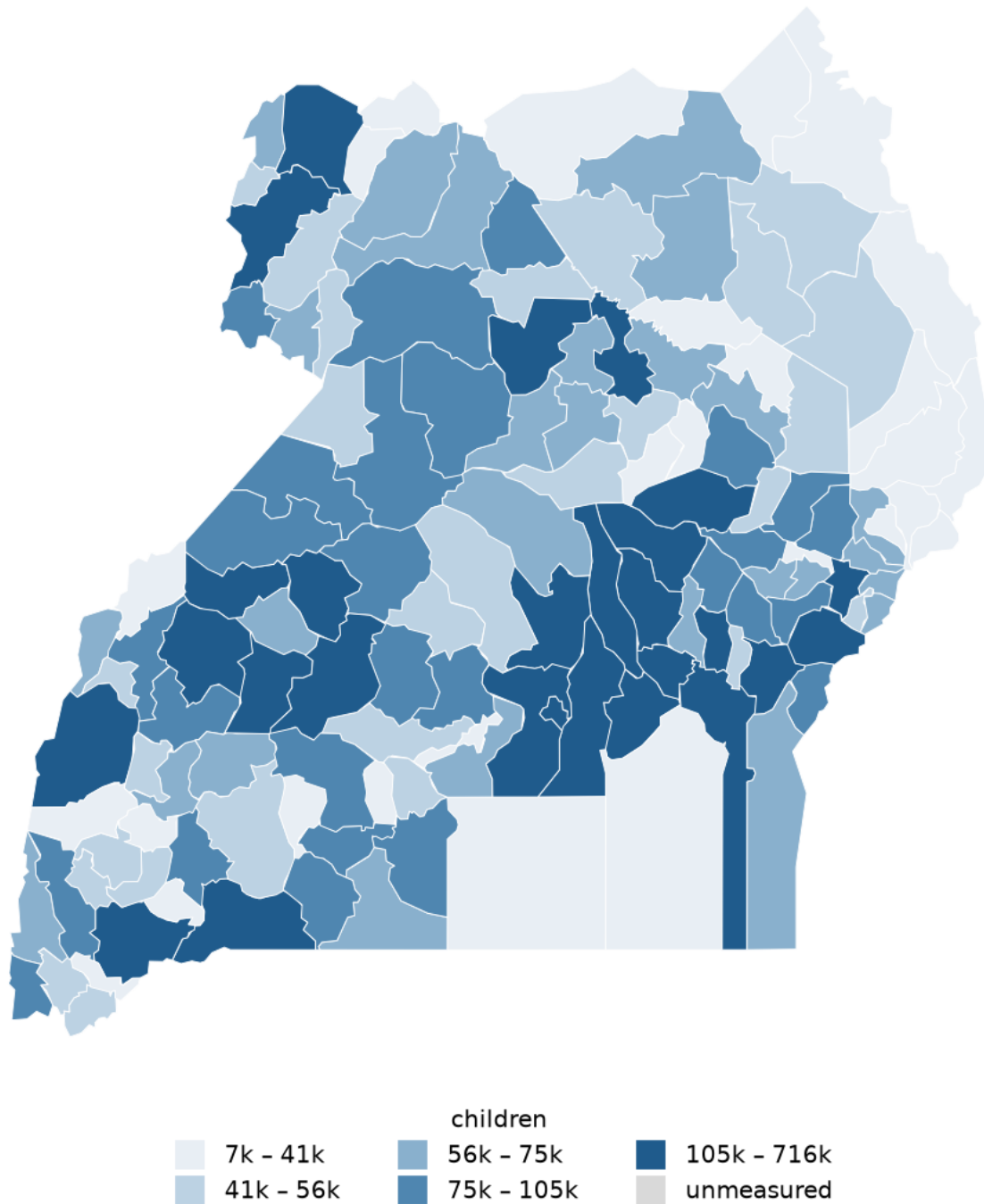


Figure 4.3: Primary school-age population by district, base year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

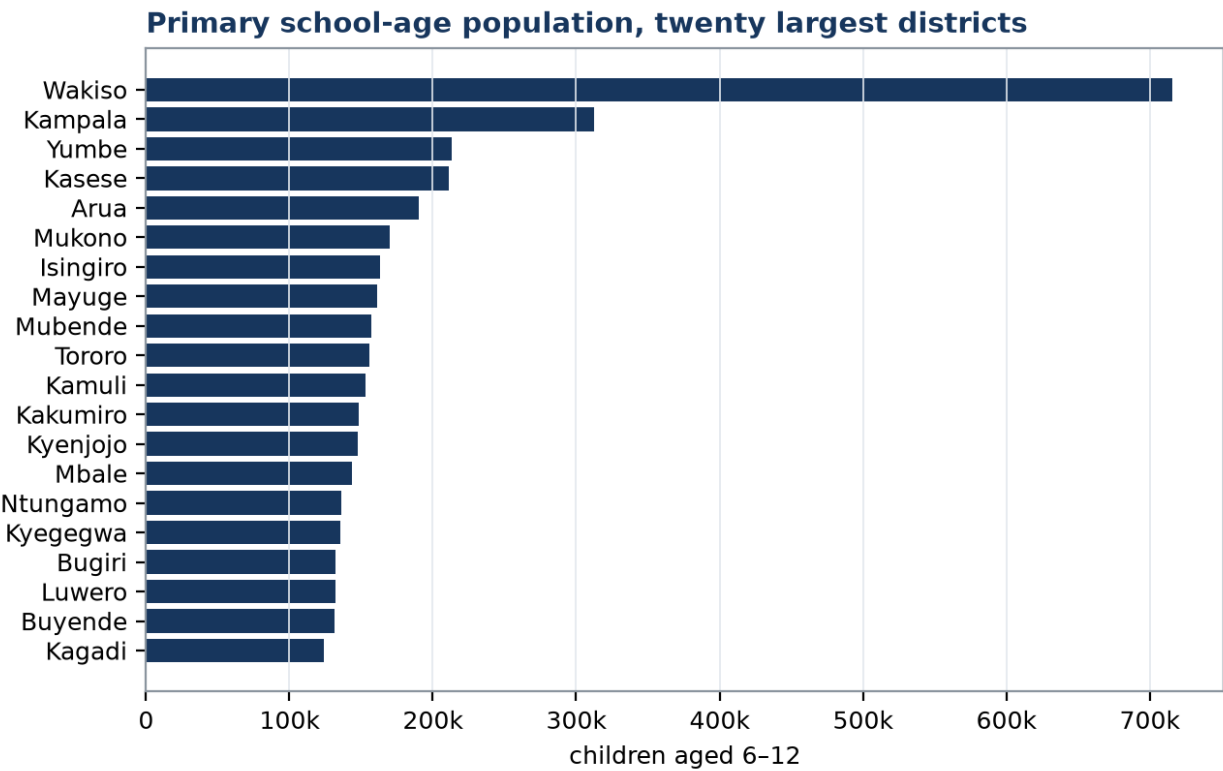


Figure 4.4: Primary school-age population, the twenty largest districts
Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

School-age children per km²

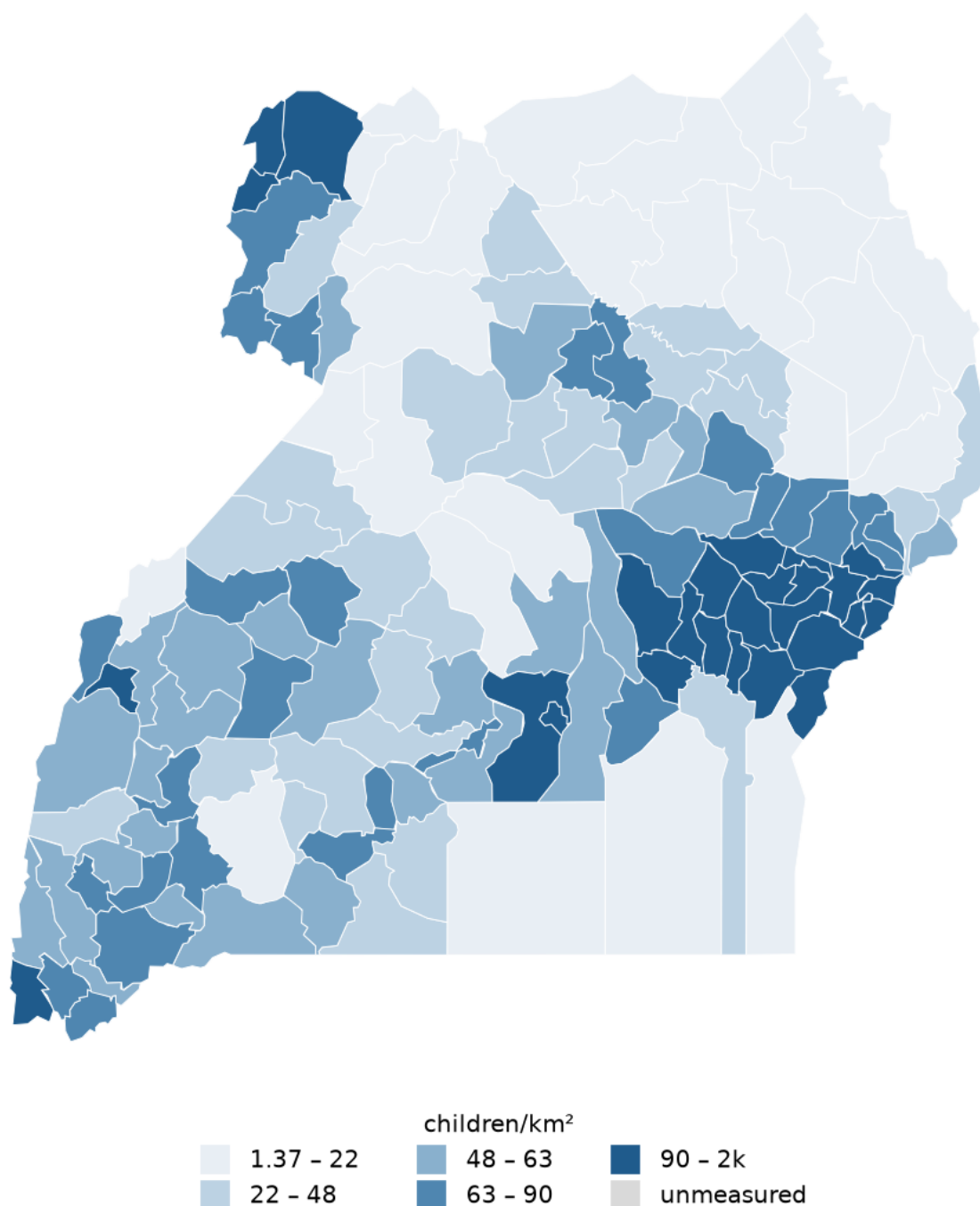


Figure 4.5: School-age children per square kilometre of district area

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 4.5 converts those counts to children per square kilometre and shows a different country. The dense belt is the east — Mbale at 272, with Namisindwa, Bududa, Manafwa, Budaka, Butebo and Sironko all above 160 children per km² — together with Kampala at about 1,579, Wakiso at 255 and the West Nile cluster around Yumbe. The sparse half is the cattle corridor and Karamoja, where Kaabong, Lamwo, Karenga and Obongi fall below 9 children per km², and the islands of Kalangala (1.4) and Buvuma (3.6) are sparser still. The two maps pull siting in opposite directions: the first says where the pupils are, the second whether a school can be filled from a catchment a child can walk. Density is a display quantity from the pinned OCHA boundary areas, never a planning input.

4.8 Where the growth is

Growth in school-age population to the horizon

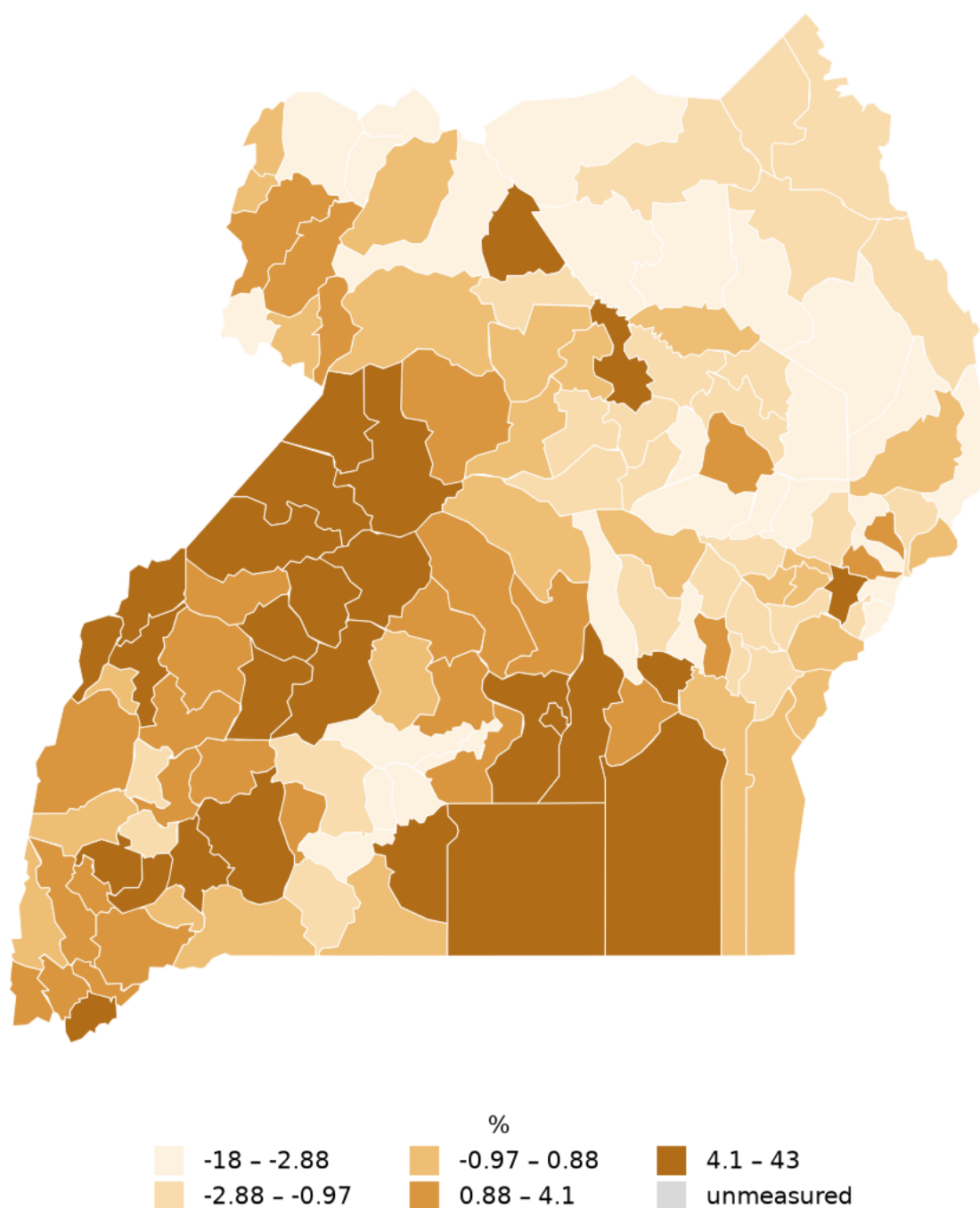


Figure 4.6: Growth in the primary school-age population between the base year and the horizon

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 4.6 shows the change in primary school-age population between the base year and the horizon. The national picture is near-stability in this age band over five years, the map's middle classes spanning roughly –1% to +4%, with a wide spread around it. The strongest growth is in Kalangala (+43.2%), Kampala (+39.6%), Wakiso (+22.2%), Mbarara (+15.5%) and Buvuma (+14.6%); the sharpest declines in Yumbe (–18.1%), Amudat (–10.6%) and Bulambuli (–7.1%).

This is where the zero-migration assumption bites hardest. Because migration is not modelled and the rates are national, none of that variation reflects movement of people. It is the echo of the 2022 age pyramid: districts whose 0–4 band was large in 2022 push a big cohort into ages 6–12 by 2030, and those whose 0–4 band was small relative to their 5–9 band lose school-age children as the larger cohort ages out. Kampala's +39.6% is a statement about the shape of its census pyramid, not a forecast of urban in-migration — and the true figure is very likely higher, because in-migration of children to the capital is real and is set to zero here. Yumbe's –18.1% is likewise an artefact of a refugee-hosting district rolled forward with national rates, not a forecast that West Nile's classrooms will empty.

Figure 4.7 carries the consequence downstream: enrolment on the target path rises across the horizon, primary moving from about 10.4 million to about 11.6 million learners. That increase is driven mainly by the participation targets of EM-02 and EM-03, not by demography, because the school-age population is close to flat in this window.

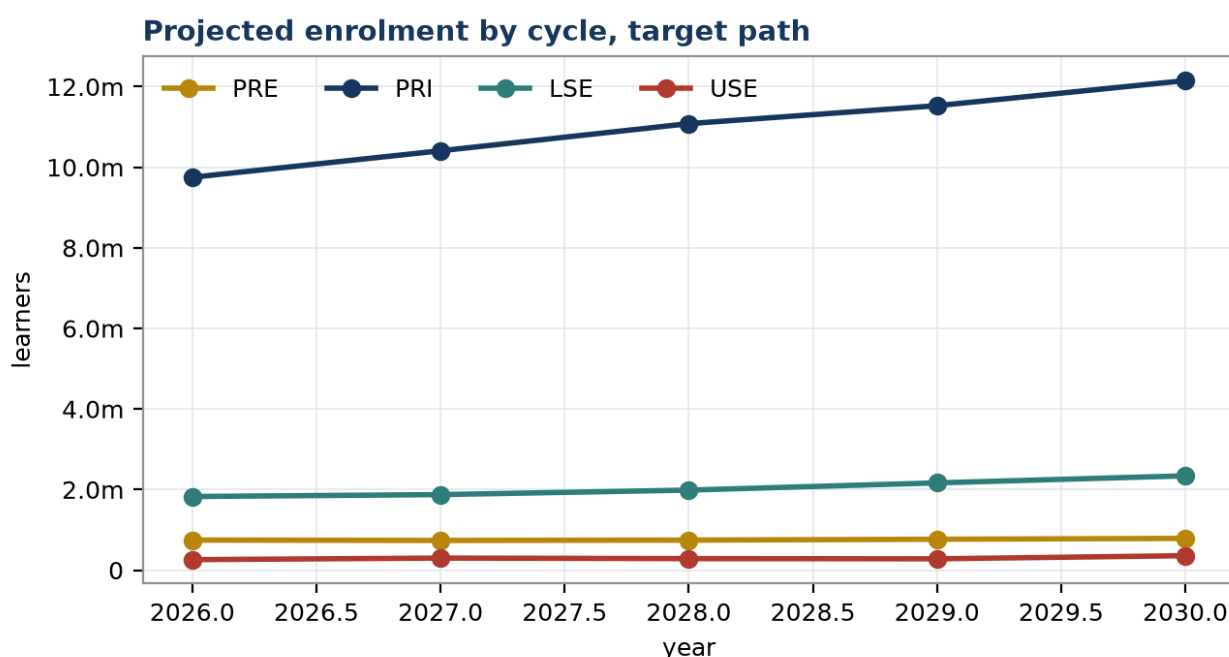


Figure 4.7: Projected enrolment by cycle on the target path, the demographic base carried downstream

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

4.9 What the engine does not disaggregate

The specification asks for four further dimensions on the population table. None is present in this run, and the report says so rather than assuming zero.

Urban and rural. The manual carries urban/rural as a share re-projected with a district urbanisation trend, because class-size norms, construction costs and walking distances all differ between them. The implemented table has columns for district, year, single age, sex, persons and quality — no urban flag, and no urbanisation trend is read — so every district is planned as one homogeneous space. Where Wakiso holds both a continuous extension of Kampala and genuinely rural sub-counties, that is material, and it flows into the siting and access work of EM-04 and EM-07.

Refugees and displaced persons. Uganda hosts one of the largest refugee populations in Africa, concentrated in a handful of districts, with a different age structure and largely partner-financed provision. No refugee layer is carried, and the consequence is visible in the district table of primary school-age population and enrolment in Annex C: Obongi records a gross enrolment ratio of 2.243 and Moyo 2.156, Madi Okollo 1.587 and Arua 1.571. Some of that is over-age enrolment, genuine and large in Uganda, but in West Nile the arithmetic also says that children are counted in the numerator whose existence the UBOS-based denominator does not record.

Nomadic and pastoralist populations. Conventional siting fails for mobile populations, but the census special enumeration that would identify them is not in the data pack. The Karamoja districts sit at the opposite extreme of the same table: Amudat at a gross enrolment ratio of 0.220, Nabilatuk 0.405, Nakapiripirit 0.416 and Kotido 0.565. Treating those as ordinary low-participation districts, to be fixed by building ordinary classrooms against an ordinary denominator, would be a planning error.

Learners with disabilities. Different staffing, materials and infrastructure norms apply, but the functional-difficulty module that would identify the population is not among the ingested sources, so it is reported as not disaggregated rather than assumed away.

4.10 Data quality

Every cell in the population projection carries the quality tier *imputed*, including the census year: the code gives the base year the same tier as the projected years, because even in 2022 the single-year counts are derived, UBOS having published bands. `data/SOURCES.md` records the same judgment — "five-year bands only; single years are therefore *imputed*".

The inputs are better tiered than the output. The census total, the growth rate, the total fertility rate and the infant mortality rate are *measured*; the survivorship coefficients, the ASFR shape and the graduation method are *imputed*; district net migration is *assumed* at zero. On the ordering *measured* < *normed* < *imputed* < *assumed*, EM-01's output is an **imputed projection resting on a measured base with one assumed input** — and that assumed input is the one the manual calls the weakest datum. No cell is *measured*, and no figure or map here should be read as an observation.

The gate report confirms the structural checks, not the substantive ones: G0 resolves the geography to 135 districts, G1 finds a population base for all 135, G5 validates the structure version at sixteen grades, and G6 confirms that population, enrolment and schools sit on the same pinned geography. Those are necessary conditions. They do not establish that the district populations are right — only that they exist and reconcile to a national total the engine itself constructed.

4.11 Implications for planning

The population used throughout this report is a projection from a 2022 census aged forward with national rates, and in the 2017 comparisons a back-cast from the same file. It is not an observed count of children in 2026. With the last published district EMIS dating from 2017, both the numerator and the denominator of every participation statistic in the next chapter are modelled, and the gap between them — the out-of-school count, the place gap, the classroom gap — is a difference of two estimates, to be planned against as a magnitude rather than a measurement. A current district EMIS extract and the single-year tabulation of the 2022 census would improve this report more than any refinement of the model.

The second implication is about geography. Because migration is zero and the rates are national, the engine cannot tell a district education officer whether the children in the projection will still be there when the classrooms open. The maps mark out where that matters most: the Kampala–Wakiso conurbation, where in-migration of children is certainly positive and is modelled as nil, and the refugee-hosting districts of West Nile, where the resident population is not fully in the denominator at all. Decisions in those two clusters should carry an explicit sensitivity on the population, and EM-07's sequencing should not treat projected growth in Kampala or projected decline in Yumbe as a hard input.

The third is about the shape of the demand. The school-age population is close to flat over this horizon while enrolment rises, so the growth in demand is a participation effect, not a demographic one. That is the more tractable planning problem, because it responds to policy, but it also means the requirement cannot be met by waiting. Where a district does face a demographic increase, Figure 4.6 shows it concentrated in a few places, and

the children are already born: the cohort entering P1 in 2030 was enumerated in 2022 as four-year-olds, and the projection of it is only as good as that band's count and the survivorship applied to it — a short, inspectable chain, and the strongest claim EM-01 makes.

The fourth is about what to fix. The four missing sub-populations each change the norms that govern class size, construction cost, walking distance, staffing and materials, and each is concentrated in identifiable districts rather than spread evenly. Their absence does not bias the national totals much; it biases the district allocation precisely where allocation is hardest. Until they are carried, this layer is adequate for national aggregates and for ranking large districts by size, and provisional for any decision about a specific school.

CHAPTER 5

5 EM-02 Participation, flows and out-of-school children

EM-01 counted the children. This chapter asks the question on which every later number depends: of those children, who is in school, in which grade, moving at what speed — and who is not in school at all. Population is a stock demography can project with confidence. Participation has to be observed.

Until this edition it could only be inferred. The engine held two years of district EMIS, 2016 and 2017, which publish enrolment and repeaters by grade and sex but not age within grade, so a chapter on that basis could form gross ratios and nothing else: net indicators were declared absent, and the out-of-school population was a survey rate spread by the inverse of administrative participation. That has changed. The Uganda Bureau of Statistics has published the **Baseline Education Census 2025** (UBOS 2026), the first nationwide complete enumeration of Uganda's formal education system — every government and private school, reference year 2025, published May 2026 — and it recorded each learner's age and class. Participation at the age the indicator asks about is now measured.

What has not changed is the part that needs two years of data. The census is a single year, and publishes learners by age and class nationally and attendance by district, but not enrolment by grade *and* district. The flow rates below therefore still come from the 2016 and 2017 abstracts, and are now the oldest component of the picture.

5.1 Two instruments, two quantities

An **administrative ratio** is a quotient of two things measured by different instruments. Its numerator is learners on a school register, counted at the school, at whatever age they happen to be; its denominator is the resident population of an official age range, projected by EM-01 from the 2022 UBOS census (UBOS 2023). The numerator is attributed to the district of the school, the denominator to the district where children live, and nothing requires those to be the same place. Such a ratio can exceed one without any child being counted twice.

A **measured attendance rate** is a different object. The census asked each learner's age and class, so UBOS can divide children of the official age attending a level by children of that age — and does, publishing net and gross attendance rates for every reporting unit, the numerator restricted to the age the indicator names. The engine ingests this one as a *rate* rather than as a pair of primitives, a deliberate exception to the rule that every ratio is computed inside the run, and the exception has a cost: the published rate carries UBOS's denominator, not EM-01's, so the engine cannot recover the numerator or re-express the rate on the pinned population base. The two answer different questions — how many places the system holds relative to the age group, and what share of children of a given age are in a class — and both are wanted.

On the pinned geography UGA-UBOS-2022 (135 districts) and the pinned structure UGA-7-4-2-LSC2020 — primary from age 6 for seven grades, lower secondary from age 13 for four, upper secondary from age 17 for two — the administrative ratios are unchanged:

$$\text{GER}_{c,d} = \frac{\sum_{g \in c} E_{g,d,2017}}{P_{d,2017}(A_c)} \quad (5.1)$$

$$\text{GIR}_d = \frac{E_{1,d,2017} - R_{1,d,2017}}{P_{d,2017}(6)} \quad (5.2)$$

where

- $E(g,d,2017)$ is enrolment in grade g in district d in the 2017 school census, both sexes, and $R(1,d,2017)$ repeaters in P1, so Equation (5.2) counts new entrants;
- $P(d,2017)(A_c)$ is the district population in the cycle's official age range — 6–12 primary, 13–16 lower secondary, 17–18 upper secondary — from EM-01, and $P(d,2017)(6)$ the population at the official entry age of 6.

A primary GER of 1.038 (Table 5.4) says, through Equation (5.1), that the system holds about four per cent more learners than there are children aged 6–12. It does not say that 96 per cent of those children are in school, and is silent on how many are out of school.

5.2 What the census measured

Table 5.1: Net and gross attendance measured by the census, mean across districts

Cycle Code	Nar Male	Nar Female	Nar Total	Gar Male	Gar Female	Gar Total
PRI	66.5	70.7	68.4	93.7	98.7	96
SEC	16.3	21.3	18.7	23.8	26.7	25.2

UBOS Baseline Education Census 2025, district annex. The net rate is attendance at the level of the age group; the gross rate counts attendance at that level at any age. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_attendance.csv).

Table 5.1 gives the census rates for the two levels it reports, as unweighted means across the 135 districts: a primary net rate of 68.4 per cent against a gross rate of 96.0, and a secondary net rate of 18.7 against a gross rate of 25.2. The primary pair is the arithmetic signature of late entry and repetition — classrooms hold almost as many learners as there are children aged 6–12, but only about two-thirds of those children are in a primary class. The secondary pair is starker: fewer than one child in five of secondary age is in a secondary class, and the gross rate is barely higher, so that system is not enrolling the wrong ages, it is small. Girls record the higher net rate at both levels, 70.7 against 66.5 at primary and 21.3 against 16.3 at secondary, which keeps check V10 testable on measured quantities.

Table 5.2: The fifteen districts with the lowest primary net attendance

District ID	Nar Total	Gar Total
Amudat	5.4	7.8
Nabilatuk	9.6	13.8
Kaabong	10.8	14.7
Kotido	12.3	17.2
Karenga	15	22.5
Napak	18.1	25.5
Nakapiripirit	23.4	31.6
Yumbe	23.9	33.4
Moroto	27.5	42.4
Buvuma	39.8	54.6
Nwoya	44.5	64.6
Abim	45.2	66.2
Kalangala	46.6	61.2
Bududa	50.9	75
Buliisa	50.9	71

Source: EPRAS run 6b2afcf6 (report/build/data/t_census_attendance_lowest.csv).

Table 5.2 ranks the fifteen districts with the lowest primary net attendance, and one sub-region takes it over. All nine districts of Karamoja — Amudat, Nabilatuk, Kaabong, Kotido, Karenga, Napak, Nakapiripirit, Moroto and Abim — appear in it, eight below 28 per cent against a district mean of 68.4, and Amudat records 5.4 per cent net with 7.8 gross. This should be stated plainly rather than softened into a gradient: on the first measured attendance

data Uganda has by district, Karamoja is not at the bottom of a distribution, it is detached from it. After Yumbe, the lowest non-Karamoja district is Buvuma at 39.8, more than four times Nabilatuk's 9.6, and Amudat's gross rate of 7.8 shows this is no age-composition artefact: almost no children of any age are in its primary classrooms.

5.3 A net attendance rate is not an in-school rate

A net attendance rate counts children of the official age for a level who are attending **that level**. It does not count a child of primary age in a pre-primary class, or one promoted early into secondary; those children are in school. It does not count a child of secondary age still sitting in primary; that child is in school too. The complement of a net attendance rate is therefore not the out-of-school rate but the rate of not attending the age-appropriate level, which bundles children outside education entirely together with children inside it at the wrong level — nowhere near the same quantity in a system with Uganda's age distribution.

Table 5.3: Turning a net attendance rate into an in-school rate

Level	In Level	In Other Levels	Adjustment	Note
PRI	6,589,436	547,585	1.083	children of primary age attending pre-primary or secondary are in school; the net rate counts only those attending primary
SEC	1,534,654	2,433,566	2.586	children of secondary age still in primary are in school; the primary 13+ band includes some over-19s, so this factor is a slight upper bound

From the census's own age-by-class tables: a child of one level's age attending another level is in school, and a net attendance rate does not count them. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_adjustment.csv).

The census settles the size of the difference from its own tables. At primary, 6,589,436 learners are of primary age in a primary class and a further 547,585 children of primary age are in a pre-primary or secondary class, giving a factor of 1.0831 — an eight per cent correction, material but not decisive. At secondary the factor is 2.5857, and the reason is in Table 5.3's second column: against 1,534,654 learners of secondary age in secondary classes, the census counts **2,433,566 primary learners aged 13 and over**. More children of secondary age are in primary than in secondary. The factor is so large precisely because that over-age population is enormous, and reading the secondary net rate as an in-school rate would mis-state the position two and a half fold.

The adjusted rate — an in-school rate, the nearest thing this run has to the specification's ANAR — and the out-of-school count that follows from it are

$$\text{ANAR}_{l,d} = \phi_l \text{NAR}_{l,d} \quad \phi_l = \frac{L_l + X_l}{L_l} \quad (5.3)$$

$$\text{OOS}_{c,d}^{\text{cen}} = \min(0.95, \max(0, 1 - \phi_l \text{NAR}_{l,d})) P_{d,2026}(A_c) \quad (5.4)$$

where

- $\text{NAR}(l,d)$ is the census net attendance rate for level l in district d , as a share, and l is the census level serving cycle c — primary for PRI, secondary for both LSE and USE, the census reporting secondary as one level;
- $L(l)$ is the national count of learners of the official age for level l attending level l , and $X(l)$ the count of children of that age attending a different level, both from the census age-by-class tables;
- $\phi(l)$ is the adjustment factor, 1.0831 at primary and 2.5857 at secondary, and $P(d,2026)(A_c)$ the base-year school-age population from EM-01;
- the result is floored at zero and capped at 0.95, a rate built from two instruments being able to leave the unit interval.

Four limits must be read with Equation (5.3). First, ϕ is a national constant, the census publishing age by class nationally, so a district whose over-age burden differs from the national one is adjusted wrongly. Second, the primary factor counts children of primary age in pre-primary, attendance *below* the age-appropriate level, so this

is an in-school rate, broader than the specification's ANAR, which counts attendance at the level or above. Third, the primary 13-and-over band includes learners over 19, so the secondary factor is a slight upper bound. Fourth, the floor binds: in eight districts — Bushenyi, Kalungu, Kumi, Luwero, Masaka, Mbarara, Mpigi and Sheema — the adjusted primary rate reaches or exceeds one and the out-of-school rate is zero (annex table a_oosc). A measured zero is not credible about children; it is a numerator counted where the school is against a denominator counted where children live. And because LSE and USE share one census level they share one district rate, their totals differing only through the populations weighting them.

5.4 Participation on the administrative basis, 2017

Table 5.4: Participation by cycle, 2017: enrolment, school-age population and the gross ratio

Cycle	Districts	Enrolled	School Age	GER
LSE	135	1,235,129	3,960,601	0.312
PRI	135	8,840,589	8,513,671	1.038
USE	135	135,454	1,710,081	0.079

Computed from primitives; no headline rate is ingested as a substitute. Source: EPRAS run 6b2afcf6 (report/build/data/t_participation.csv).

Table 5.4 shows a primary system at gross saturation — 8,840,589 learners against 8,513,671 children of primary age — above a secondary system that thins sharply: 1,235,129 learners in lower secondary against 3,960,601 children aged 13–16, a ratio of 0.312, and 135,454 in upper secondary against 1,710,081 aged 17–18, a ratio of 0.079. The primary total reconciles exactly with the UIS (2025) and WDI (World Bank 2026) series.

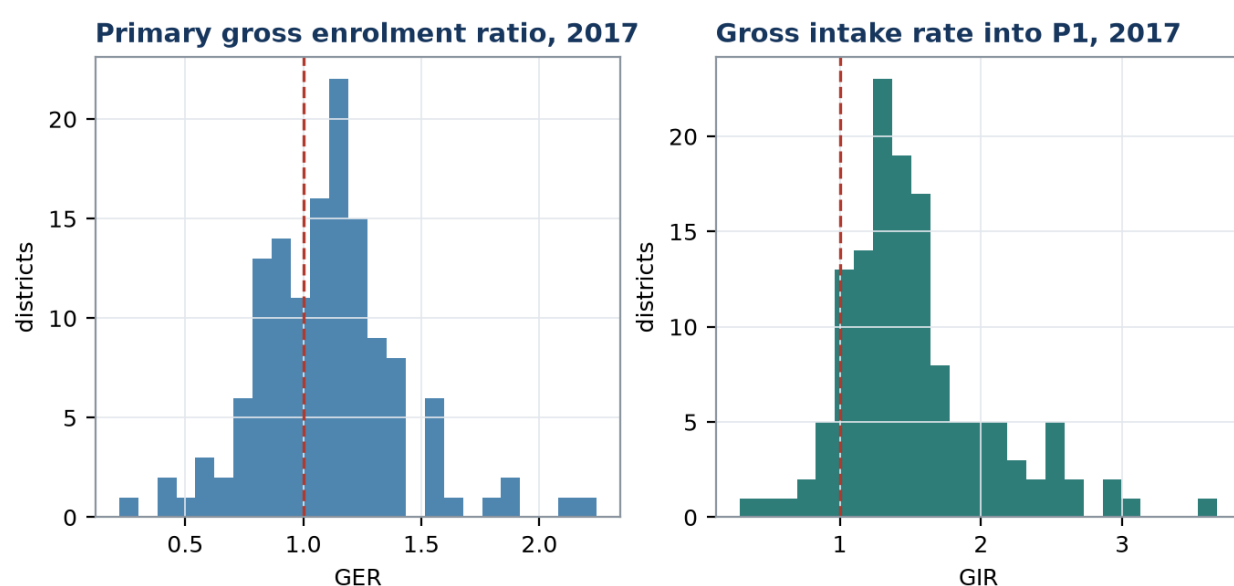


Figure 5.1: Primary gross enrolment ratio and gross intake rate into P1 across the 135 districts, 2017

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 5.5: The fifteen districts with the lowest primary gross enrolment ratio, 2017

District ID	GER	GIR	Enrolled	School Age
Amudat	0.22	0.29	6,797	30,964
Nabilatuk	0.405	1.124	8,443	20,861
Nakapiripirit	0.416	1.141	9,426	22,679
Nwoya	0.514	0.522	28,626	55,736
Kotido	0.565	1.502	21,902	38,784
Wakiso	0.571	0.681	304,222	532,695
Moroto	0.614	1.338	13,139	21,412
Hoima	0.674	0.773	48,446	71,930

District ID	GER	GIR	Enrolled	School Age
Kikuube	0.702	0.743	49,220	70,097
Kyegegwa	0.707	0.96	65,129	92,167
Napak	0.732	1.648	22,019	30,070
Mukono	0.734	0.894	101,945	138,919
Kakumiro	0.75	1.067	73,163	97,536
Mpigi	0.755	0.869	44,447	58,853
Kyankwanzi	0.776	1.214	42,961	55,349

Source: EPRAS run 6b2afcf6 (report/build/data/t_participation_top.csv).

Figure 5.1 and Figure 5.2 show a spread the plan must work at district level. The fifteen districts in Table 5.5 record a primary GER below 0.78; the lowest, Amudat, is 0.22, with 6,797 learners against 30,964 children of primary age. Six — Amudat, Nabilatuk, Nakapiripirit, Kotido, Moroto and Napak — form the Karamoja cluster Figure 5.2 renders as a contiguous block, and the census corroborates it from an independent instrument: the same districts hold the lowest measured net attendance. That matters for EM-07, because a contiguous deficit is addressable by a sub-regional programme and a scattered one is not.

Gross enrolment ratio, primary 2017

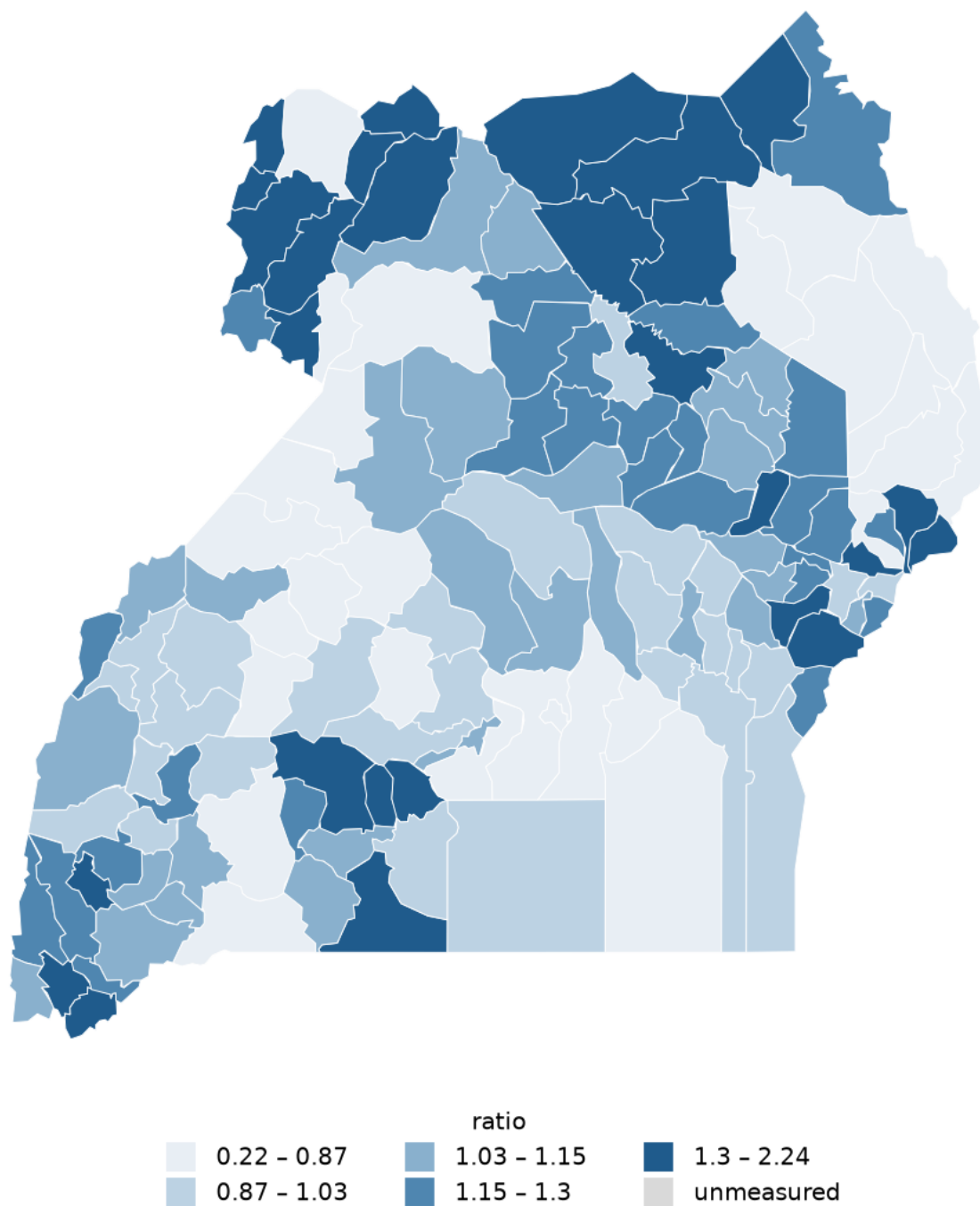


Figure 5.2: Gross enrolment ratio, primary 2017 (ratio), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Gross intake rate into P1, 2017

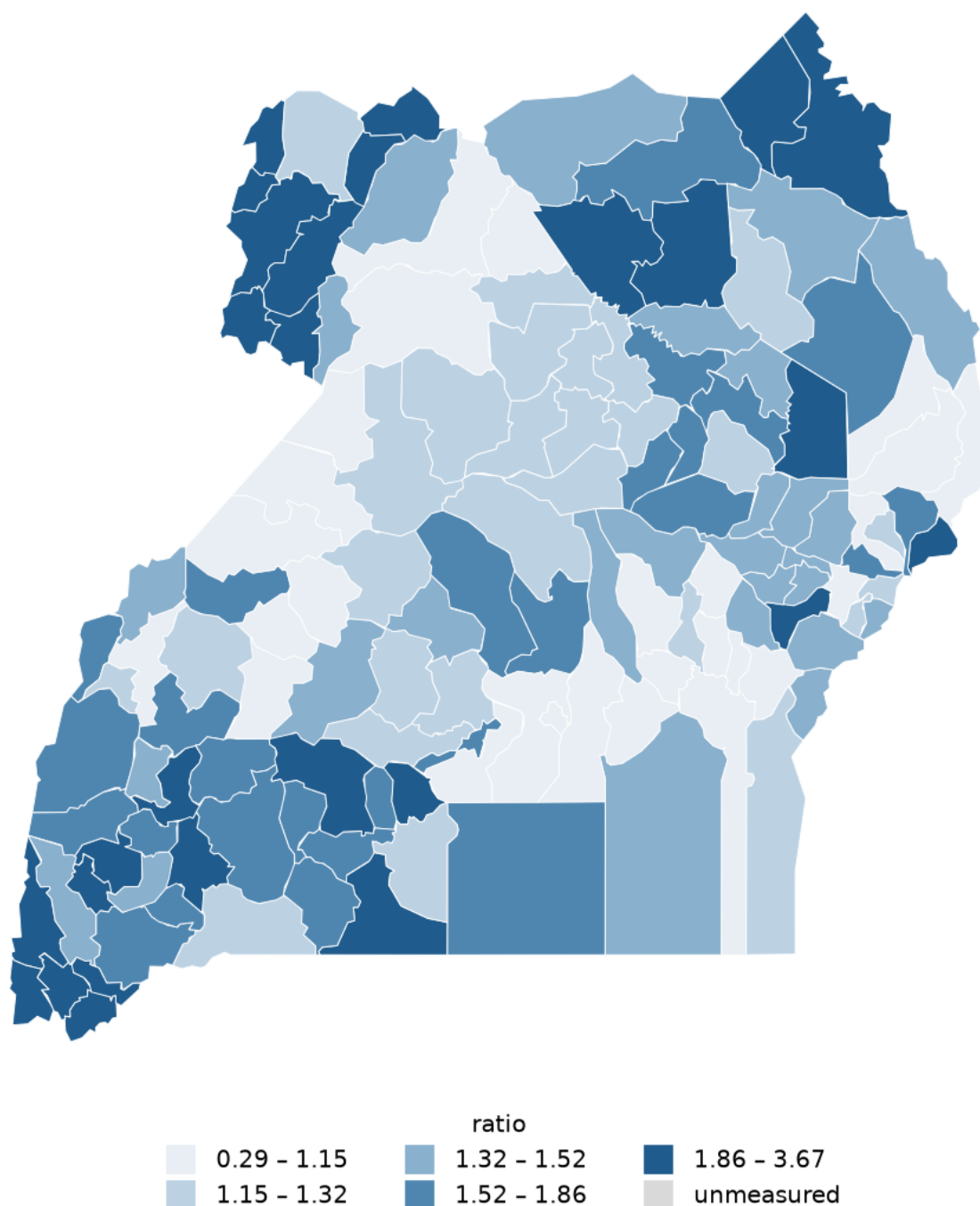


Figure 5.3: Gross intake rate into P1, 2017 (ratio), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The intake map, Figure 5.3, partly contradicts the enrolment map. Nakapiripirit records a GER of 0.416 with a gross intake rate of 1.141; Kotido 0.565 with 1.502; Napak 0.732 with 1.648. Intake above one alongside a stock ratio well below one is the signature of late and repeated entry into P1 combined with a cohort that does not survive the early grades; the mean district intake rate is 1.536. A second group reads differently, and here the census changes the reading: Wakiso (0.571), Mukono (0.734) and Mpigi (0.755) ring Kampala, and their low ratios measure not children outside education but where those children are *counted* — Mpigi being one of the eight

districts whose adjusted attendance rate reaches one. Specification §2.4's cross-district attendance problem is visible from both directions and still unresolved.

5.5 Reconstructing the flows from a pair of years

Enrolment here is never population multiplied by a coverage rate: it comes from a cohort moving through grades, on rates reconstructed from the 2016 and 2017 censuses per district, grade and sex. The Baseline Education Census does not replace them: it fixes the level of the system but publishes no grade-by-district enrolment, so the flow rates are the one part of this chapter still resting on data a decade old — the EMIS vintage warning is marked superseded for schools, learners, teachers and attendance, and retained for the grade profile and the flows. For grade g , with 2016 as the base year,

$$\rho_g = \frac{R_{g,2017}}{E_{g,2016}} \quad \pi_g = \frac{E_{g+1,2017} - R_{g+1,2017}}{E_{g,2016}} \quad \delta_g^* = 1 - \rho_g - \pi_g \quad (5.5)$$

$$\delta_g = \max(\delta_g^*, 0) \quad \varepsilon_g = \max(-\delta_g^*, 0) \quad \rho_g + \pi_g + \delta_g - \varepsilon_g = 1 \quad (5.6)$$

where ρ is repetition, π promotion, δ^* the raw residual, ε the re-entry-or-error term, $R(g,2017)$ the repeaters in grade g in 2017 and $E(g,2016)$ enrolment in grade g in 2016. By Equation (5.5) a child in grade g in 2016 is repeating, promoted, or off the register — and dropout is not observed. It is what is left, so it absorbs every error in the system, and where the error runs the other way the residual goes negative: impossible as a dropout rate, and real information about in-migration, boarding or re-entry. In Equation (5.6) that mass is held against promotion so the stored triple sums to one exactly (check V1 holds by construction), while ε records the move. 304 of the 3,510 district–grade–sex cells carry a positive ε , and a large ε is a question about the register, not a finding about children.

With only two census years the specification's preferred defence, smoothing over three years, is unavailable, so the engine shrinks each district rate towards the national rate for the same grade and sex with an empirical-Bayes weight

$$w_{g,d,s} = \frac{E_{g,d,s,2016}}{E_{g,d,s,2016} + k} \quad (5.7)$$

$$\hat{\rho}_{g,d,s} = w_{g,d,s} \rho_{g,d,s} + (1 - w_{g,d,s}) \rho_{g,s}^{\text{nat}} \quad (5.8)$$

the same weight applied to π , after which δ is recomputed. In Equation (5.7) and Equation (5.8), w is the weight on the district's own observation, $E(g,d,s,2016)$ the base-year enrolment it rests on, k the shrinkage constant — 5,000 learners inside a cycle and 50,000 at a cycle boundary, because boarding moves learners across district lines — and $\rho(\text{nat})$ the national rate from summed numerators and denominators. Three situations discard the district's own rate and are logged with their reason: no base-year denominator, a split district, and a raw residual outside $[-0.15, 0.40]$.

Table 5.6: Reconstructed flow rates by grade: repetition, promotion and dropout

Grade	Rep	Prom	Drop
LSE_1	0.003	0.88	0.117
LSE_2	0.005	0.86	0.135
LSE_3	0.012	0.807	0.181
LSE_4	0.037	0.242	0.721
PRI_1	0.053	0.674	0.272
PRI_2	0.089	0.898	0.012
PRI_3	0.099	0.884	0.017
PRI_4	0.113	0.783	0.104

Grade	Rep	Prom	Drop
PRI_5	0.109	0.74	0.152
PRI_6	0.114	0.618	0.267
PRI_7	0.055	0.559	0.386
USE_1	0.007	0.815	0.178
USE_2	0.017	0	0.983

Dropout is the residual; a negative residual is recorded as re-entry or error, never clamped away. Source: EPRAS run 6b2afcf6 (report/build/data/t_flow_rates.csv).

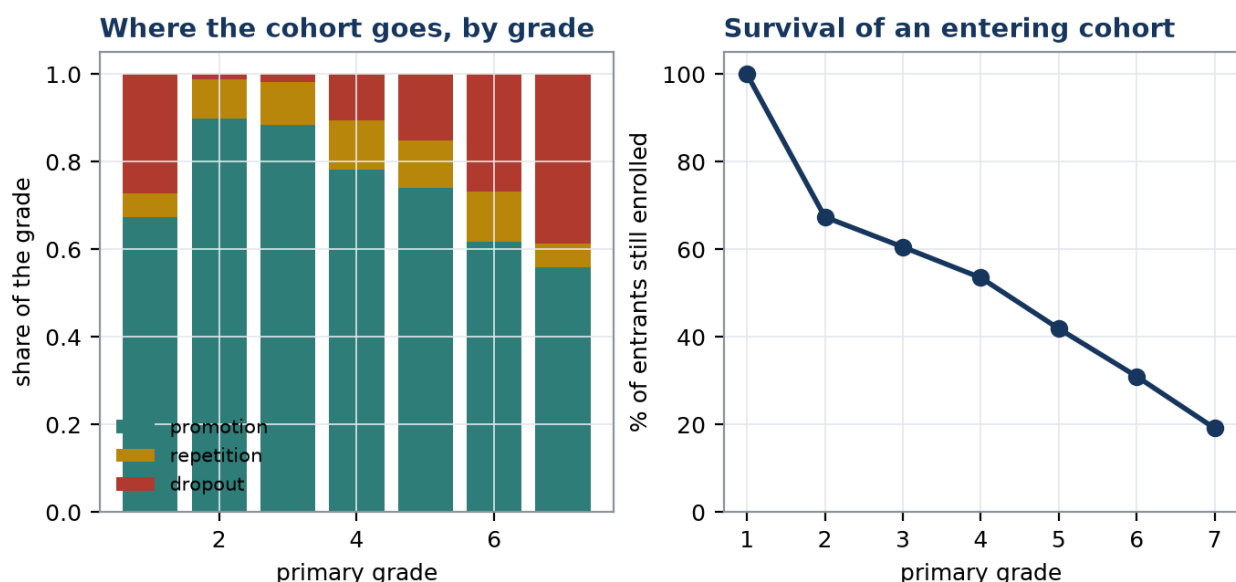


Figure 5.4: Each primary grade by promotion, repetition and dropout, and the survival curve implied for a cohort entering P1

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 5.6 reports the mean rate across districts and sexes for the 13 flow grades and Figure 5.4 draws its primary column. Repetition concentrates in the middle of primary, rising from 0.053 in P1 to 0.113 in P4 and 0.114 in P6 before falling to 0.055 in P7: at roughly one learner in nine, those repeaters occupy places EM-03 must provision and EM-06 price without advancing. The P1 residual of 0.272 against 0.012 in P2 and 0.017 in P3 deserves the most caution: it is what one expects when a grade is inflated by late entrants, and equally what one expects if P1 is over-reported a year later. The cycle boundaries lose most children: promotion out of P7 is 0.559 with a residual of 0.386, a failure to transition rather than ordinary dropout, and out of LSE_4 it is 0.242 with a residual of 0.721, the survival curve leaving fewer than one in five of an entering P1 cohort enrolled at P7. USE_2's residual of 0.983 is an artefact of its being the last grade of the pinned structure. The census's secondary net rate of 18.7 per cent is the corroboration those boundary rates lacked.

5.6 Children out of school: two measures that disagree

Table 5.7: Two measures of how many children are out of school, side by side

Cycle	Basis	Rate	Children
PRI	census: one minus adjusted net attendance	0.226	2,467,716
PRI	survey: national rate distributed by inverse participation	0.069	753,482
LSE	census: one minus adjusted net attendance	0.481	2,439,735
LSE	survey: national rate distributed by inverse participation	0.192	974,315
USE	census: one minus adjusted net attendance	0.473	1,086,601
USE	survey: national rate distributed by inverse participation	0.527	1,211,867

The census counts attendance; the international series models a rate from household surveys. They disagree, so both are reported and neither is averaged into the other. Source: EPRAS run 6b2afcf6 (report/build/data/t_oos_sources.csv).

Table 5.7 is the central result of this revision, and it does not resolve into one number.

The **census measure** is one minus the adjusted net attendance rate of Equation (5.4), district by district, times the base-year school-age population. It gives 2,467,716 primary-age children out of school at a rate of 0.226, 2,439,735 of lower-secondary age at 0.481 and 1,086,601 of upper-secondary age at 0.473 — 5,994,051 in all. It is conditional on a count: every child in the complement was enumerated in a school, with an age, in 2025. Its weaknesses are attribution and denominator — a learner is counted where the school is, the adjustment is a national constant, and the denominator is UBOS's, not EM-01's.

The **survey measure** is the UIS SDG 4 out-of-school series from household survey data: 0.069 at primary age, 0.192 at lower-secondary age and 0.527 at upper-secondary age, which on the same populations give 753,482, 974,315 and 1,211,867 children. It is conditional on a model — a rate estimated from survey rounds and carried forward to the reference year, in which a parent reports whether a child attends. Its strength is that it asks about the child at home, so it is immune to the attribution problem; its weaknesses are sampling error sub-nationally, reporting bias towards saying a child attends, and that the series is modelled rather than observed for recent years (data/SOURCES.md).

At primary the two differ by a factor of three: 2,467,716 against 753,482, 0.226 against 0.069. At lower secondary, by about two and a half in the same direction. At upper secondary the ordering reverses, the census measure being lower at 1,086,601 against 1,211,867 — what a factor of 2.5857 does to the oldest age group, where over-age primary attendance keeps most children in school at all.

The disagreement is not averaged away, and the run records it as the warning SRC_OOSC_DIVERGENCE. **The engine uses the census measure for the plan.** The reason is stated rather than assumed: where a census has measured attendance, the out-of-school rate is one minus that rate and nothing else — a counted quantity for a named age group, rather than a national rate spread by the inverse of administrative participation, which was never independent evidence but the enrolment map re-expressed. The survey route survives in the code for cycles and districts a census does not reach, the national rate distributed by inverse GER and rescaled. In this run it is dormant: the census reaches all 135 districts at both levels, every row of the out-of-school table is on the census basis and carries tier *measured*, and the rescaling never fires.

What would settle it is specific, and none of it is a modelling choice: a household survey round sharing the census's 2025 reference year and linking the district a child lives in to the district of the child's school, which would price the attribution error directly; the census's age-by-class tables published by district, which would make ϕ district-specific; and the denominator UBOS used, which would let the engine recover the numerator. Until then the census counts who is in school, the survey models who says they attend, and the plan is built on the count.

5.6.1 Where they are

Table 5.8: Out-of-school children by cycle and dimension

Cycle	School Age	Oosc	Never	Dropped	Rate
LSE	5,074,559	2,439,735	0	2,439,735	0.481
PRI	10,920,035	2,467,716	987,086	1,480,630	0.226
USE	2,299,557	1,086,601	0	1,086,601	0.473

The national rate is the UIS household-survey rate; the district split is imputed from administrative GER. Source: EPRAS run 6b2afcf6 (report/build/data/t_oosc.csv).

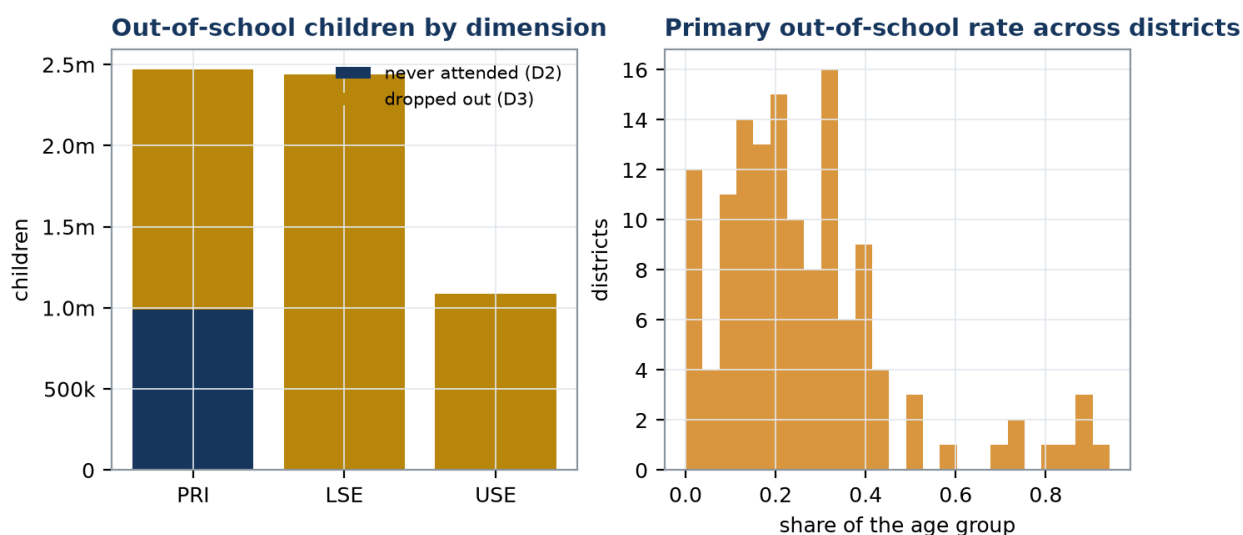


Figure 5.5: Out-of-school children by cycle and dimension, and the spread of the primary out-of-school rate across districts

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 5.9: The fifteen districts with the most primary-age children out of school

District ID	School Age	Oos Rate	Oosc
Yumbe	213,525	0.741	158,252
Kasese	211,338	0.318	67,131
Kyegegwa	135,208	0.406	54,957
Isingiro	163,205	0.306	49,897
Kakumiro	148,642	0.335	49,792
Kampala	312,799	0.155	48,541
Kyenjojo	147,772	0.327	48,380
Kotido	52,015	0.867	45,085
Arua	190,508	0.22	41,874
Mayuge	161,364	0.247	39,896
Kagadi	124,230	0.321	39,865
Nwoya	75,510	0.518	39,116
Amudat	40,919	0.942	38,526
Buyende	131,738	0.287	37,851
Napak	44,719	0.804	35,952

Source: EPRAS run 6b2afcf6 (report/build/data/t_oosc_top.csv).

Table 5.8 gives the cycle totals against base-year age-group populations of 10,920,035, 5,074,559 and 2,299,557; Table 5.9 the fifteen districts with the most primary-age children out of school. The geography has changed character, as a direct consequence of replacing an inverse-GER distribution with a measured rate. Yumbe now carries 158,252 primary-age children out of school at a rate of 0.741, more than twice the next district, Kasese at 67,131, where before the list was headed by Wakiso. Wakiso now records 25,808 at 0.036 (annex table a_oosc), a substantive finding rather than a correction: the peri-urban counting artefact largely disappears once attendance is asked about directly.

Primary-age children out of school

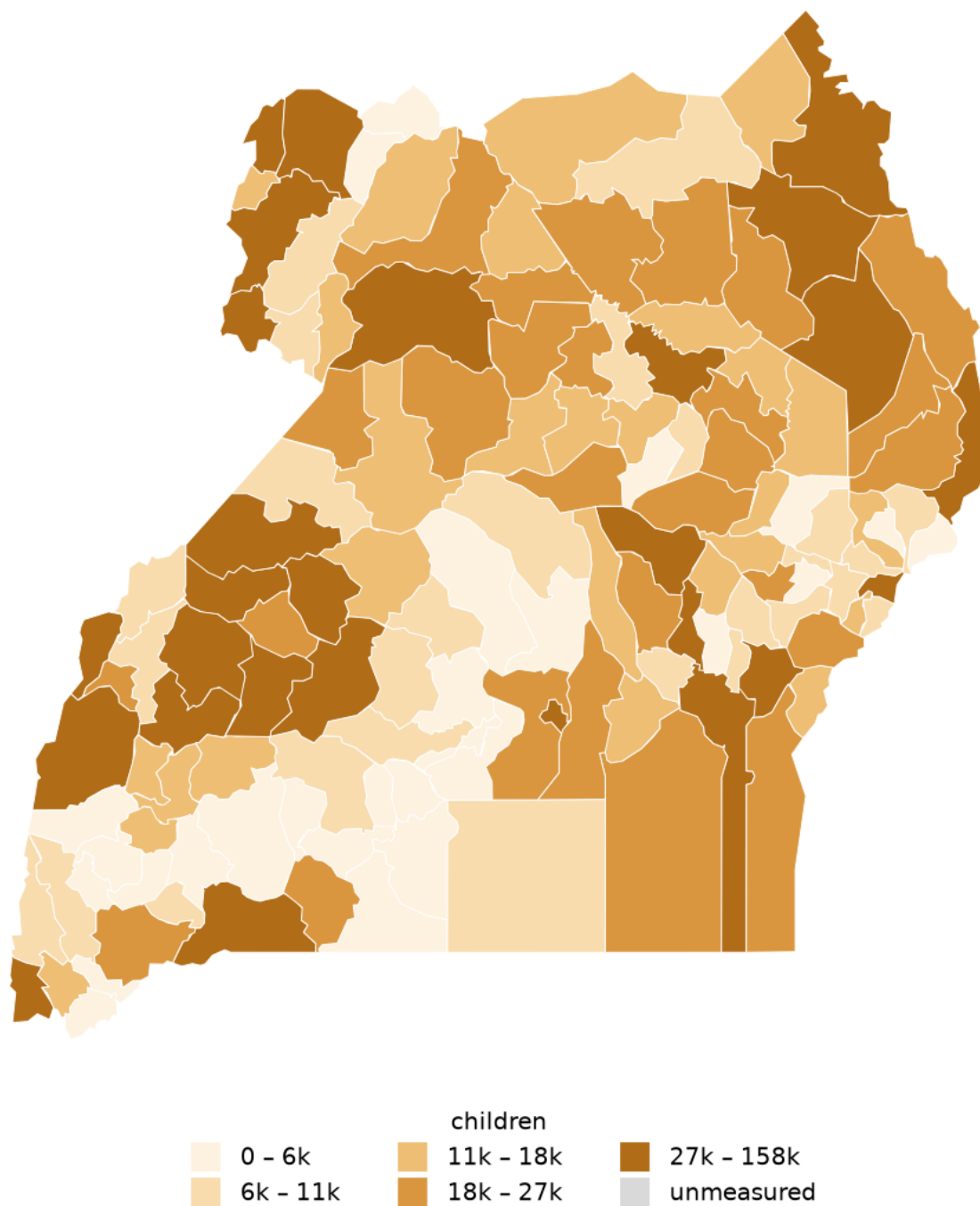


Figure 5.6: Primary-age children out of school (children), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Out-of-school rate, primary age

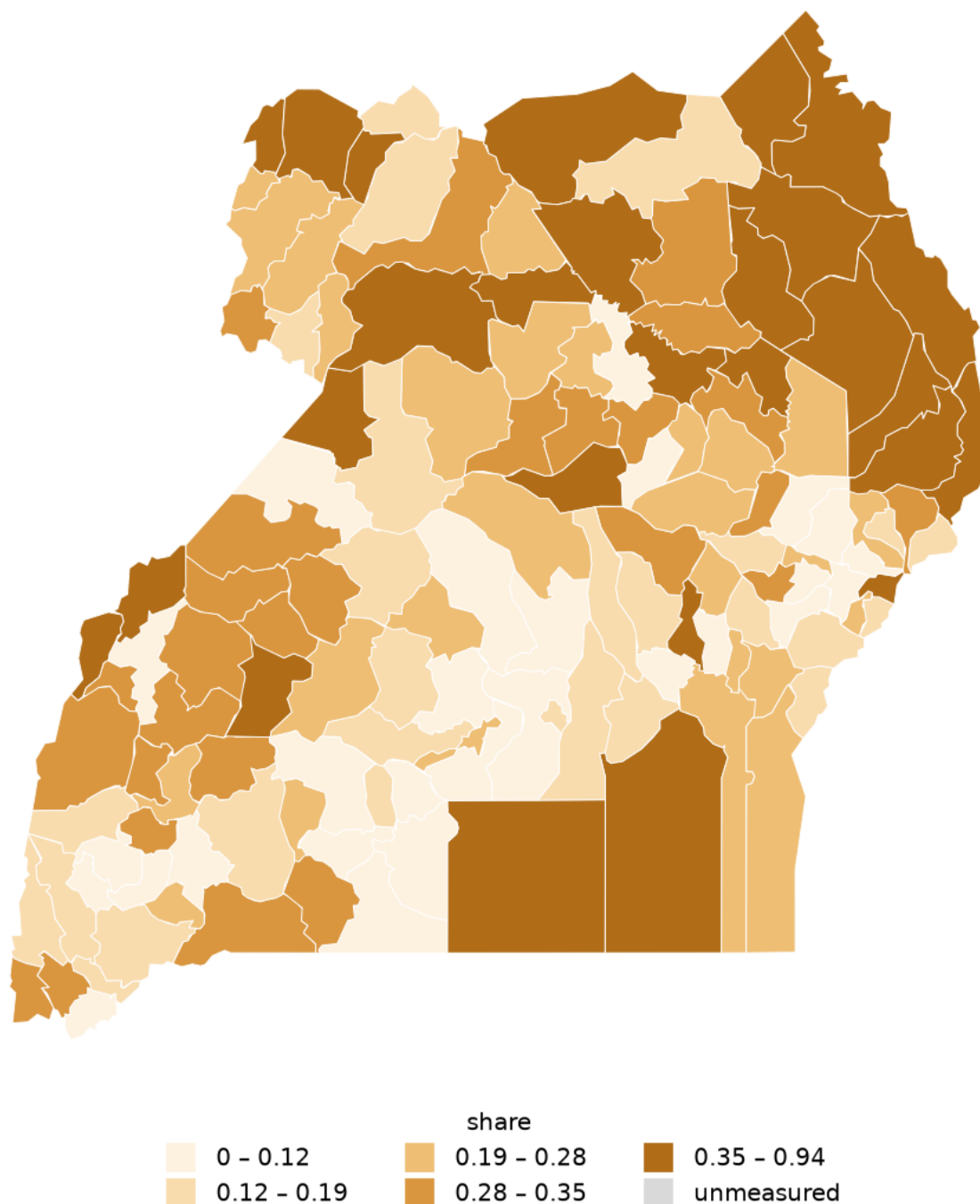


Figure 5.7: Out-of-school rate, primary age (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 5.6 maps the count and Figure 5.7 the rate, and they still disagree by design. The rate map is now the stronger of the two: the ordering is a measurement, not an inversion of Figure 5.2. Karamoja dominates it — Amudat at 0.942, Nabilatuk 0.896, Kaabong 0.883, Kotido 0.867, Karenga 0.838, Napak 0.804 — against a median district rate of 0.22 and the floor of zero where Equation (5.4) clamps, and Figure 5.5 shows the distribution: a mass of districts between a tenth and a third with a detached group above 0.8. Kotido's 45,085, Amudat's 38,526 and Napak's 35,952 put four Karamoja districts among the fifteen largest counts despite small populations. The

ranking criterion of this run is `oosc_primary`, so these counts order the EM-07 investment candidates directly: the siting list differs from the previous edition's because the basis changed, not because Uganda did.

5.6.2 Five dimensions, and what the census could now give

The specification's typology has five dimensions: D1 pre-primary age not in pre-primary, D2 primary age never attended, D3 primary age attended and dropped out, D4 and D5 lower- and upper-secondary age out of school. This run produces two, on an assumed split: D2 and D3 are divided from the primary total on a national ratio of 40 to 60 — 987,086 never attended, 1,480,630 dropped out — D1 is not produced, and the secondary totals go wholly into the dropped-out column.

What has changed is availability rather than output. The census recorded each learner's age, disability status and nationality, and this run ingests only part of it: the district attendance annexes, census tables 3.A6 and 4.A4, and the national age profile (`scripts/extract_bec2025.py`). D1 is within reach, because the census counts 2,374,674 pre-primary learners with an age breakdown and reports pre-primary provision by district. The disability tables would give the cross-cutting dimension the specification asks for, carrying different norms in EM-03 and different unit costs in EM-06. The nationality tables matter most in the district that now heads Table 5.9: Yumbe's 158,252 cannot be interpreted without knowing whether refugee children are in the numerator, the denominator, or neither.

What it would take is ingestion work, not method: three further annex extractions — age by class by district, disability by district, nationality by district. The D2/D3 split is the exception no school census can settle, because a child who never enrolled appears in no register, so separating never-attended from dropped-out needs the ever-attended question from a household survey. The 40/60 ratio stays assumed until then, so the responses attached to those dimensions — siting and fee abolition for D2, retention measures for D3 — rest on an assumption about which half of the problem is which.

5.7 Seeding the base year

The chain plans for 2026. The last district EMIS is 2017 and the census is 2025, so what was a nine-year extrapolation is now a one-year one: the 2017 grade profile is rescaled onto the census's counted learners per district, cycle and sex, and seeded from 2025. Gate G8 passes at 0.0 per cent, the flow model's grades summing to 11,126,447 against the census's 11,126,447.

Table 5.10: Bridge calibration: the observed participation trend the projection is held to

Item	Value	Source
GER 2011	1.139	WDI SE.PRM.ENRL / UIS SAP.1
GER 2017	1.062	WDI SE.PRM.ENRL / UIS SAP.1
annual GER trend	0.988	derived

The trend is measured over 2011-2017, the years for which a national series exists. Since the Baseline Education Census 2025 it is applied over one year rather than nine, because the projection is seeded from the counted level; the base year remains a projection and is flagged imputed. Source: EPRAS run 6b2afcf6 (report/build/data/t_bridge.csv).

The trend calibration survives with a narrower job. Against the UIS series the national primary gross ratio fell from 1.139 in 2011 to 1.062 in 2017 (Table 5.10), an annual factor of 0.988 applied to the district intake rate between the seed year and the year projected — one year now, rather than nine. Rebasing the stock without the rates would have left the projection drifting back to the level the 2017 rates imply, so EM-03 calibrates intake and transition by the same district factor as the stock they feed, those factors averaging 0.996 and 1.309 (`t_census_calibration`).

5.8 Data quality: what each output is worth

Using the tiers measured < normed < imputed < assumed:

- **Census learners, schools, teachers and attendance rates** — measured, every national total reconciling exactly to the census report: 9,118,314 primary learners, 2,008,133 secondary, 2,374,674 pre-primary, 12,557 government and 31,010 private primary schools.
- **The attendance adjustment (Table 5.3)** — measured nationally from the age-by-class tables; assumed as applied to any one district, ϕ being a national constant.
- **Out-of-school counts (Table 5.8, Table 5.9, `a\_oosc`)** — measured on the census route, every row here. The D2/D3 split remains assumed (40/60), and the eight zero rates are the clamp of Equation (5.4).
- **2016 and 2017 enrolment, repeaters and new entrants** — measured, reconciling to the UIS/WDI totals: 8,840,589 primary learners in 2017, 8,655,924 in 2016, 778,349 primary repeaters in 2017.
- **GER and GIR by district (Table 5.4, Table 5.5)** — imputed, on basis adm: a measured numerator over an EM-01 projection graduated from five-year bands.
- **Flow rates (Table 5.6)** — measured where the shrinkage weight leaves the district's own observation dominant ($w > 0.5$), imputed otherwise. All of them are nine years old.
- **The bridge (Table 5.10)** — endpoint ratios measured; the factor derived, the projection imputed.

Three specification requirements remain unmet. EMIS response rates are recorded on none of the 7,020 enrolment cells, so gate G2 is waived, the non-response reweighting cannot be performed and check V6 fails. Check V5 is not evaluated cause by cause: Table 5.7 reports the two measures and their difference but does not decompose it into the specification's five named causes, so no row carries basis reconciled. Checks V3 and V4 — $NER \leq GER$, $ANAR \geq NER$ — are now testable in principle, both rates existing, but are not evaluated, because the two come from different instruments on different denominators and an inequality between them would not mean what the check intends.

5.9 Who the census found in school: difficulty and nationality

Two characteristics of the learners themselves were counted for the first time, and both bear on the D1–D5 exclusion analysis this chapter has until now had to leave open.

Table 5.11: Learners reported with a difficulty, by level and ownership

Level	Government	Private	Total	Percent Of Learners
PRE	19,700	225,672	245,372	
PRI	403,274	367,721	770,995	8.7
SEC	75,276	108,792	184,068	9.2

UBOS Baseline Education Census 2025, national totals. The census asks whether a learner has difficulty in one of the standard functional domains rather than recording a diagnosis, and publishes the answer by sub-region and not by district. It is not apportioned to districts, and no special-needs requirement is costed: this engine holds no norm for one. Source: EPRAS run 6b2afcf6 (report/build/data/t_disability.csv).

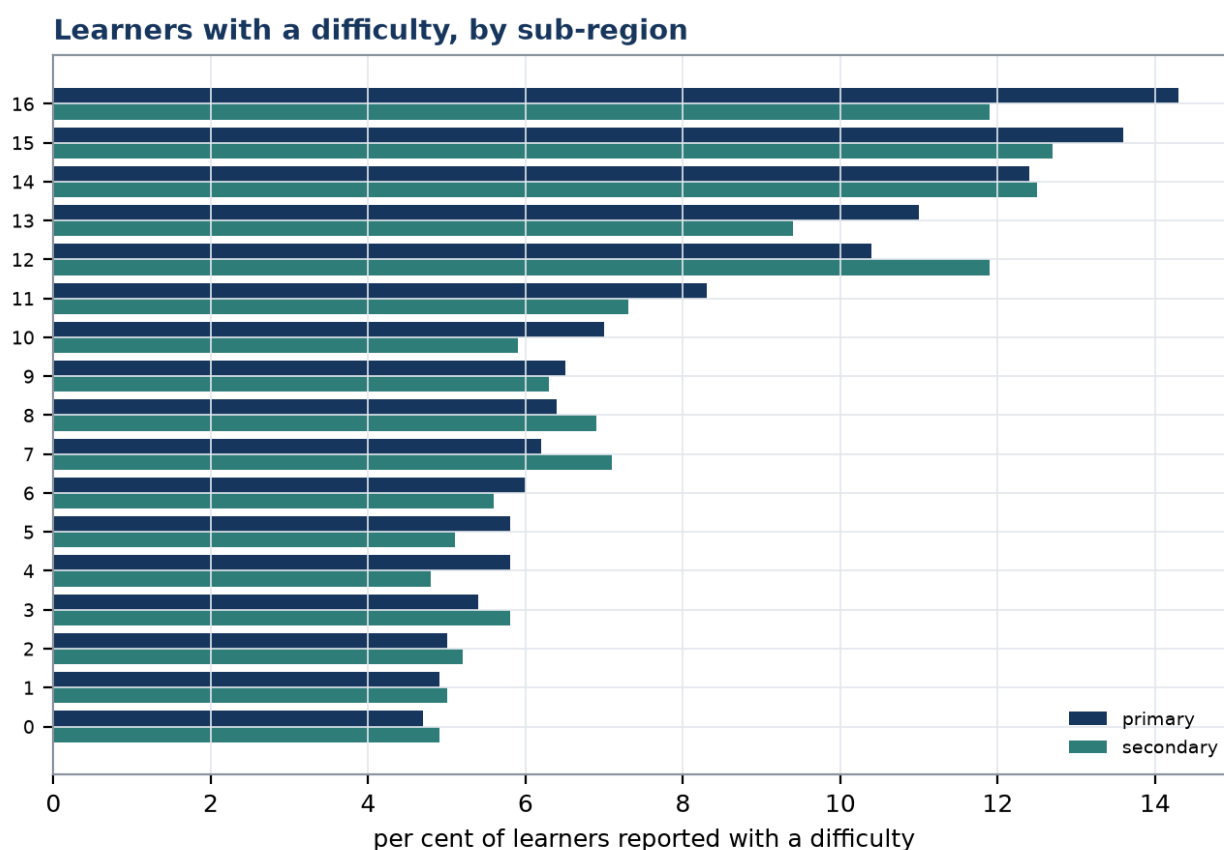


Figure 5.8: Share of learners reported with a difficulty, by sub-region and level

Source: UBOS Baseline Education Census 2025, tables 3.7A and 4.7B; published by sub-region, not by district

Roughly one primary learner in twelve is reported as having a difficulty. The census asks whether a learner has difficulty in a functional domain — seeing, hearing, walking, remembering, self-care, communicating — rather than recording a diagnosis, which is the same construction the household surveys use and a far wider net than a special-needs register. On that definition Table 5.11 records **770,995 primary learners, 184,068 secondary learners and 245,372 in pre-primary**, which the census puts at 8.7 and 9.2 per cent of learners at the two levels — percentages computed on its own base, which excludes the learners for whom the question was not answered, and so slightly above the share of all counted learners. Government schools report 8.0 per cent at primary against 9.5 per cent in private schools — a difference whose direction is hard to interpret, since it mixes who enrolls where with who records what.

Figure 5.8 shows the sub-regional spread, which is wide: the share runs from 4.7 per cent in **Tooro** and 4.9 in **Lango** to 13.6 in **Bunyoro** and 14.3 in **Kampala** at primary. A spread of that size across a single question asked in one year is more likely to reflect how the question was answered than how children differ, and it should be read as the first observation of a series rather than a measurement of prevalence.

What this does and does not let the plan do. It establishes an order of magnitude: roughly three quarters of a million primary learners who are already *in* school report a difficulty, and that is before any of the children in D1–D5 who are out of it. It does not support a requirement. There is no norm in this engine for a special-needs teacher, a resource room or an assistive-device allocation, and the census publishes the count by sub-region and not by district, so it could not be sited even if a norm existed. It is reported, and SRC_BEC_SUBREGION_ONLY records why it goes no further.

Table 5.12: Learners by nationality, as the census records it

Level	Ugandan	Non Ugandan	Not Stated	Total	Non Ugandan Share
PRE	2,323,383	51,029	262	2,374,674	0.021

Level	Ugandan	Non Ugandan	Not Stated	Total	Non Ugandan Share
PRI	8,638,547	240,824	238,943	9,118,314	0.026
SEC	1,965,156	37,317	5,660	2,008,133	0.019

UBOS Baseline Education Census 2025, national totals. A non-Ugandan learner in a government school is a learner the plan must provide for; the census publishes nationality by sub-region, so the district detail that would place them is not available from this source. Source: EPRAS run 6b2afcf6 (report/build/data/t_nationality.csv).

A quarter of a million learners in Uganda's schools are not Ugandan. Table 5.12 records **240,824 non-Ugandan primary learners (2.6 per cent), 37,317 at secondary and 51,029 in pre-primary** — 329,170 in all, which is consistent with a country hosting one of the largest refugee populations in Africa. The same table carries a figure that deserves equal attention: **238,943 primary learners whose nationality was "not stated"**, almost as many as the non-Ugandan count. Where a question's non-response is the same order as its positive answers, the positive answers are a floor and not an estimate.

Table 5.13: Where the non-Ugandan learners come from

Country	Primary	Secondary	Both
South Sudan	158,967	25,445	184,412
Democratic Republic of Congo	53,175	5,376	58,551
Rwanda	10,056	2,085	12,141
Other Africa	5,530	778	6,308
Burundi	3,448	677	4,125
Somalia	2,914	786	3,700
Kenya	2,179	876	3,055
Other Asia	1,299	483	1,782
Tanzania	1,137	416	1,553
Other United Arab Emirates	599	89	688
Other Europe	317	48	365
USA	152	52	204

UBOS Baseline Education Census 2025, tables 3.5A and 4.7A, national totals; the twelve largest origins. The census publishes this nationally only, so it cannot be used to site anything, and the 'Other' rows are the census's own grouping. Source: EPRAS run 6b2afcf6 (report/build/data/t_origin.csv).

The census also names where they come from, which the nationality tables collapse into one column. Table 5.13 gives the twelve largest origins. **South Sudan accounts for 158,967 primary learners and 25,445 secondary**, two thirds of the non-Ugandan total on its own; the **Democratic Republic of Congo** adds 53,175 and 5,376, **Rwanda** 10,056 and 2,085, and **Burundi, Somalia and Kenya** between two and four thousand each at primary. Thirty-odd further origins are counted in the hundreds or the tens. This is a refugee-displacement profile, not a migration one, and it says that the learners in question are concentrated in the settlement-hosting districts rather than spread across the country.

The origin table is published nationally only, and it carries one small inconsistency with its neighbours which is recorded rather than smoothed: its split of primary learners by sex differs from the learner annex's by 4,612, while the grand total agrees exactly (SRC_BEC_ORIGIN_INTERNAL). The distribution across countries is used here; the sex split is not.

For planning this matters in one specific way. The EM-01 population projection is built from the 2022 national census, which counts residents, and the enrolment it feeds is a count of learners at school. A district hosting a settlement has learners its resident population does not contain, and the two are reconciled here only through the intake and transition calibration of Table 16.4 — which absorbs the discrepancy into a rate rather than naming it. **West-Nile (60,302), Madi (45,670) and Bunyoro (38,104)** hold three fifths of the non-Ugandan primary learners between them, and Yumbe, the district the chapter has already named as carrying the largest out-of-school count in the country, sits inside the first of them. Naming the cause is progress; the fix is a district-level count of non-Ugandan learners, which this source does not publish.

5.10 Implications for planning

The first implication is that the largest data gap in this report has closed and the second-largest has not. Participation at the indicator's own age is measured by district for the first time, the base year is seeded one year from a complete enumeration rather than nine from an old abstract, and the out-of-school population is a count rather than a rate spread by a proxy. The flow rates are the exception. One year of enrolment by grade *and* district — a single annex cut of the 2025 collection, whose returns UBOS already holds — would retire the 2016 and 2017 abstracts and improve the demand projection more than any refinement of the methods above.

The second concerns Karamoja, and needs no hedging. Nine districts record primary net attendance between 5.4 and 45.2 per cent against a district mean of 68.4, out-of-school rates between 0.51 and 0.942 against a median of 0.22, and the lowest administrative enrolment ratios in the country, over a contiguous block of territory. Three instruments — the 2017 register, the 2025 census attendance rates and the counts derived from them — point the same way over the same area. This is the one place in the participation evidence where a sub-regional programme is supported by the data rather than inferred from it.

The third is a governance point rather than a technical one. A ministry planning on the UIS series plans for 753,482 primary-age children out of school; one planning on the census plans for 2,467,716. The gap is larger than most interventions this report prices, it sets the ranking of investment districts through `oosc_primary`, and cannot be resolved by choosing the more convenient figure — only by a household survey sharing the census's reference year and carrying a residence-to-school question. Until then, every out-of-school figure here should be read as "counted by the census, attributed to the district of the school".

The fourth is that the net-to-in-school distinction has to survive contact with the officials who will quote these numbers. A secondary net attendance rate of 18.7 per cent is not a statement that 81 per cent of children of secondary age are out of school: 2,433,566 of them are sitting in primary classrooms, which is why the adjustment factor is 2.5857 and why the secondary out-of-school rate lands near 0.48. Those over-age primary learners are the largest single planning fact the census has produced. They occupy primary places EM-03 provisions and EM-06 prices; they are the population a transition instrument would move into secondary, where the gross ratio is 0.312; and they are why a plan answering a primary GER of 1.038 with primary places alone builds for a cohort that should already have left.

CHAPTER 6

6 EM-03 Demand: places, classes, teachers and materials

Every education plan reduces to four questions: how many children will be in school and in which grade; how many teaching groups that forms; how many teachers, of which kind, those groups need; and what must be bought so they can learn. EM-03 answers all four, and the rest of the engine is built around it. If the requirement is wrong here, every number downstream is wrong in the same direction.

The module is defined as much by what it refuses to do: estimate enrolment as population times a coverage target, let a scenario write an enrolment number directly, round classes down, or derive teachers from a pupil–teacher ratio.

The run covers 135 districts, 16 grades in four cycles, a base year of 2026 — FY2025/26 — and a horizon to 2030, on norm set UGA-EPRAS-2026-DRAFT and target set UGA-ESSP-PATH. The projection is seeded from the Baseline Education Census 2025 (UBOS 2026), which counted every school in the country: each district's cycle total is the counted one, the grade profile within the cycle is scaled from the 2017 abstracts, and the intake and transition rates are calibrated by the same factor so the projection does not drift back to the level the older rates imply. The base year is therefore one year forward from a count, not nine years forward from the last abstract, and it is flagged `imputed` only because it is a projection at all.

6.1 The flow model: enrolment as a cohort, not a coverage rate

The requirement begins with children. For each district, sex and year the model takes the entry-age population from EM-01 and the flow rates from EM-02 and rolls a cohort through the grades. Intake into P1 is the six-year-old population times the gross intake rate, and the grade is filled out by those repeating it:

$$I_{d,t} = P_{d,t}^6 \cdot \text{GIR}_{d,t} \quad (6.1)$$

$$E_{1,d,t} = I_{d,t} + \rho_{1,d,t-1} \cdot E_{1,d,t-1} \quad (6.2)$$

where I is intake into P1, P^6 the population aged six in district d and year t , GIR the gross intake rate on the path being run, E enrolment in a grade and ρ the repetition rate. Observed gross intake in 2017 was 1.536 against a gross enrolment ratio of 1.038 — the signature of a system admitting many over-age children. That over-age entry is already inside the observed GIR, so the engine adds no separate late-entrant term in this run.

For every interior grade, enrolment is what is promoted in plus what repeats:

$$E_{g,d,t} = \pi_{g-1,d,t-1} \cdot E_{g-1,d,t-1} + \rho_{g,d,t-1} \cdot E_{g,d,t-1} \quad (6.3)$$

where π is the promotion rate out of the grade below. The three rates on a grade are exhaustive:

$$\pi_{g,d,t} = 1 - \rho_{g,d,t} - \delta_{g,d,t} \quad (6.4)$$

with δ the dropout rate. At a cycle boundary the promoted mass is split over the destinations the structure allows, and the first grade of the receiving cycle is filled by transition plus its own repeaters:

$$E_{1,c',d,t} = \tau_{c \rightarrow c',d,t-1} \cdot E_{G_c,d,t-1} + \rho_{1,c',d,t-1} \cdot E_{1,c',d,t-1} \quad (6.5)$$

where τ is the transition rate from cycle c to cycle c' and G_c the terminal grade of the feeding cycle. The τ over available destinations sum to at most one; the remainder leaves the system. The cycle boundaries are where Uganda loses most of its children: observed promotion out of P7 is 0.559 and out of S4 is 0.242. At a terminal grade the mass that neither repeats nor transits is **exit**, not dropout, computed as the residual $1 - \rho - \pi$ and moved only by the explicit transition lever. Treated as dropout, a target that halved dropout would silently double S5 intake without a child having passed S4.

6.1.1 The bridge from 2017 and the two paths

Because the last observed year is 2017, the model first rolls the flow forward on observed district rates to the base year. That bridge carries the national trend: primary gross enrolment fell from 1.139 in 2011 to 1.062 in 2017 on WDI (World Bank 2026) and UIS (2025) series, an annual factor of 0.988, applied to intake rather than assuming participation stood still.

From the base year the engine runs two paths. The **baseline** holds observed rates and lets intake keep declining on that factor. The **target** path applies the target set's rate adjustments, converging linearly to the end of the horizon: intake held at the base-year level rather than allowed to fall, dropout halved and repetition halved by 2030, with no transition uplift. Those four levers are the whole of the scenario's action on demand.

The scenario acts on rates and never on enrolment. A commitment to universal primary completion is expressed as a path for GIR, for δ and for ρ , never written into grade 7 as a number. You cannot have universal completion in 2030 without having put the children into P1 in 2024, and the flow model makes that arithmetic visible instead of letting a target paper over it. It is also why the intake lever does nothing here: with gross intake already at 1.536, a target of 1.00 does not bind, and the divergence in Table 6.1 comes from halving repetition and dropout and holding the intake trend flat.

Table 6.1: Projected enrolment by path, year and cycle

Path	Year	Lse	Pre	Pri	Use
baseline	2025	1,786,976	763,717	9,118,314	221,157
baseline	2026	1,828,002	746,867	9,751,560	260,764
baseline	2027	1,850,015	737,236	10,207,148	296,490
baseline	2028	1,884,913	745,658	10,532,861	277,531
baseline	2029	1,922,459	767,118	10,532,599	261,655
baseline	2030	1,901,795	787,933	10,637,115	314,502
target	2025	1,786,976	763,717	9,118,314	221,157
target	2026	1,828,002	746,867	9,751,560	260,764
target	2027	1,874,947	737,236	10,409,294	299,419
target	2028	1,986,958	745,658	11,082,778	286,247
target	2029	2,166,262	767,118	11,528,733	281,163
target	2030	2,340,790	787,933	12,150,686	358,620

The baseline path holds the observed rates; the target path applies the target set's rate adjustments. Source: EPRAS run 6b2afcf6 (report/build/data/t_enrolment_path.csv).

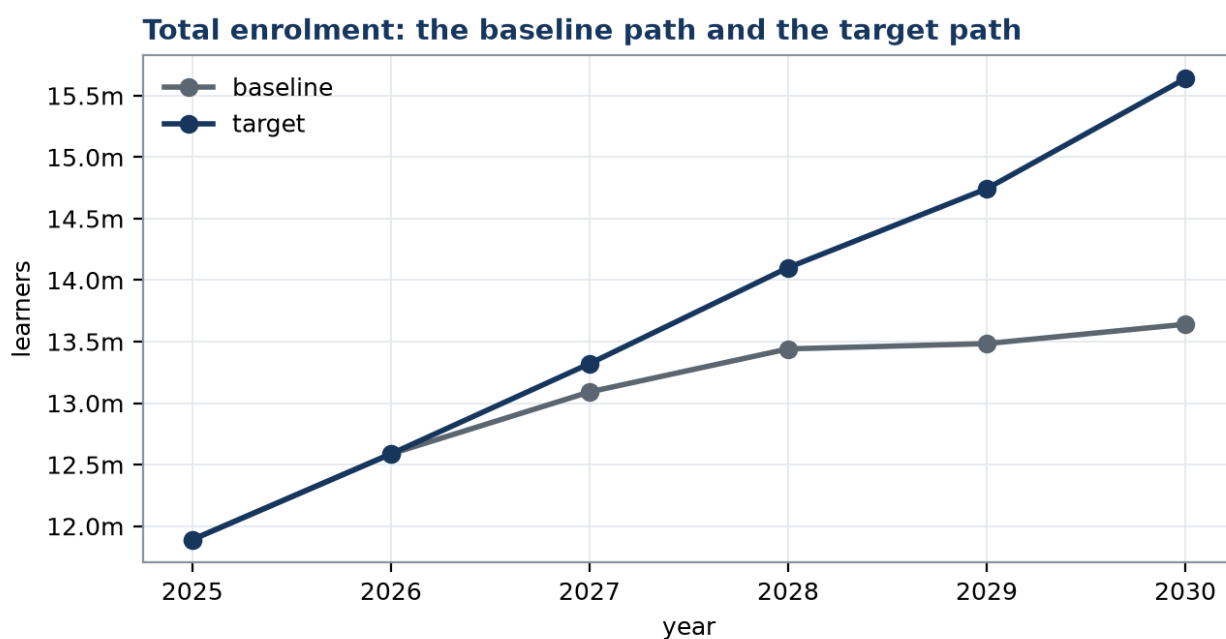


Figure 6.1: Total enrolment under the baseline and the target path

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

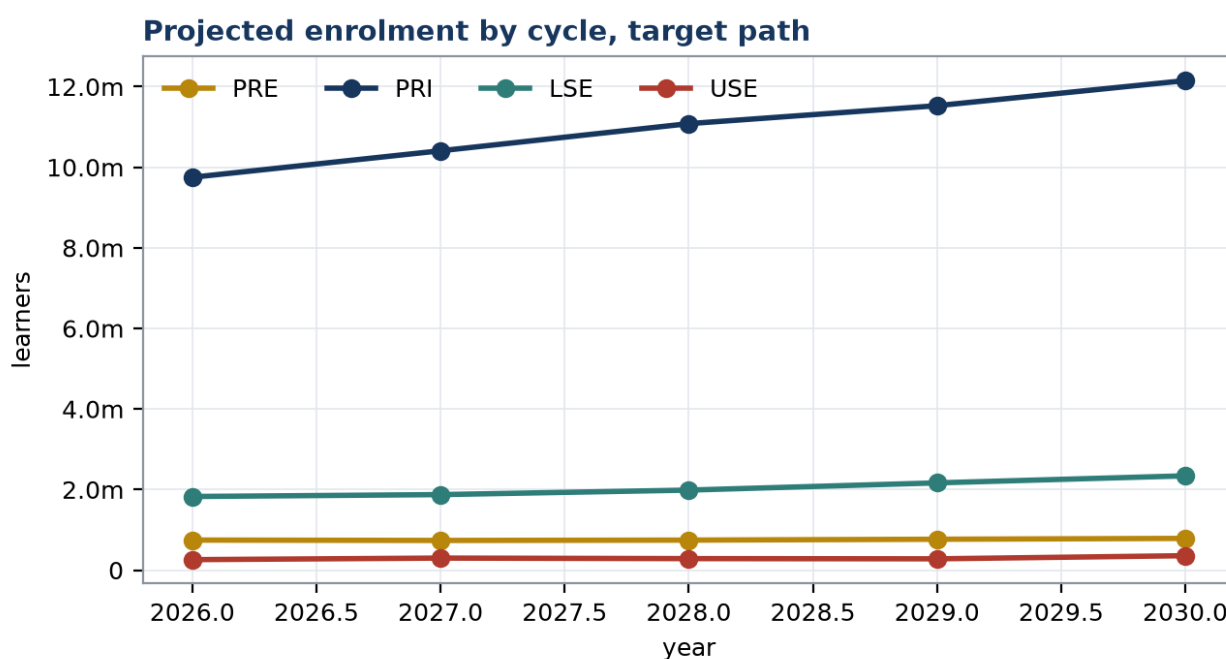


Figure 6.2: Projected enrolment by cycle, target path

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

In Figure 6.1 the paths are identical in the base year by construction and separate from 2027. By 2030 the target path carries 14.20 million learners against 12.31 million on the baseline — 1.89 million children kept in school by halving repetition and dropout. Figure 6.2 decomposes it. Primary rises from 10.42 to 11.57 million; lower secondary from 1.29 to 1.71 million, proportionally much steeper, because primary survivors arrive at a transition rate held constant. Upper secondary reaches 133,072 in 2030, still below the 135,454 observed in 2017: with S4 promotion at 0.242, improving primary flows barely touch A-level. Pre-primary is flat in both paths, at 746,867 in 2026 and 787,933 in 2030, because it is not on the flow model at all.

6.2 Ownership: costing public places, reporting total places

Total required places are not all public places, and a plan that quietly assumes the private sector will absorb growth will be missing classrooms in five years. The engine splits enrolment before forming a single class:

$$E_{g,d,t}^{pub} = (1 - \sigma_{g,d}) \cdot E_{g,d,t} \quad (6.6)$$

where σ is the non-state share of enrolment. Three treatments are possible and the scenario must choose one explicitly: `frozen_share`, the sector keeping its current share; `frozen_absolute`, keeping its absolute enrolment so all growth is public; and `policy_path`, a share path the scenario supplies. This run uses `frozen_share` on 2017 EMIS ownership at cycle level.

The effect is large. Of 12.56 million learners in the base year, 9.51 million are public: 75.7%. The split differs sharply by cycle — public primary is 8.32 million of 10.42 million, while public lower secondary is 641,417 of 1.29 million and public upper secondary 53,350 of 107,142, both a little under half. Every class, teacher, room and textbook below is computed on the public column and the total column reported beside it, because the Ministry is accountable for all children in school and finances only some. Conflating the two is how a plan loses 3.05 million learners.

6.3 Forming classes: integers, not ratios

A class is a whole thing: a teacher, a room, a timetable. There is no such object as 1.09 of one.

$$C_{g,d,t} = \max \left(\left\lceil \frac{E_{g,d,t}^{pub}}{\kappa_g} + n_d^{sch} \cdot \varepsilon_c \right\rceil, 1 \right) \cdot m_g \quad (6.7)$$

where κ is the class-size norm for the grade's service, n^{sch} the government schools in the district for the cycle, ε the small-school correction in extra classes per school per grade, and m the multigrade factor. Class sizes here are 53 for primary and 60 for lower secondary, both from the MoES Local Government Planning Guidelines 2022, with 45 assumed for upper secondary and 40 for pre-primary.

The ceiling is not a rounding nicety. **A grade with 58 learners against a norm of 53 forms two classes, not 1.09.** They need two teachers and two rooms, and the mean class size is 29, not 53. Applying the ratio understates small-school costs by 40 to 80 per cent — and small schools are exactly where the unserved children are, so the ratio is most wrong where the plan most needs to be right.

The honest difficulty is that integer formation is a **school-level** operation and this run has no school-level enrolment; the 2017 EMIS carries district totals. The engine therefore approximates the sum of per-school ceilings by adding a fixed correction per school per grade before taking the district ceiling — the ε term in Equation (6.7) — and flags the result `imputed`. The manual's range is 0.3 to 0.5; this run uses 0.35 for primary and lower secondary, 0.105 for upper secondary and zero for pre-primary.

The magnitude is worth stating plainly. Primary carries 8,324,607 public learners against a norm of 53, which on the plain ratio is 157,068 classes. With 12,036 government primary schools and seven grades the correction adds $0.35 \times 12,036 \times 7 = 29,488$ classes and the district ceiling a further 482, for 187,038 classes formed — 19.1% above the ratio. That adjustment is worth almost 30,000 teachers and almost 30,000 classrooms, and it exists because Uganda's primary estate is made of small schools.

Table 6.2: Class formation in the base year, by treatment

Correction	Rows	Classes	Mean Class Size
integer	405	9,149	37.7
small_school_imputed+integer	1755	155,195	40.6

Classes are integers: a grade of 58 against a norm of 53 is two classes, never 1.09. Source: EPRAS run 6b2afc6 (report/build/data/t_class_formation.csv).

Table 6.2 separates the treatments: 405 pre-primary district–grade cells formed by integer ceiling alone, averaging 37.9 learners a class, and 1,755 primary and secondary cells carrying the correction, averaging 44.1. Across all cycles the base year forms 213,381 classes at a mean formed size of 42.9 — a fifth below the primary norm, not because the plan is generous but because integers and small schools make it so. The right-hand panel of Figure 6.3 shows the distribution.

Multigrade and shifts. Where policy permits, a small school combines grades into one teaching group, reducing teachers and rooms and changing nothing else; the factor m expresses it. Here m is 1.0 for every service and shifts are 1 everywhere, so both levers sit in the code and are inert in the results. Shifts multiply capacity per room, not classes — two shifts mean one room serving two class groups, each with its own teacher, or the same teacher on an allowance — and which applies is a norm, never an assumption in code.

6.4 Teachers from the timetable

Teachers are derived from the timetable the curriculum obliges the school to run, not from learners. For subject j in grade g the periods that must be taught are classes times curriculum periods times a split factor:

$$s_{j,g} = \left\lceil \frac{\kappa_g}{M_{j,g}} \right\rceil \quad (6.8)$$

$$\text{FTE}_{q,d,t} = \frac{1+a_q}{1-r_q} \sum_{j,g} \frac{C_{g,d,t} \cdot h_{j,g} \cdot s_{j,g}}{L_{q,c}} \quad (6.9)$$

where h is curriculum periods per week for the subject in that grade, M the maximum teaching-group size for a practical subject, s the resulting split factor, L the periods a full-time teacher of cadre q teaches each week in cycle c , a the absence allowance and r the administrative release. A class of 60 in a laboratory subject with a maximum group of 30 generates two teaching groups and twice the periods: that is the whole of Equation (6.8), and it is the difference between a physics timetable that can be run and one that exists on paper.

Table 6.3: Curriculum periods by grade and subject

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_1	AGRIC	2		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	BIO	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	CHEM	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ELECT	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ICT	2	40	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	KIS	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	PHY	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	RE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	AGRIC	2		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	BIO	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	CHEM	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ELECT	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_2	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ICT	2	40	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	KIS	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	PHY	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	RE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	BIO	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	CHEM	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ELECT	8		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	PHY	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	BIO	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_4	CHEM	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ELECT	8		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	PHY	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
PRE_1	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRE_2	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRE_3	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_1	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_2	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_3	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_4	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_5	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_6	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_7	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
USE_1	A_PRINC	30	25	TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
USE_1	A_SUBS	10		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Source: EPRAS run 6b2afcf6 (report/build/data/t_curriculum.csv).

Table 6.4: Teaching load: the periods one full-time teacher teaches

Cadre Code	Cycle Code	Periods Per Week Taught	Absence Allowance	Admin Release	Source	Quality
TEACH_SEC_ARTS	LSE	24	0.05	0	assumed: 24 taught periods; ch.15 \$15.4 review	assumed
TEACH_SEC_SCI	LSE	24	0.05	0	assumed: 24 taught periods; ch.15 \$15.4 review	assumed
TEACH_PRE	PRE	36	0.05	0	assumed: 36 of 40 periods taught; ch.15 \$15.4 review	assumed
TEACH_PRI	PRI	36	0.05	0	assumed: 36 of 40 periods taught (class-teacher model); ch.15 \$15.4 review	assumed
TEACH_SEC_ARTS	USE	22	0.05	0	assumed	assumed
TEACH_SEC_SCI	USE	22	0.05	0	assumed	assumed

Source: EPRAS run 6b2afcf6 (report/build/data/t_teaching_load.csv).

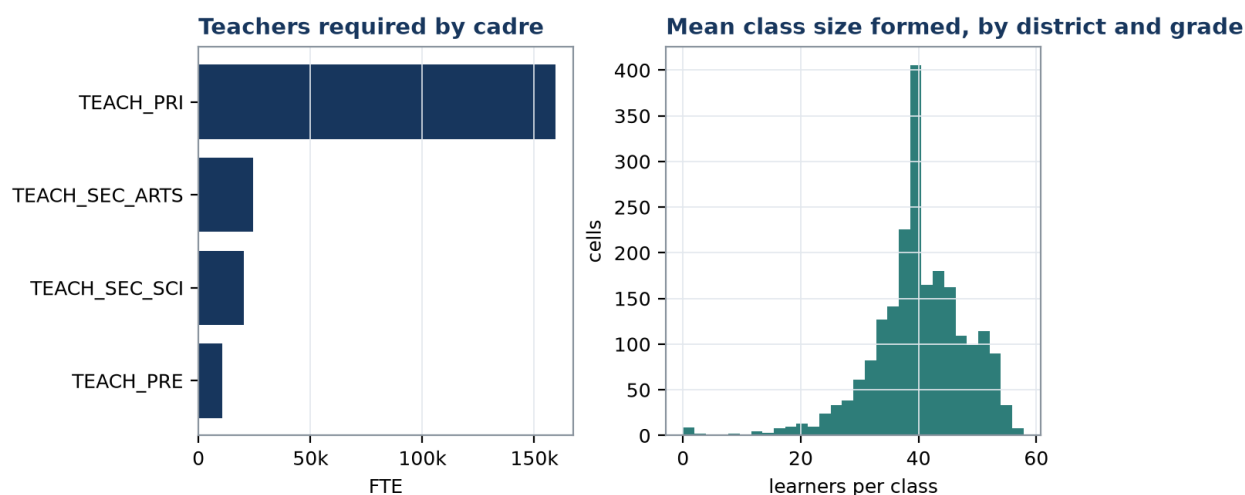
Table 6.3 gives the curriculum and Table 6.4 the loads. The arithmetic is easiest one class at a time. A primary class is taught by one class teacher across a 40-period week; the load is 36 taught periods, absence allowance 5%, administrative release zero. The requirement is $40 \div 36 \times 1.05 = 1.17$ teachers per class, not one. The fractional excess is the specialist and relief requirement, and it is real: the teacher who is ill, the teacher on in-service training, the specialist the class teacher is not.

Lower secondary is where the method earns its keep. An S1 class of 60 generates 22 arts periods a week and 29 science periods — mathematics and agriculture taught whole, but biology, chemistry and physics at three periods each split into two groups of 30, and ICT at two periods split into two groups of 40. That is 51 teaching-group periods out of a 40-period timetable. Against a load of 24 taught periods and the 5% allowance, one S1 class needs $51 \div 24 \times 1.05 = 2.23$ teachers.

Table 6.5: Teachers required by cycle and cadre, base year

Cycle	Cadre	FTE
PRI	TEACH_PRI	159,447
LSE	TEACH_SEC_SCI	20,098
LSE	TEACH_SEC_ARTS	15,553
PRE	TEACH_PRE	10,674
USE	TEACH_SEC_ARTS	8,970

From classes $\times$ curriculum periods / teaching load, with the absence allowance and administrative release. Source: EPRAS run 6b2afcf6 (report/build/data/t_teacher_req.csv).

**Figure 6.3:** Teachers required by cadre, and the distribution of formed class sizes

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 6.5 and the left panel of Figure 6.3 give the base-year result: 265,682 teaching FTE, of which 218,211 primary, 15,698 lower secondary science, 14,509 pre-primary, 12,140 lower secondary arts and 5,125 upper secondary arts. The subject dimension is never collapsed, because a district can sit comfortably on a national pupil–teacher ratio and still be unable to timetable physics. EM-05 turns the cadre split into the subject-mix gap, the most actionable output the secondary system gets from this engine.

6.4.1 What a pupil–teacher ratio would have said

Take the class-size norms as pupil–teacher ratios — 53 in primary, 60 in lower secondary, 45 in upper secondary, 40 in pre-primary — and apply them to the same public enrolment. The result is 181,180 teachers against the 265,682 the curriculum-and-load method gives: the ratio understates the requirement by 84,502 teachers, or 47 per cent.

The gap has two sources and they compound: integer class formation with the small-school correction, which lifts teaching groups above enrolment ÷ class size, and the timetable itself, which needs 1.17 teachers for a primary class and 2.23 for a lower secondary one. The manual's worked example makes the same point on one district — 9,540 lower secondary learners form 212 classes and require 427 FTE on the load method against 212 on a 1:45 ratio.

Teacher salaries are 65.9% of the unit cost of a public primary place here. A 47 per cent error in the teacher requirement, multiplied through the wage bill, is larger than every other error in a typical education plan combined, and it runs in the direction that makes a plan look affordable when it is not.

6.4.2 Non-teaching staff

Head teachers, deputies and laboratory technicians are not a function of learner numbers and must not be derived from them. Each standard carries its own basis and the engine applies it: per school, per class, per stream, or per n learners with a threshold, where a threshold on a per-school standard is a school-size condition — a deputy in a primary school above seven classes. The base year requires 27,108 non-teaching posts: a head and a deputy in each of the 12,036 government primary schools, and a head, a deputy and a laboratory technician in each of the 1,012 government secondary schools. With district totals only, the threshold is evaluated on mean classes per school, so it is all-or-nothing by district.

6.5 Rooms, specialist rooms and sanitation

Rooms follow classes, discounted by utilisation:

$$R_{g,d,t}^{room} = \frac{C_{g,d,t}}{S_c \cdot u_c} \quad (6.10)$$

where S is the number of shifts and u the utilisation target. Utilisation is 0.90 on the primary classroom standard and 0.85 on the secondary, with areas of 56 m² and 63 m². With one shift everywhere, the base year requires 221,638 classrooms on the primary standard and 16,361 on the secondary — about eleven per cent more rooms than classes, which is what a 0.90 target means.

Table 6.6: Capacity standards: rooms, utilisation and area

School Type Code	Facility Input	Basis	Quantity	Utilisation Target	Area M2	Source	Quality
PRI_GOV	CLASSROOM	per_class	1	0.9	56	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.90	norm ed
PRI_GOV	LATRINE_STAN CE	per_40_learners	1	1		MoES LG Planning Guidelines 2022 p.23	norm ed
SEC_GOV	CLASSROOM_S EC	per_class	1	0.85	63	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.85	norm ed

School Type Code	Facility Input	Basis	Quantity	Utilisation Target	Area M2	Source	Quality
SEC_GOV	SCIENCE_BLOCK	per_school	1	1		MoES LG Planning Guidelines 2022 p.23	norm ed

Source: EPRAS run 6b2afcf6 (report/build/data/t_capacity_standards.csv).

Specialist rooms are derived from periods, not from schools. A school does not need a laboratory because it is a secondary school; it needs as many as its science timetable demands:

$$N_{d,t}^{lab} = \max \left(n_d^{sch}, \left\lceil \frac{\sum_{j \in F} p_{j,d,t}}{H \cdot u_{lab}} \right\rceil \right) \quad (6.11)$$

where F is the set of subjects requiring a facility, p the periods those subjects demand, H the periods in a timetabled week and u_lab the facility's utilisation target, with one per school as a floor for any district teaching the subject at all. The result is 7,483 science blocks against 1,012 government secondary schools — seven times what one laboratory per school would have built. A single laboratory in a school running 29 science periods a week per class is a building, not a capability.

Sanitation is derived from enrolment, not classes, at one stance per 40 learners: 225,484 stances in the base year. The specification asks for a sex-specific stance norm, because separate and private sanitation is a measurable determinant of adolescent girls' attendance; the norm set carries one undifferentiated 1:40 line, so that dimension is defined and unpopulated.

6.6 The bill of materials

Everything else a place consumes is expanded from norm lines. For input r:

$$\bar{q}_r = \frac{q_r \cdot \phi_r \cdot (1 + w_r)}{\max(\ell_r, 1)} \quad (6.12)$$

$$R_{r,g,d,t} = B_{r,d,t} \cdot \bar{q}_r \quad (6.13)$$

where q is the quantity the norm specifies, ϕ the share of learners who receive it, w the wastage allowance, ℓ the lifespan in years and B the base the input scales on. For a learner-driven line B is public enrolment. For a **shared** line it is not: laboratory apparatus serves a laboratory, a library a school, a wall chart a class. The sharing base is named on the input — per_room, per_class or per_school — and the engine divides by it instead of multiplying by learners. A shared input whose unit names no base fails the run rather than defaulting.

Table 6.7: The bill of materials: what one learner-year consumes

Service Code	Input Code	Cadre Code	Quantity	Unit	Share Of Learners	Wastage	Lifespan Years	Source	Source Year	Quality
PLACE_LSE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26 60 sets per classroom	2022	normed
PLACE_LSE	TEXTBOOK		8	copy	1	0.05	3	assumed: eight subjects 1:1	2022	assumed
PLACE_LSE	CAPITATION_USE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 USE per learner	2022	normed
PLACE_LSE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_PRE	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_LOWER	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_LOWER	TEXTBOOK		2	copy	1	0.05	3	assumed: literacy + numeracy readers 1:1	2022	assumed
PLACE_PRI_LOWER	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	normed
PLACE_PRI_LOWER	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_PRI_UPPER	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_UPPER	TEXTBOOK		4	copy	1	0.05	3	assumed: four examinable subjects 1:1	2022	assumed
PLACE_PRI_UPPER	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	normed
PLACE_PRI_UPPER	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_USE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26	2022	normed
PLACE_USE	TEXTBOOK		4	copy	1	0.05	3	assumed: three principals + GP	2022	assumed
PLACE_USE	CAPITATION_UPOLET		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPOLET per learner	2022	normed
PLACE_USE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
SYS_SCHOOL	INSPECT_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 inspection per school	2022	normed
SYS_SCHOOL	MONITOR_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 monitoring per school	2022	normed
SYS_SCHOOL	CAPITATION_UPE_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE fixed per school	2022	normed

Effective annual quantity is quantity x share of learners x (1 + wastage) / lifespan years. Source: EPRAS run 6b2afcf6 (report/build/data/t_norm_lines.csv).

Table 6.8: The twenty largest input requirements in the base year

Item	Unit	Cost Class	Quantity
TEXTBOOK	copy	capital	24,143,893
CAPITATION_UPE	learner_year	recurrent	5,586,942
DESK_3SEAT	desk	capital	2,021,416
FURN_SEC	place	capital	928,995
CAPITATION_USE	learner_year	recurrent	810,130
LATRINE_STANCE	stance	capital	162,443
CLASSROOM	room	capital	162,020
CAPITATION_UPOLET	learner_year	recurrent	100,649
CLASSROOM_SEC	room	capital	21,795
MONITOR_SCHOOL	school_year	recurrent	14,041
INSPECT_SCHOOL	school_year	recurrent	14,041
CAPITATION_UPE_SCHOOL	school_year	recurrent	12,557
SCIENCE_BLOCK	unit	capital	9,564
DEO_FIXED	district_year	recurrent	135

Expanded from the bill of materials; shared inputs are divided by their sharing base. Source: EPRAS run 6b2afcf6 (report/build/data/t_input_req.csv).

Table 6.7 is the bill and Table 6.8 the result: 31,152,444 textbook copies, 8,324,607 UPE capitation learner-years, 2,996,772 three-seat desks, 708,663 secondary furniture places, 641,417 USE capitation learner-years and 225,484 latrine stances. Textbooks show Equation (6.12) working — two copies per lower primary learner, four per upper primary learner, 5% wastage, three-year life. Capitation is the degenerate case: one learner-year per learner, no wastage, one-year life, which is why its quantity is exactly public primary enrolment.

One note on annualisation. Equation (6.12) divides by lifespan, but EM-03 reports durable inputs as the **stock that must exist**, $q \times \phi \times (1 + w)$, and leaves the conversion to an annual replacement flow to EM-06, where capital and recurrent are separated and priced. Only one-year lines are flows here, so the lifespan division is applied at costing and never double-counted.

6.7 System services: what costing cannot omit

Some costs are driven by schools rather than learners, and those are the costs that go missing. Inspection, monitoring, the fixed school-level component of capitation and the district education office are computed inside EM-03 so they cannot be forgotten later: 13,048 inspection and 13,048 monitoring visits in the base year, one per government school, 12,036 school-level UPE capitation grants, and 135 district education office allocations. A plan that finances teachers and textbooks but not the office that supervises them produces the pattern Uganda's inspection reports describe; putting these lines in the requirement makes them compete for the envelope on the same terms as everything else.

6.8 What the maps show

Public primary places required, 2026

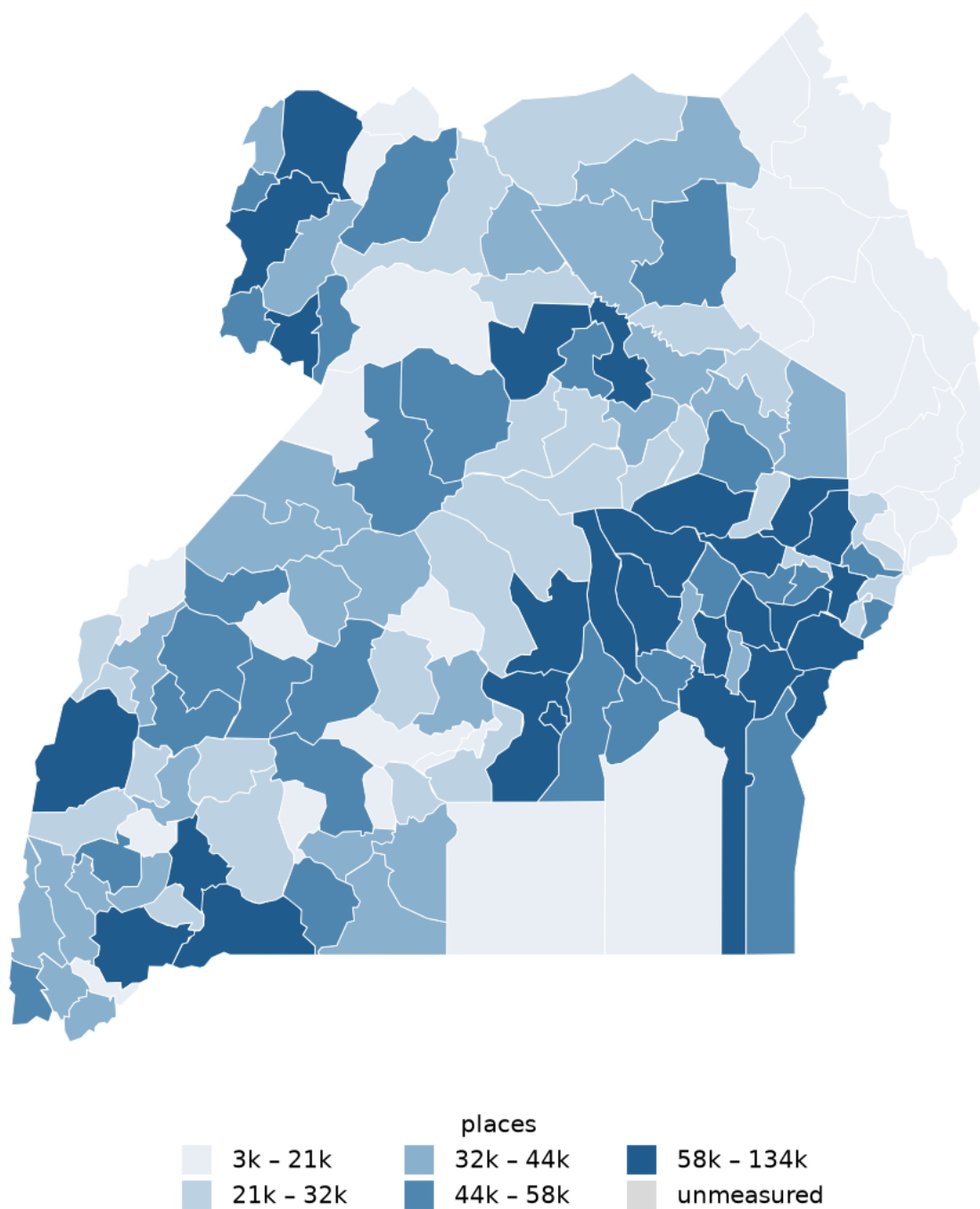


Figure 6.4: Public primary places required, base year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Primary teachers required

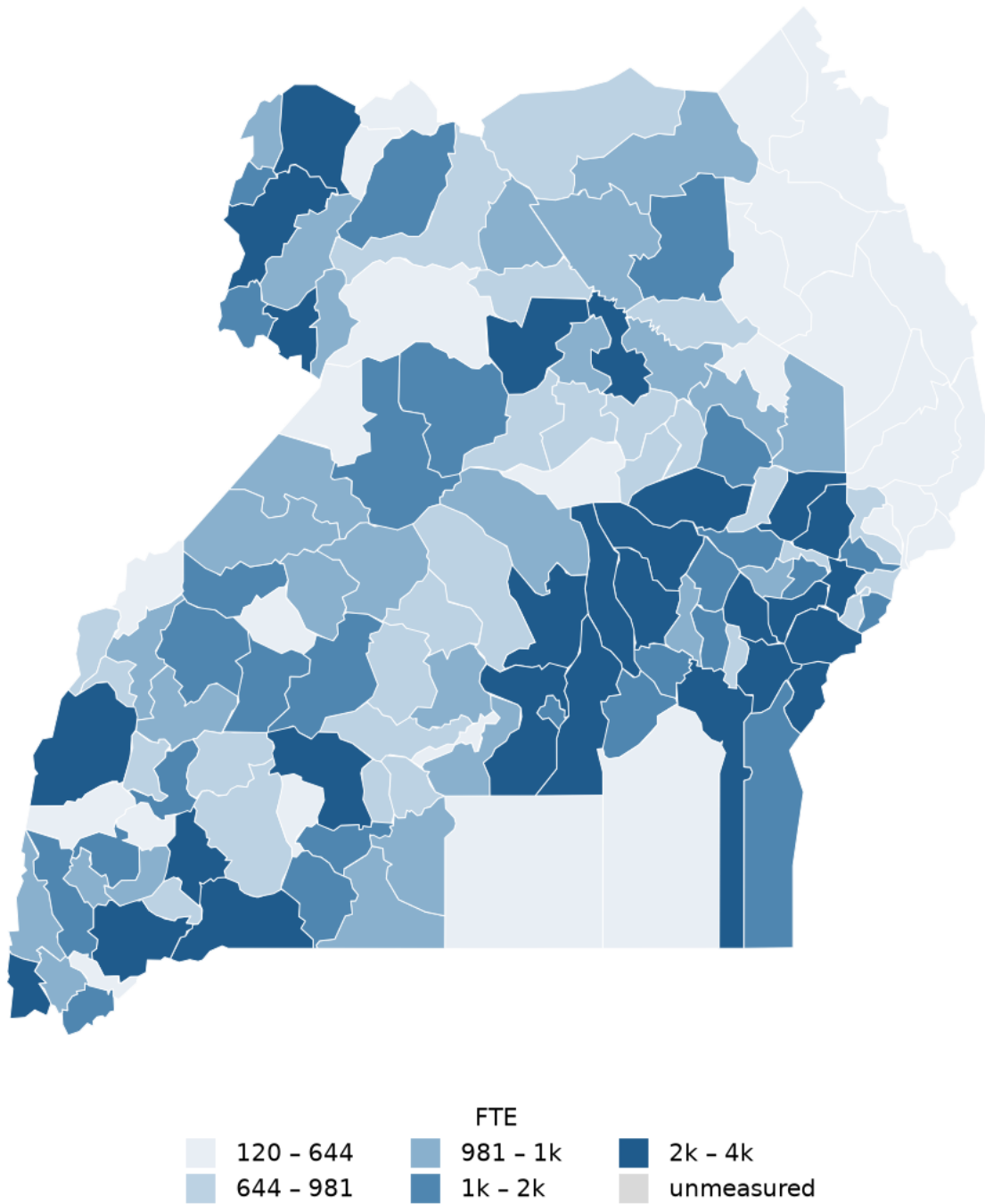


Figure 6.5: Primary teachers required, base year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Pre-primary and primary classrooms required

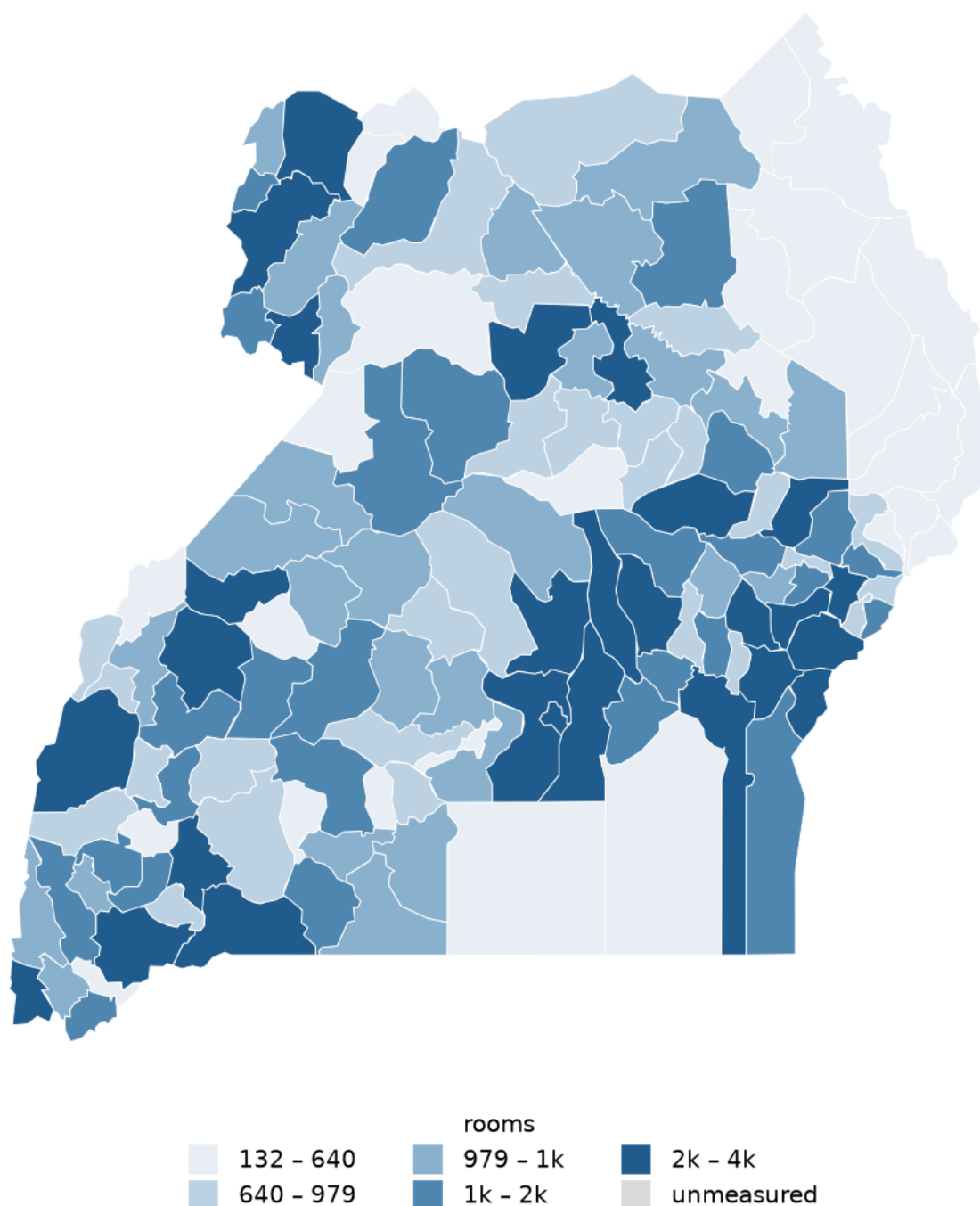


Figure 6.6: Primary classrooms required, base year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The three maps carry the same geography in different units. Figure 6.4 shows public primary places. Arua is the largest single requirement at 307,002, and the top of the distribution is a West Nile cluster — Arua, Maracha, Nebbi, Yumbe, Koboko — joined by Kasese, Tororo, Butaleja, Oyam, Wakiso and Ntungamo. The bottom is Karamoja and the small, recently created districts: Amudat at 6,728 places, then Obongi, Kalangala, Ntoroko and Nabilatuk. The spread is a factor of 46, a reminder that a uniform district allocation is a regressive one.

Figure 6.5 and Figure 6.6 are not that map rescaled, and the difference is this chapter's central mechanism made visible. Nationally the requirement is 26.2 teacher FTE per 1,000 public primary places, but districts range from

23.4 in Maracha to 33.9 in Nakasongola, and the pattern is almost entirely school size: across the 135 districts the correlation between the log of places per school and FTE per 1,000 places is -0.96 . Maracha, Koboko, Kotido, Karenga and Kaabong have large schools, 1,500 to 2,100 public primary places each, and need the fewest teachers per learner; Nakasongola, Sheema, Mpigi, Mityana and Rukungiri average under 300 places a school and need a third more. The relationship is partly by construction, since the small-school correction puts it there — which is the point, not an objection: it says, in the only units a budget understands, that the cost of a place is not the same everywhere. The classrooms map carries the same signal, with the caveat that its line covers pre-primary and primary together, so districts with high pre-primary coverage — Kampala and Wakiso most visibly — sit higher on it than on the places map.

6.9 Data quality and its limits

The tiers are measured < normed < imputed < assumed, and EM-03's outputs sit mostly in the lower two.

Imputed, unavoidably. No enrolment figure here is measured. The last published district EMIS is 2017; the base year is a bridge from it on observed flows and must be replaced when a current extract is obtained. Class formation is `small_school_imputed+integer` for every primary and secondary cell, because there is no school-level enrolment and the per-school ceiling can only be approximated. The correction coefficient of 0.35 is assumed within the manual's 0.3–0.5 range; moving it across that range moves the teacher and classroom requirement by close to the 19 per cent it currently contributes.

Normed. The primary and lower secondary class sizes, the capitation, desk, stance and furniture lines, the classroom and laboratory standards and the head-teacher establishment come from the MoES Local Government Planning Guidelines 2022, cited line by line in Table 6.7 and Table 6.6.

Assumed, and flagged. The secondary curriculum periods are not yet verified against the NCDC framework; every teaching load in Table 6.4 is assumed, including 36 taught periods for a primary class teacher and 24 for a secondary one, as are the 5% absence allowance, the zero administrative release, the utilisation targets, the pre-primary and upper secondary class sizes and the textbook ratios. Of 99 norm coefficients, 64 are flagged assumed.

Not in this run at all. Multigrade and double shifting are set to 1, so neither reduces the requirement. Modality and locality do not exist as dimensions here; norms resolve nationally by service only, so a boarding place and a day place carry the same bill of materials. The participation ceiling and the infeasible-target report are not exercised: the target path is expressed purely in rates, no access ceiling binds and no row carries a binding reason. And pre-primary is not on the flow model. It is a **coverage fallback** — district coverage held at its 2017 level applied to the population aged three to five — which is why pre-primary is identical on both paths in Table 6.1 and why its 14,509 teachers and 12,436 classes respond to population and nothing else. Every pre-primary row is flagged `coverage_fallback`, and its norm lines carry only a desk: no capitation, no textbook, no stance. The pre-primary requirement here is a floor, not an estimate.

6.10 Implications for planning

The small-school correction is a fiscal fact, not a technical footnote. It adds roughly 30,000 primary classes, and with them close to 30,000 teachers and 30,000 rooms, to a requirement a ratio method would never have shown. Those classes are real, and the teacher in front of a group of twenty-nine costs exactly what the teacher in front of fifty-three costs. Any formula that distributes teachers or capitation strictly per learner will under-resource the districts identified in Figure 6.5, year after year, without the shortfall ever appearing as a line item. The first practical use of this chapter is to test the current allocation formula against a per-class rather than per-learner requirement.

The secondary teacher requirement is the plan's largest single fiscal risk. A ratio method understates the total requirement by 47 per cent and understates it worst at secondary, where a class of 60 needs 2.23 teachers. Lower

secondary expands on the target path from 1.29 million to 1.71 million learners in four years, and every one of those learners arrives with a share of a physics teacher, a chemistry teacher and a laboratory attached. EM-07 takes up the pipeline that must train them; the requirement side is settled here.

Build laboratories to the timetable. The 7,483 specialist rooms the science timetable demands against 1,012 secondary schools is the clearest case of a norm expressed per school producing a requirement that is not per school. The decision it supports is not whether to build laboratories but how many and where — the second laboratory in a large school buys more science periods than the first in a small one. The utilisation target applied to laboratories here is 1.0, which is optimistic; the 0.85 used for secondary classrooms would raise the requirement by about a sixth, and the norm review should settle it.

Fix the data before refining the model, and report both ownership columns. Almost every caveat above has one root: no district EMIS after 2017 and no school-level enrolment at all. With a current school-level extract, class formation would stop being an approximation, ϵ would disappear, the deputy-head threshold would be evaluated school by school, and the base year would carry a *measured* tier. That is worth more than any refinement of the norms. Alongside it, the ownership treatment belongs on the face of every scenario comparison rather than in an assumptions annex: if the non-state share of primary falls by even a few points over the horizon, the public requirement rises by hundreds of thousands of places that appear nowhere in this run.

CHAPTER 7

7 EM-04 Supply: schools, classrooms, teachers and access

The previous chapter established what Uganda's children require. This chapter establishes what the system already has. In every earlier edition that was the harder half of the planning identity: a requirement can be computed from a population and a norm, whereas supply has to be observed, and the most recent district education data Uganda had published was the 2017 statistical abstract. Supply was an eight-year extrapolation, and the chapter said so at length.

That is no longer the position. In May 2026 the Uganda Bureau of Statistics published the **Baseline Education Census 2025** (UBOS 2026), a complete enumeration of every government and private school implementing the national curriculum, with reference year 2025. The engine takes its supply from the census where it is loaded, and falls back to the 2017 abstract only where it is not. **The supply in this report is counted, not carried forward.**

The module's discipline is unchanged and now easier to keep: supply is measured, not inferred, and where it must be inferred the inference is named and flagged (`docs/06_EM04_SUPPLY.md`). What it holds it converts into the one quantity EM-05 can difference against the requirement: **places**, computed twice, from rooms and from teachers, with the smaller kept and the binding side recorded.

7.1 The source of the supply, and its tier

Table 7.1 records the vintage, source, coverage and quality tier of the measured supply the whole chain stands on: reference year **2025**, the **UBOS Baseline Education Census 2025**, **135 districts**, basis "complete enumeration of government and private schools", quality **measured**. The row is written by the engine from whichever source `supply_source` selected, not asserted in the report text: remove the census from the database and the table reads 2017, "school census annexes, carried forward", *imputed*.

Table 7.1: The source of the measured supply in this run

Year	Source	Districts	Basis	Quality
2025	UBOS Baseline Education Census 2025	135	complete enumeration of government and private schools	measured

The engine uses the most recent count of schools it has. Source: EPRAS run 6b2afcf6 (report/build/data/t_supply_vintage.csv).

The census reports **146 units**: the 135 pinned districts, ten cities carved from their parents, and Terego. **Thirteen** are folded back, with the rule for each written to a crosswalk rather than applied as a silent rename. The reference year is 2025, so the bridge to the plan year is one year, not nine.

7.2 What the census counted

Table 7.2: What the Baseline Education Census 2025 counted

Cycle Code	Schools Gov	Schools Private	Learners Gov	Learners Private	Teachers	Classrooms	Stances
PRE	3193	35154	205339	2169335	82,763	116,394	102,825
PRI	12557	31010	5211732	3906582	270,176	292,791	214,569
SEC	1484	4014	903996	1104137	49,631	44,679	50,885

UBOS Baseline Education Census 2025. Every column reconciles exactly with the totals printed in the census report; classrooms and stances are derived from its published ratios and raked to those totals. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_national.csv).

Every column of Table 7.2 matches the census report's own key findings. At primary it counts **12,557 government schools and 31,010 private ones, 5,211,732 government and 3,906,582 private learners** (9,118,314 in all), **270,176 teachers** of whom **109,606 are in government schools, 292,791 classrooms** of which **103,602 are government**, and **214,569 latrine stances**. At secondary it counts **1,484 government schools and 4,014 private ones, 903,996 government and 1,104,137 private learners** (2,008,133 in all), **49,631 teachers** of whom **22,150 are in government schools**, and, for the first time anywhere, the secondary estate itself: **44,679 classrooms**, of which **14,945 are government**, and **50,885 latrine stances**. The stance totals are published for all schools together; the government share is derived from the ownership-specific stance ratios published by district.

The government columns, carried into the base year, are the supply in Table 7.3: **12,557 primary schools, 104,465 usable classrooms** — the 103,602 counted rooms plus one year of the development grant, discussed below — **109,606 teachers in post and 4,689,263 primary places**; and **1,484 secondary schools, 14,945 classrooms, 22,150 teachers in post and 682,167 secondary places**.

Table 7.3: Government supply by cycle in the base year

Cycle	Schools	Osm Points	Classrooms	Teachers In Post	Places
PRI	12,557	16,786	104,466	109,606	4,689,263
SEC	1,484	3,308	14,945	22,150	682,167

Classrooms are weighted by condition through the usability factors. Where the Baseline Education Census supplies the supply, secondary classrooms and stances are counted too; they were unmeasured in every edition before it. Source: EPRAS run 6b2afcf6 (report/build/data/t_supply.csv).

Government primary schools

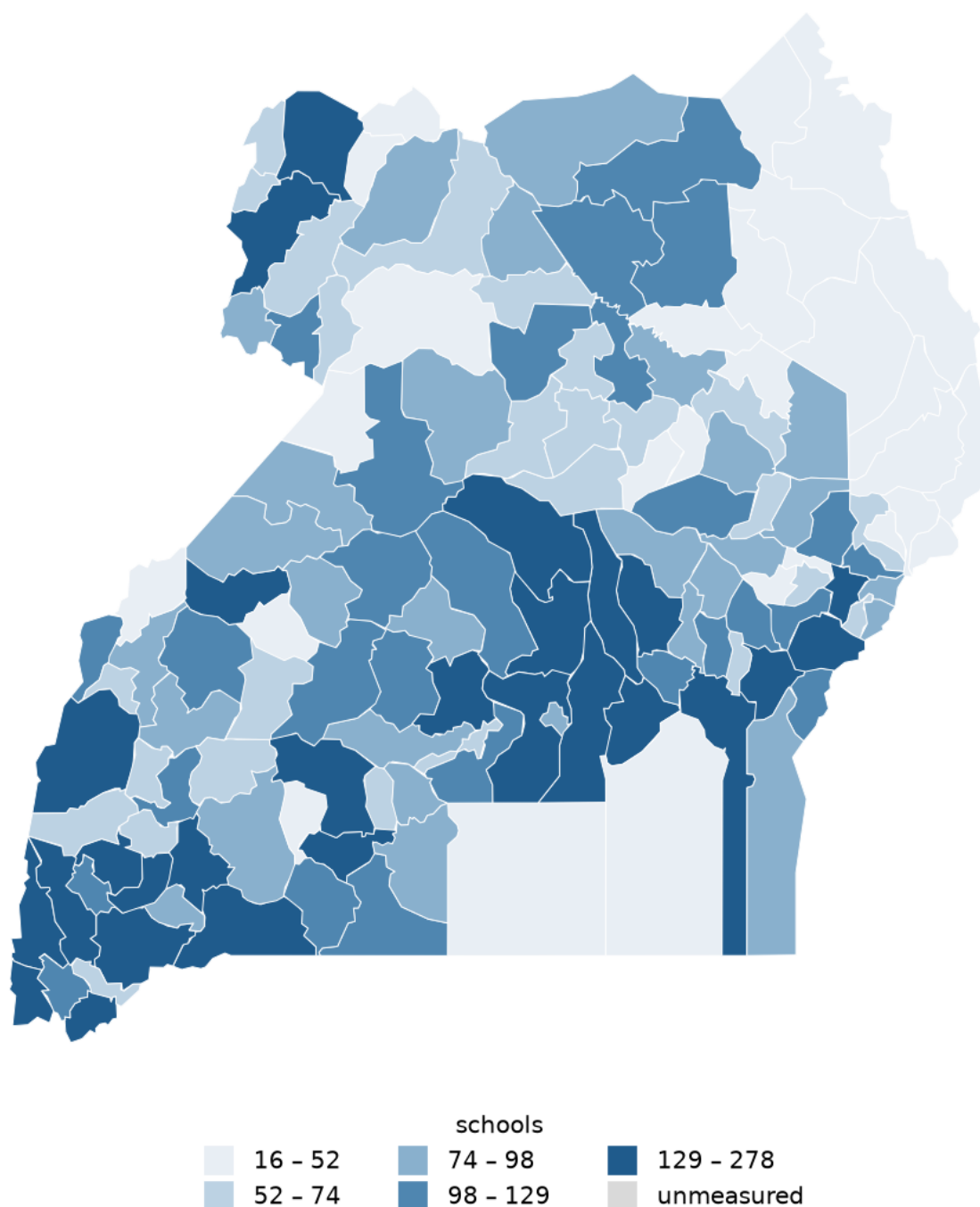


Figure 7.1: Government primary schools by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

7.2.1 What the count replaced, and why conclusions moved

The differences against the 2017 carry-forward are large and run in one direction. The carry-forward **overstated government primary teachers** — 158,229 against a counted 109,606, an excess of 48,623 — and **overstated classrooms**, 123,575 against a counted 103,602, an excess of 19,973. It made the same error at secondary, carrying 27,071 teachers against a counted 22,150. In the other direction it **understated the number of schools**: 12,036 government primary schools against 12,557 counted, and 1,012 government secondary schools against 1,484.

The pattern is coherent. The 2017 teacher figure was a national total split to government by an enrolment share too generous to the public system; the 2017 classroom figure was enrolment divided by a published pupil–classroom ratio, and inherited the same error; the school counts had simply not been updated for nine years. The carry-forward therefore described a public system with fewer, larger, better-staffed and better-roomed schools than Uganda has, and several conclusions moved with it: the classroom and place gaps are roughly half what the previous edition reported, the staffing picture is markedly worse, and the binding constraint changed from a clear national classroom shortage to a near-even split — changes in knowledge, not in the world.

7.3 Private provision, and the size of the public system

The largest single surprise in the census is not a stock but a share. **Private schools outnumber government primary schools by nearly three to one** — 31,010 against 12,557 — and they teach **42.8 per cent of primary learners**. At secondary the imbalance is sharper: 4,014 private schools against 1,484 government ones, and more private learners (1,104,137) than government ones (903,996).

This matters arithmetically for a government plan. Non-state capacity is never added to public capacity: it is netted out on the **demand** side in EM-03, so that a later change to the ownership treatment cannot double-count. A larger private share therefore makes the public requirement smaller. Of the 12.59 million learners projected across the four cycles in the base year, **6.86 million are the public system's to finance** — against the 9.51 million the 2017-based split implied — and the cost of closing the gaps falls with it. That is not a smaller problem: those children are seated at their parents' expense, which the household-cost analysis accounts for. And the share is an observation for 2025 held fixed across the horizon, not a policy.

7.3.1 Where the schools are, which the census does not say

The census counts schools by district but does not place them on a map, and access and the siting model in EM-07 need coordinates. The OpenStreetMap education point layer in the Africa Education GIS Database supplies them: 34,652 Uganda school points, **34,646** of them inside a district polygon, carrying a coordinate and often an ISCED level but no EMIS number, enrolment or capacity attributes. It states **where schools exist** and nothing about supply, so the `osm_points` column in Table 7.3 is a cross-check that enters no capacity calculation: 16,786 located primary points against 12,557 government primary schools, and 3,308 secondary points against 1,484 government secondary ones, the difference being largely ownership. Figure 7.1 maps the counted register, not the points.

7.4 Classrooms and stances: measured ratios, imputed counts

The census publishes classrooms and latrine stances **by district as ratios, not as counts** — pupil–classroom, pupil–stance and pupil–teacher ratios, by ownership. Counts are recovered as learners divided by the ratio, computed **per census unit before any aggregation**, because a ratio cannot be summed, and then raked to the national totals the census prints, because the published ratios are rounded to whole numbers. The raking factor is recorded for every column.

The tier difference this creates is deliberate and runs through the chapter. Schools, learners and teachers are **measured**: the census counted them, and the extract reconciles exactly to the published totals. Classrooms and stances are **imputed**: they are measured quantities recovered through a rounded ratio, so the national totals are as good as the census's own while the district split carries the rounding error — a ratio printed as 60 rather than 59.5 moves a district's classroom count by about a per cent. The distinction is recorded as the data-quality finding `SRC_BEC_RATIO_DERIVED`, one of eight in the run.

Rooms are then weighted by condition before they become capacity:

$$C_d^{\text{usable}} = \sum_k R_{d,k} u_k \quad (7.1)$$

where

- C usable is usable classrooms in district d , the quantity that enters capacity;
- R is the number of rooms in district d recorded in condition k ;
- u is the usability weight attached to condition k by the norm set;
- k runs over the four conditions the norm set recognises: permanent, semi-permanent, temporary and unusable.

The weights in the pinned norm set are 1.0 for permanent and semi-permanent, 0.7 for temporary and 0.0 for unusable. The 0.7 is the important number: a temporary structure is not zero, because children are taught in it today, and not one, because a plan that counts a grass-thatched shelter as the equal of a classroom will never replace it.

The census does not publish a condition split either, so the module still passes the whole stock through Equation (7.1) in the single condition whose weight is 1.0, under the named constant `ROOM_CONDITION_ASSUMED`, leaving the omission a visible line in the source rather than an invisible default. Equation (7.1) is therefore an identity, and Uganda still cannot distinguish a classroom deficit needing new construction from one needing rehabilitation. This is now the largest single hole in an otherwise counted estate.

One year is bridged between the census reference year and the base year, using the only construction money visible in the approved budget: the local government primary development grant, UGX 75.9bn in FY2025/26. The engine assumes 60 per cent of it is spent on classrooms — a declared assumption in one named constant, `DEV_CLASSROOM_SHARE` — divides by the Construction Management Unit classroom price of UGX 52,711,605 per room in constant 2026 terms, and allocates the result by counted stock. That is **864 rooms**, added to the 103,602 counted to give the 104,465 usable classrooms in Table 7.3, flagged *assumed*. Over nine years the bridge was a material share of the stock; over one year it is 0.8 per cent of it. No equivalent bridge is applied at secondary, where the stock is the counted 14,945.

7.5 From stock to places, and which constraint binds

Capacity is computed twice, rooms first:

$$P_d^{\text{room}} = C_d^{\text{usable}} \kappa \sigma \omega \quad (7.2)$$

where

- P room is places supplied by classrooms in district d ;
- κ is the class-size norm — 53 learners for primary, 60 for lower secondary (MoES 2022, p. 23);
- σ is the shifts a room is used per day, 1 in the pinned norm set for every cycle;
- ω is the utilisation target — 0.90 primary, 0.85 secondary (Table 7.4) — the allowance for rooms not in class use every period. The standard records it as assumed, while the ratio and the 56 m² and 63 m² room areas beside it are normed.

Table 7.4: Capacity standards: rooms, utilisation and area

School Type Code	Facility Input	Basis	Quantity	Utilisation Target	Area M2	Source	Quality
PRI_GOV	CLASSROOM	per_class	1	0.9	56	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.90	normed
PRI_GOV	LATRINE_STAN CE	per_40_learners	1	1		MoES LG Planning Guidelines 2022 p.23	normed

School Type Code	Facility Input	Basis	Quantity	Utilisation Target	Area M2	Source	Quality
SEC_GOV	CLASSROOM_SE	per_class	1	0.85	63	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.85	norm ed
SEC_GOV	SCIENCE_BLOCK	per_school	1	1		MoES LG Planning Guidelines 2022 p.23	norm ed

Source: EPRAS run 6b2afcf6 (report/build/data/t_capacity_standards.csv).

Teachers second, and from the timetable rather than from a pupil–teacher ratio, as the principle that governs the whole engine requires:

$$P_d^{\text{teach}} = \frac{T_d^{\text{post}} \lambda}{\pi(1 + \alpha)} \kappa \quad (7.3)$$

where

- P_d^{teach} is places supplied by teachers in district d ;
- T_d^{post} is teachers **in post** — now the census count, never the payroll and never the establishment;
- λ is the teaching load, the periods a teacher actually teaches per week: 36 for a primary class teacher, 24 for a lower-secondary subject teacher, both tiered assumed and flagged for the norms review;
- π is the periods a class must be taught per week, 40 in the pinned structure for both cycles;
- α is the absence allowance, 0.05, which inflates the staffing needed to keep a class taught and so deflates the places a given headcount supplies;
- κ is the same class-size norm as in Equation (7.2).

The first factor of Equation (7.3) is the classes a district's teachers can staff; κ converts classes into places. Capacity is the smaller of the two, and the argument of the minimum is stored:

$$K_d = \min(P_d^{\text{room}}, P_d^{\text{teach}}) \quad b_d = \text{argmin}(P_d^{\text{room}}, P_d^{\text{teach}}) \quad (7.4)$$

where K is the district's available places and b the binding constraint, recorded as `room` or `teacher`. District capacity is the sum of its schools' capacity, never a national figure disaggregated downward.

7.5.1 Secondary capacity now has a real binding constraint

Until the census, **secondary classrooms and secondary latrine stances had never been published by district at all**. The room side of Equation (7.4) could not be computed, the minimum collapsed to its teacher term, and the binding constraint was recorded as `teacher` (`rooms` unmeasured). Every secondary district in every previous edition was **teacher-bound by construction**, and that label carried no information: it was a missing column wearing the appearance of a finding, and the secondary capacity figure was a ceiling on what teachers could staff rather than a statement that rooms were adequate. Both sides are now counted: `teacher` (`rooms` unmeasured) appears on no row, and the 682,167 secondary places in Table 7.3 are a capacity figure in the same sense as the primary one.

7.5.2 The split, and where it has moved

Table 7.5: What binds capacity in each district: rooms or teachers

Binding Constraint	Districts
room	69
teacher	66

A teacher-bound district receiving a classroom grant is the defect this table exists to surface. Source: EPRAS run 6b2afcf6 (report/build/data/t_binding.csv).

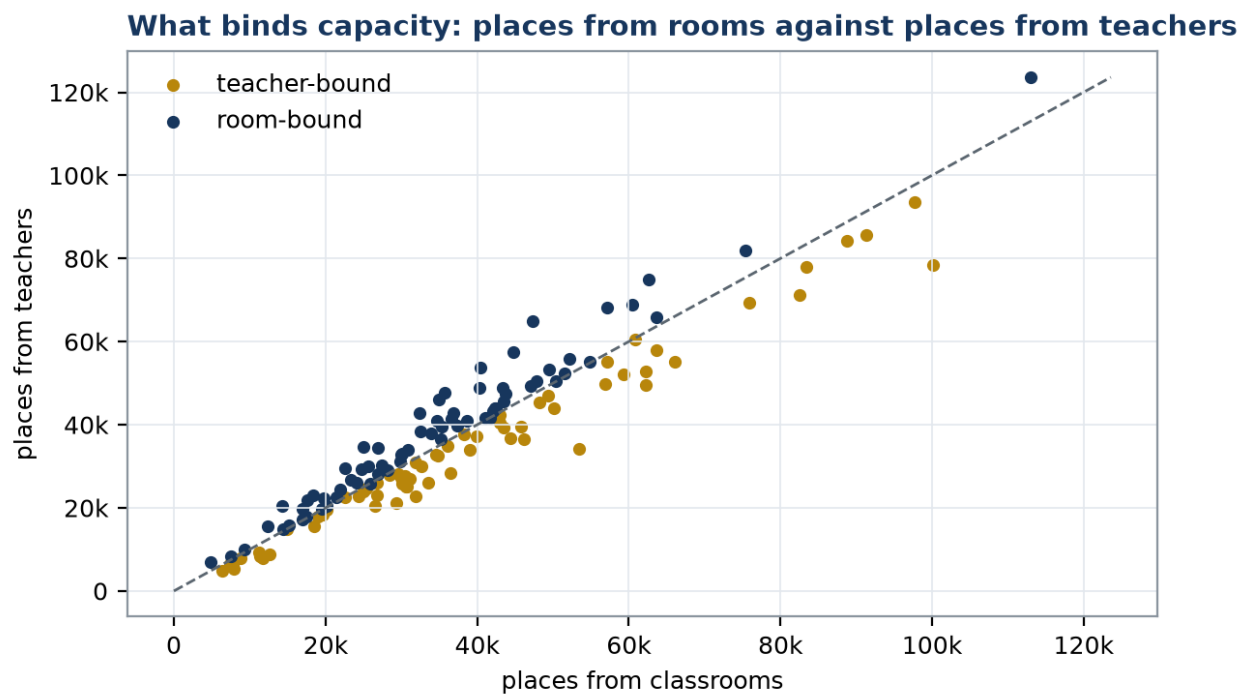


Figure 7.2: Places from rooms against places from teachers, one point per district

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

What binds: rooms or teachers

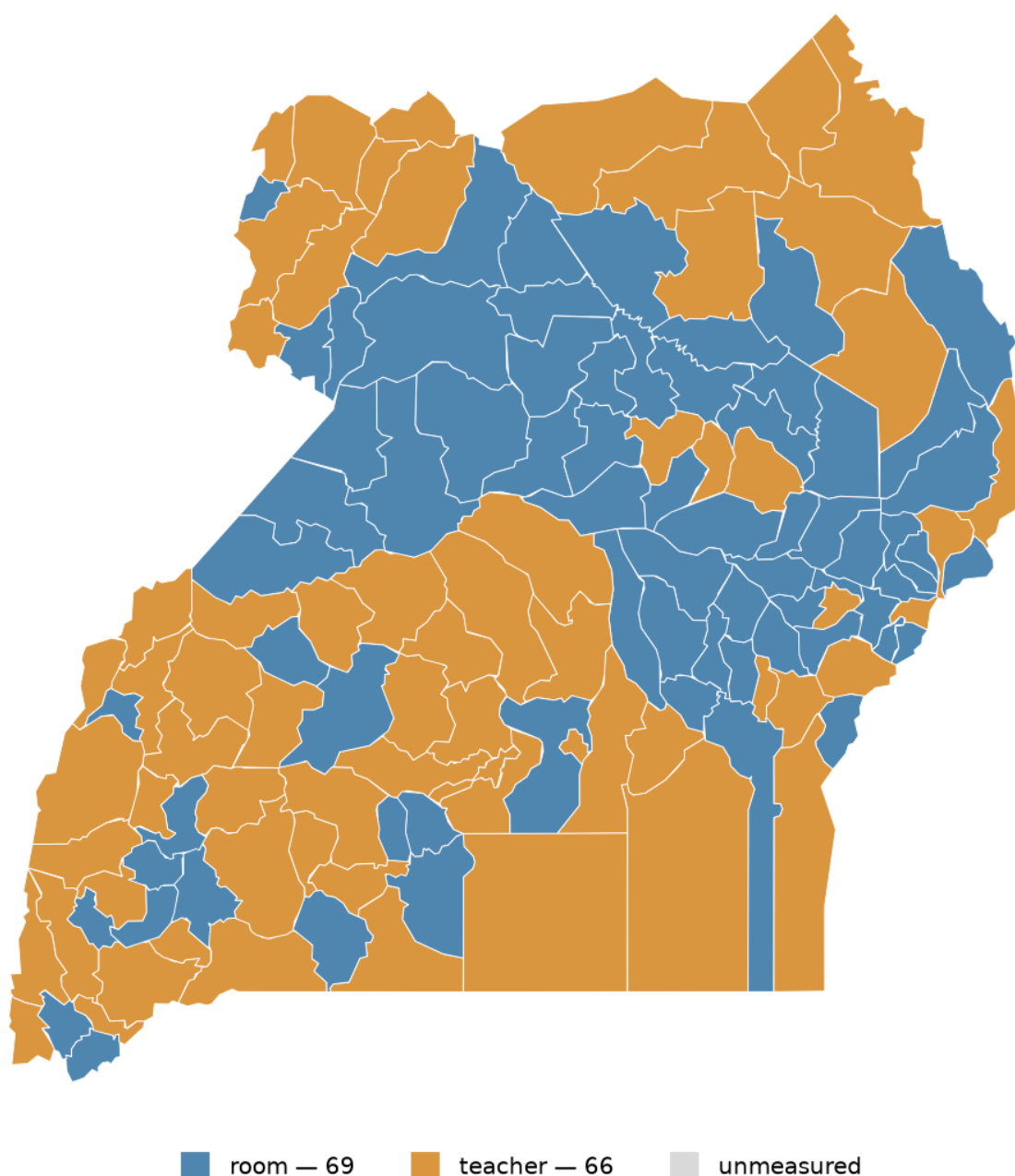


Figure 7.3: What binds capacity in each district: rooms or teachers

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The count is **69 room-bound districts and 66 teacher-bound ones** (Table 7.5). On the carried-forward data it was 104 room-bound and 31 teacher-bound. **The split has shifted markedly towards teacher-bound** — from roughly three-to-one in favour of rooms to almost even — and the reason is the teacher count itself: the carry-forward credited the system with 48,623 government primary teachers it does not have, and those were what held most districts on the room-bound side of the minimum.

Figure 7.2 plots the two quantities against each other, with the 45-degree line marking where they would be equal: districts above it are room-bound and those below teacher-bound. Figure 7.3 maps the same classification. Both should be read with Table 7.5, which carries the authoritative counts.

Nationally the classroom and teacher stocks now support similar numbers of places, so **no national statistic can tell a planner which instrument to buy**. A construction-led programme justified on a national classroom shortage would put rooms into sixty-six districts that cannot staff the rooms they have: they would arrive with their full capital cost, add an induced recurrent cost, and add no places, because the minimum would not move.

The geography is no longer the clean regional story the carried-forward data told. Five of Karamoja's eight districts — Amudat, Kaabong, Karenga, Kotido and Napak — are teacher-bound, while Moroto, Nabilatuk and Nakapiripirit are room-bound. Amudat holds 133 usable classrooms against 109 teachers in post, and its 18 government primary schools yield 4,952 places, among the lowest in the country alongside Nabilatuk's 4,898; Wakiso, the largest at 113,002 places from 278 schools, 2,369 classrooms and 2,721 teachers, is room-bound.

Primary places available

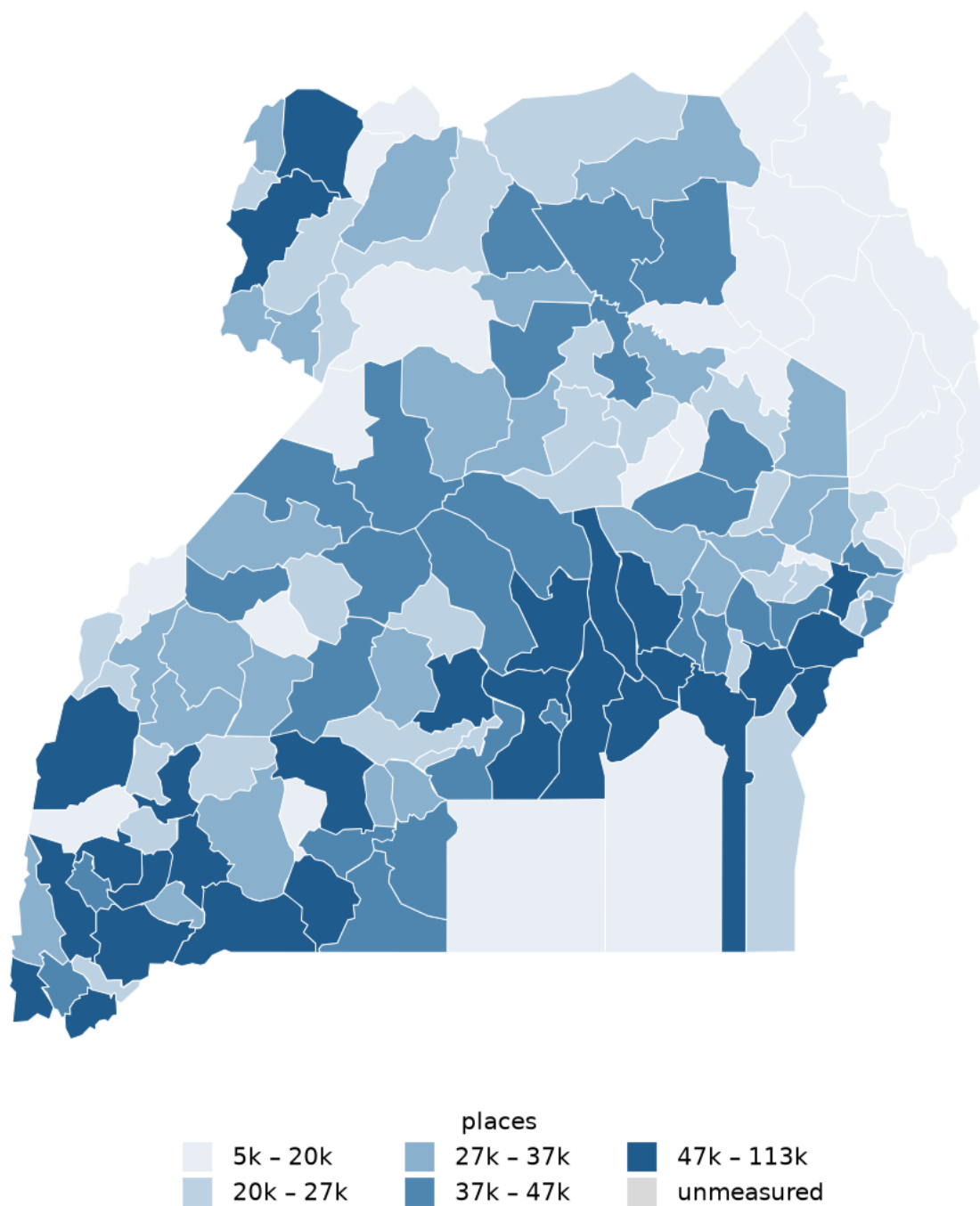


Figure 7.4: Primary places available by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Pupil-teacher ratio, primary

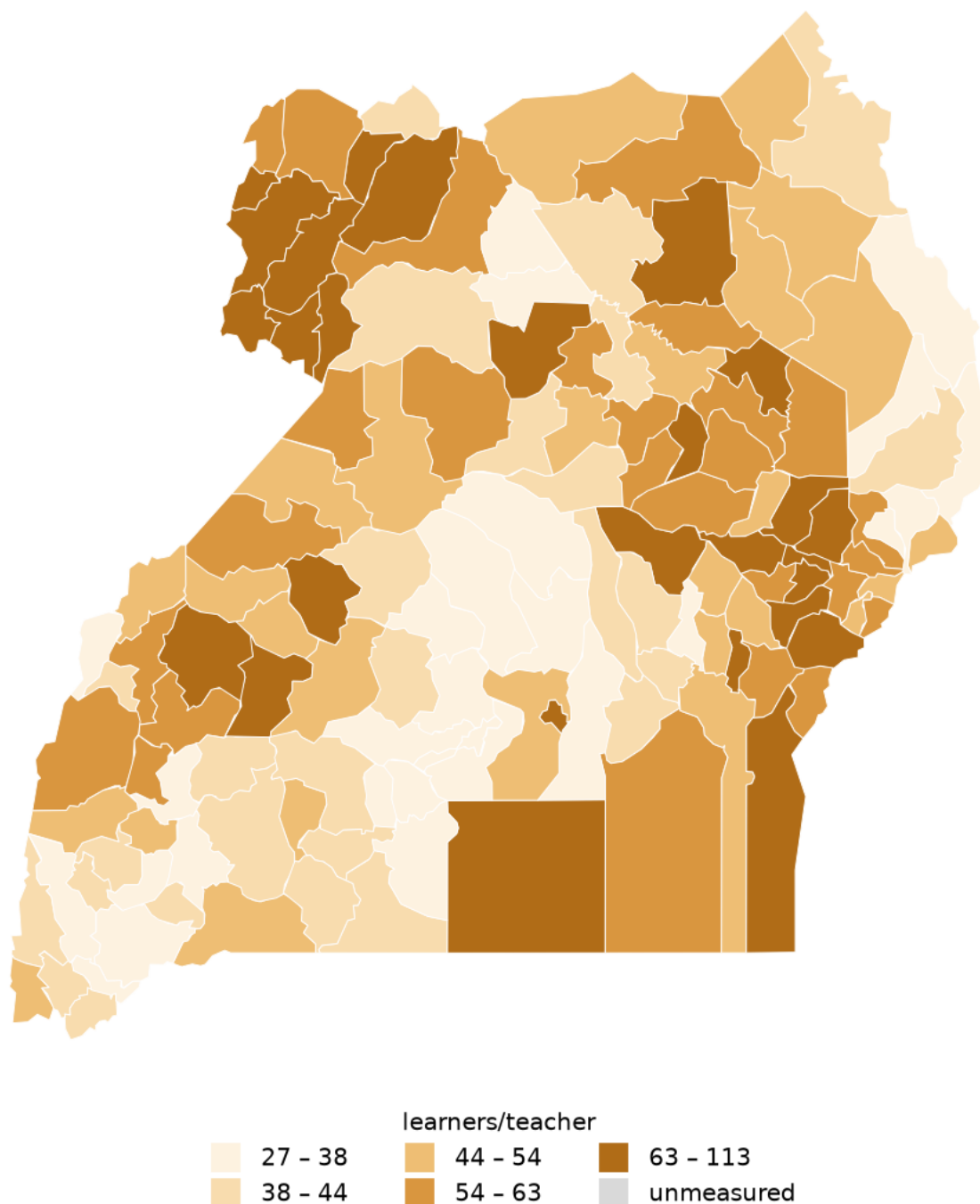


Figure 7.5: Pupil–teacher ratio, primary

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 7.4 maps available primary places and Figure 7.5 the pupil–teacher ratio; read together they show districts that look adequately provisioned on places whose ratios say those places exist only on paper. The national arithmetic agrees: 4,689,263 government primary places against the 5,211,732 government primary learners counted. The public system teaches more children than its own norms say it has rooms and staff for, and the difference is class size.

7.6 Teachers: three counts that are never reconciled into one

The specification requires the engine to carry three teacher counts and forbids it to reconcile them: each is correct for a different question.

- **In post** is the count of people at the school; capacity is computed from it, and it enters Equation (7.3). It is **now counted**, by the census, at 109,606 government primary and 22,150 government secondary teachers.
- **On payroll** is the count of people being paid, from which the wage bill follows. It is **still derived from money**, because no teacher management system extract or payroll file was available.
- **Established posts** is the count of funded positions, with $\text{posts} - \text{payroll}$ the recruitment space available without a new establishment. It is **still not published**.

Table 7.6: The three teacher counts, never reconciled into one

Cycle	In Post	Payroll	Posts	Payroll Minus In Post	Note
PRI	109,606	137,247		27,641	in_post: UBOS Baseline Education Census 2025 (2025); payroll: FY2025/26 wage bill / avg cost
SEC	22,150	27,915		5,765	in_post: UBOS Baseline Education Census 2025 (2025); payroll: FY2025/26 wage bill / avg cost (science share from EM-03)

Capacity uses teachers in post; the wage bill uses the payroll; recruitment space uses posts less payroll. Source: EPRAS run 6b2afcf6 (report/build/data/t_teacher_counts.csv).

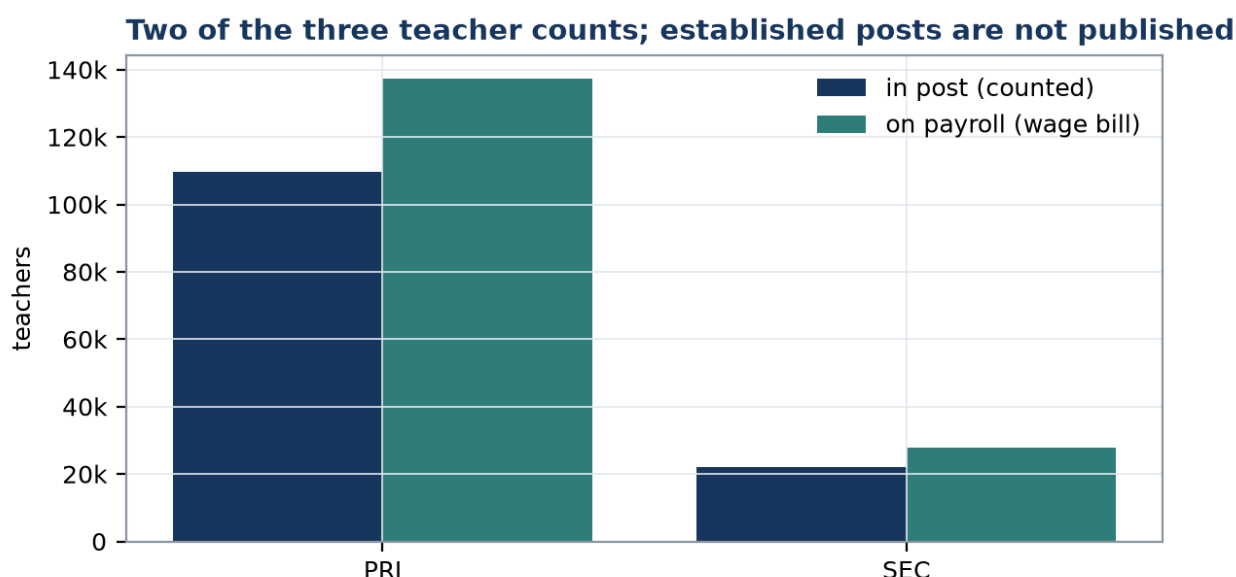


Figure 7.6: Two of the three teacher counts; established posts are not published

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

The payroll derivation is unchanged: the approved FY2025/26 local government primary wage grant of UGX 1,029.8bn divided by an average annual cost per primary teacher, built from the Ministry of Public Service salary structure at UGX 7,047,810 for a primary teacher and UGX 11,600,972 for a head teacher, mixed nine to one — the mix a declared assumption. The same method on the UGX 870.3bn secondary wage grant, with the science/arts mix from EM-03, gives the secondary count. The results are **137,247** and **27,915** (Table 7.6). Established posts remain absent, so that column is empty: not inferred from staffing norms, not set equal to the payroll, not silently dropped. Figure 7.6 shows two bars per cycle where the specification calls for three, and its title says why.

7.6.1 What the difference between the counts does and does not say

On the new basis the $\text{payroll} - \text{in_post}$ difference is **+27,641** at primary and **+5,765** at secondary. **The sign has reversed.** On carried-forward data it was negative at both cycles, which under the specification's decision rule

pointed to unpaid provision — community-hired, PTA-paid or volunteer teachers in government classrooms. It now points the other way: more teachers are being paid than the census found at school, which under the same rule is the signature of absence or payroll leakage.

That reading has become more credible, and it is still not a finding. More credible, because the vintage mismatch that contaminated the old comparison has almost gone: the in-post count is a 2025 enumeration and the payroll a FY2025/26 wage bill, one year apart rather than nine. Not a finding, because the payroll side is not a payroll. It is a budget line divided by an assumed 9:1 teacher-to-head staff mix at a 2026 salary scale, and a different mix moves the quotient by thousands. A wage bill paying for about a fifth more people than the census found at school is worth investigating; but the engine cannot say how much is ghost workers, how much secondment, how much absence on the day of enumeration, and how much the wrong staff mix in a denominator.

Two limits follow from the absent establishment register. The quantity a ministry most needs when deciding whether to recruit is $\text{posts} - \text{payroll}$: how many funded positions sit unfilled. The engine cannot compute it, so every recruitment number in the later chapters is requirement-side, with no statement of how many could be hired inside the existing establishment and how many need new funded posts — different budget instruments with different approval routes. And the within-district deployment index still needs school-level counts; since intra-district inequality of pupil–teacher ratios is frequently larger than inter-district inequality, that remains the cheapest unmeasured gap in the system.

7.7 Physical access: the 3 km norm on a straight line

Access is a supply attribute of the district, not of a school. A classroom no child can reach supplies no places, so the engine measures reach as the share of settlements within the walking norm of a school:

$$A_d = \frac{1}{N_d} \sum_{i \in S_d} I(\delta_i \leq 3) \quad (7.5)$$

where

- A is the access share for district d — the share of its settlements within the walking norm;
- S is the set of settlement points inside district d and N is their number;
- δ is the distance in kilometres from settlement i to the nearest school point;
- I is the indicator, 1 when the condition holds and 0 otherwise, and 3 is the walking norm in kilometres.

Nothing in this calculation changed. The inputs are the AEGDB (2026) settlement layer — 81,746 points with 80,160 settlement-to-nearest-school links — located to district by point-in-polygon, with the nearest school taken from the OSM layer, because the census publishes no coordinates. The national figure, **94.6 per cent**, is the district shares weighted by available places; EM-05 converts the complement into **726,951** primary-age children beyond the norm.

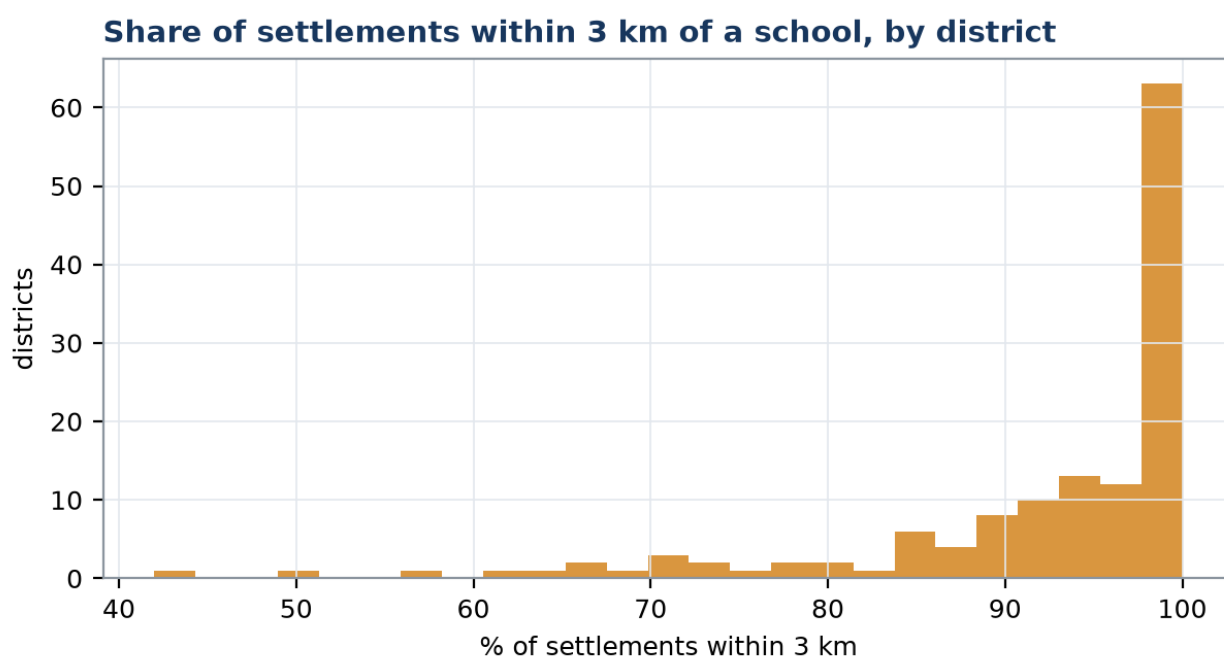


Figure 7.7: Share of settlements within 3 km of a school, by district

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Children beyond the 3 km walking norm

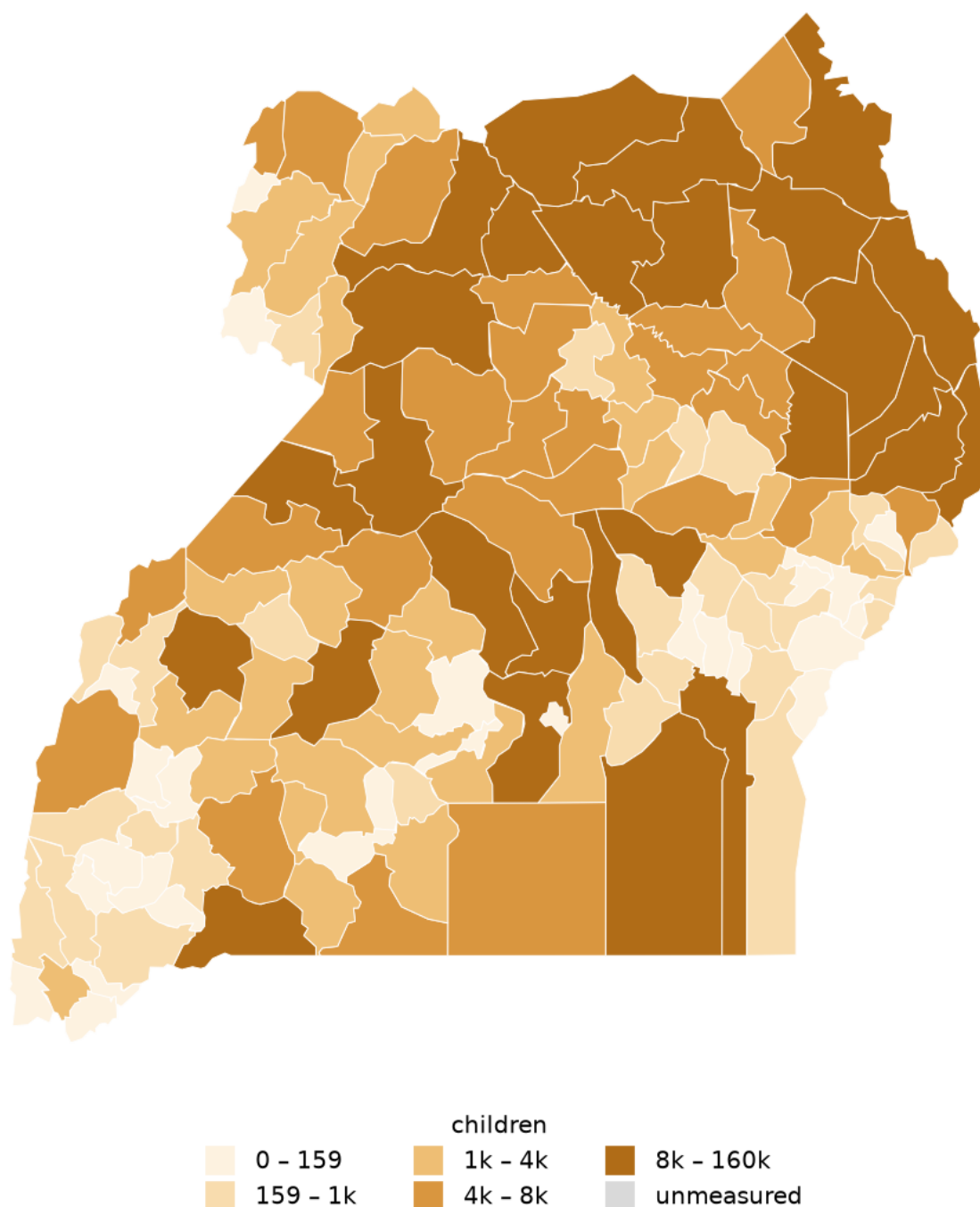


Figure 7.8: Children beyond the 3 km walking norm

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 7.7 shows the distribution across the 135 districts. It is strongly left-skewed: the median district sits at 0.972 and 24 districts are at or effectively at 100 per cent, while a thin tail runs down to 42 per cent. Figure 7.8 maps the children beyond the norm and Table 7.7 lists the fifteen worst districts.

Table 7.7: The fifteen districts where the fewest settlements lie within 3 km of a school

District ID	Access Share 3Km	Access Method
Amudat	0.42	euclidean

District ID	Access Share 3Km	Access Method
Napak	0.498	euclidean
Nabilatuk	0.562	euclidean
Kotido	0.619	euclidean
Karenga	0.633	euclidean
Kalangala	0.673	euclidean
Lamwo	0.673	euclidean
Nakaseke	0.696	euclidean
Moroto	0.702	euclidean
Kaabong	0.713	euclidean
Nwoya	0.713	euclidean
Nakapiripirit	0.725	euclidean
Ntoroko	0.728	euclidean
Buvuma	0.767	euclidean
Pader	0.772	euclidean

Straight-line distance on OSM layers; the method is recorded on every row and raises a warning. Source: EPRAS run 6b2afcf6 (report/build/data/t_access_lowest.csv).

The tail is Karamoja and the far north, with the island districts alongside. Amudat at 0.420 and Napak at 0.498 are the only districts where more than half the settlements lie beyond a 3 km walk; Nabilatuk, Kotido and Karenga follow between 0.562 and 0.633; Kalangala and Buvuma are the island cases. Ten of these fifteen districts are also teacher-bound: the access deficit and the staffing deficit still land on the same places, the most important spatial fact in this chapter.

7.7.1 Why access is now the weakest part of the supply picture

The `access_method` column in Table 7.7 reads `euclidean` on all 135 districts, which is deliberate exposure: the module reads the method from the observation itself rather than asserting a literal, so when a friction surface or road network is loaded the column changes with no code change. The specification's ladder is friction surface, then road network, then straight line; this build sits on the bottom rung, and the fallback raises the warning `SRC_ACCESS_EUCLID`.

Two distortions follow. Straight-line distance ignores barriers: a river without a bridge is not 800 metres away, and the specification's estimate is that Euclidean, road-network and friction measures can differ by a factor of two in mountainous or riverine districts — which makes Kalangala, Buvuma, Ntoroko and the Elgon and Rwenzori districts the least reliable rows in the table, and all of them optimistic. And the settlements in Equation (7.5) are counted, not weighted by population, because population is missing for 98 per cent of the points, so the access share is the share of *places on a map*, not of *children*. Wakiso shows the failure mode — 0.776 in a peri-urban district ringing Kampala with 278 government primary schools, far more plausibly a statement about the density of OSM settlement points than about children walking three kilometres.

The change here is one of relative standing rather than of method. Schools, learners and teachers are now measured, classrooms and stances imputed from measured ratios published by the same census; access alone is imputed from a crowd-sourced point layer with no census date, on a straight-line surface, with no population weights. **It has become the weakest part of the supply picture precisely because everything around it improved.** It is sound enough to identify the tail and not sound enough to separate a district at 0.88 from one at 0.92, so its ranking should still not be used to allocate money directly.

7.8 Pre-primary, counted for the first time

Table 7.8: Pre-primary, counted for the first time

Schools	Attached To Government	Private	Learners	Teachers	Classrooms	Stances
38347	3193	35154	2374674	82,763	116,394	102,825

The census enumerated pre-primary provision, which is overwhelmingly private and sits outside the government plan this report costs. Source: EPRAS run 6b2afcf6 (report/build/data/t_preprimary.csv).

The census enumerated pre-primary provision, which no previous source here did. Table 7.8 records **38,347 pre-primary schools**, of which only **3,193 are attached to government schools** and **35,154 are private**; **2,374,674 learners**, of whom 205,339 are in the government-attached centres; **82,763 teachers**; **116,394 classrooms**; and **102,825 latrine stances**.

Pre-primary in Uganda is therefore **overwhelmingly private** — roughly nine in ten of both schools and learners — and public pre-primary is an adjunct to a minority of primary schools rather than a system. It also sits **outside the government plan this report costs**. The engine keeps these rows as their own table rather than pushing them through the two cycles the capacity arithmetic is defined for, because pre-primary enrolment is a flagged coverage fallback rather than a cohort flow, and because there is no public place norm, capitation rate or teacher cadre to cost against. Reporting it and excluding it is the honest combination: the count is available to a future plan that chooses to finance the sub-sector, and no figure here assumes that it will.

7.9 The condition of the stock: water, hand-washing and waste

A classroom is a place in this engine's arithmetic, and two classrooms of the same size count the same. The census makes it possible to say something the arithmetic does not: what condition the counted stock is actually in. It classifies every school by its main source of drinking water, by whether it has a functional hand-washing facility, and by how it disposes of waste. None of this existed by district before.

Table 7.9: Government schools by condition: water, hand-washing, waste and boarding

Level	Water Improved	Handwash Water And Soap	Handwash Water Only	Handwash None	Garbage Proper	Day Only	Boarding Only	Day And Boarding
PRE	0.775	0.498	0.208	0.293	0.017			
PRI	0.808	0.567	0.211	0.223		0.953	0.004	0.043
SEC	0.904	0.66	0.198	0.142	0.039			

Shares of the government schools the census counted at each level. The census publishes waste disposal by district at pre-primary and secondary only, and day/boarding status by district at primary only; a blank is a dimension the census does not publish at that level, not a zero. No capital standard for this exists in this engine, so it is reported as counted and is neither costed nor differenced into a gap. Source: EPRAS run 6b2afcf6 (report/build/data/t_facility_conditions.csv).

The condition of government schools, as counted in 2025

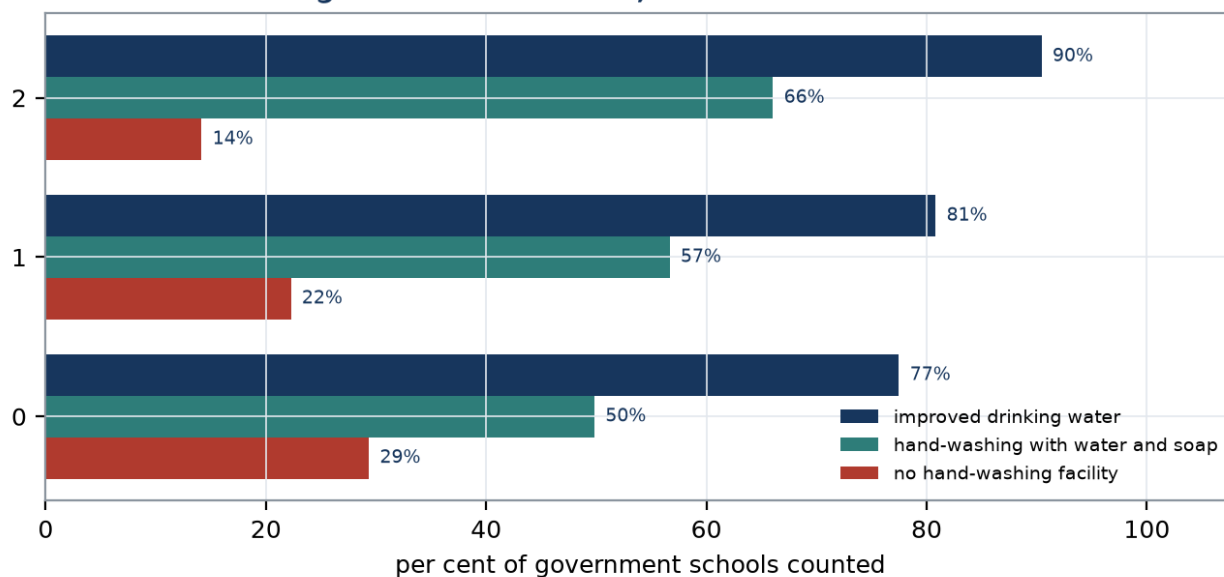


Figure 7.9: Government schools by drinking-water source and hand-washing facility, by level

Source: UBOS Baseline Education Census 2025, district annexes 2.A3-2.A4, 3.A8-3.A9, 4.A8, 4.A10

Table 7.9 and Figure 7.9 give the picture for government schools. **Four fifths of government primary schools — 80.8 per cent — drink from an improved source, and 2,410 do not.** Secondary schools do better at 90.4 per cent, pre-primary worse at 77.5. Across all ownership the primary figure is 85.5 per cent, so the un-improved schools are disproportionately *government* ones: 6,320 schools of all kinds draw drinking water from an un-improved source, and more than a third of them are public.

Hand-washing is the weaker dimension. The census splits schools three ways: a functional facility with water *and* soap, one with water only, and none at all. Of the 12,557 government primary schools, **7,114 (56.7 per cent) have water and soap, 2,648 (21.1 per cent) have water without soap, and 2,795 (22.3 per cent) have nothing.** More than one government primary school in five has nowhere to wash hands — and a government primary school holds 415 learners on average, so the schools in that category account for something over a million children. At secondary the same count gives 210 government schools (14.2 per cent) with no facility. Across all primary schools of both ownerships the figure is 11,629.

Table 7.10: The fifteen districts where most government primary schools have nowhere to wash hands

District ID	Schools	Handwash None Share	Handwash Soap Share	Water Improved Share
Karenga	21	0.524	0.143	1
Kotido	20	0.5	0.45	1
Buvuma	20	0.45	0.35	0.35
Lamwo	74	0.432	0.243	0.973
Pakwach	64	0.422	0.344	0.922
Bukomansimbi	73	0.411	0.438	0.356
Apac	64	0.406	0.391	0.984
Kween	40	0.4	0.325	0.85
Serere	103	0.398	0.32	1
Kanungu	137	0.394	0.438	0.701
Isingiro	191	0.377	0.44	0.471
Ssembabule	183	0.372	0.481	0.361
Kitgum	99	0.364	0.455	0.949
Gomba	91	0.363	0.253	0.604
Agago	114	0.36	0.325	0.974

Counted by the census. A school in the 'none' category has no functional hand-washing facility at all; the soap column is the schools that have both water and soap. No capital standard for this exists in this engine, so it is reported as counted and is neither costed nor differenced into a gap. Source: EPRAS run 6b2afc6 (report/build/data/t_wash_worst.csv).

Government primary schools with no hand-washing facility

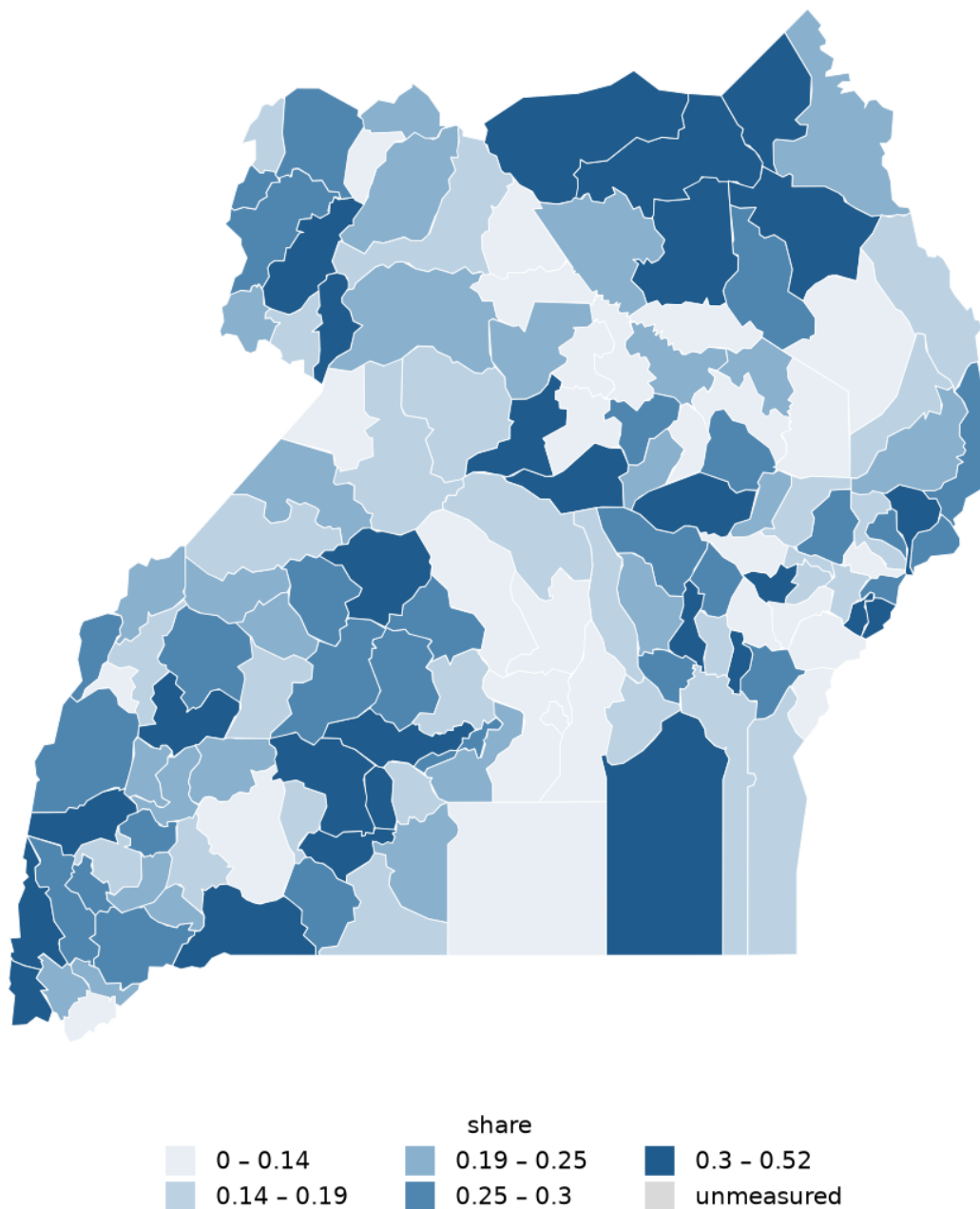


Figure 7.10: Government primary schools with no hand-washing facility (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Government primary schools on an improved drinking-water source

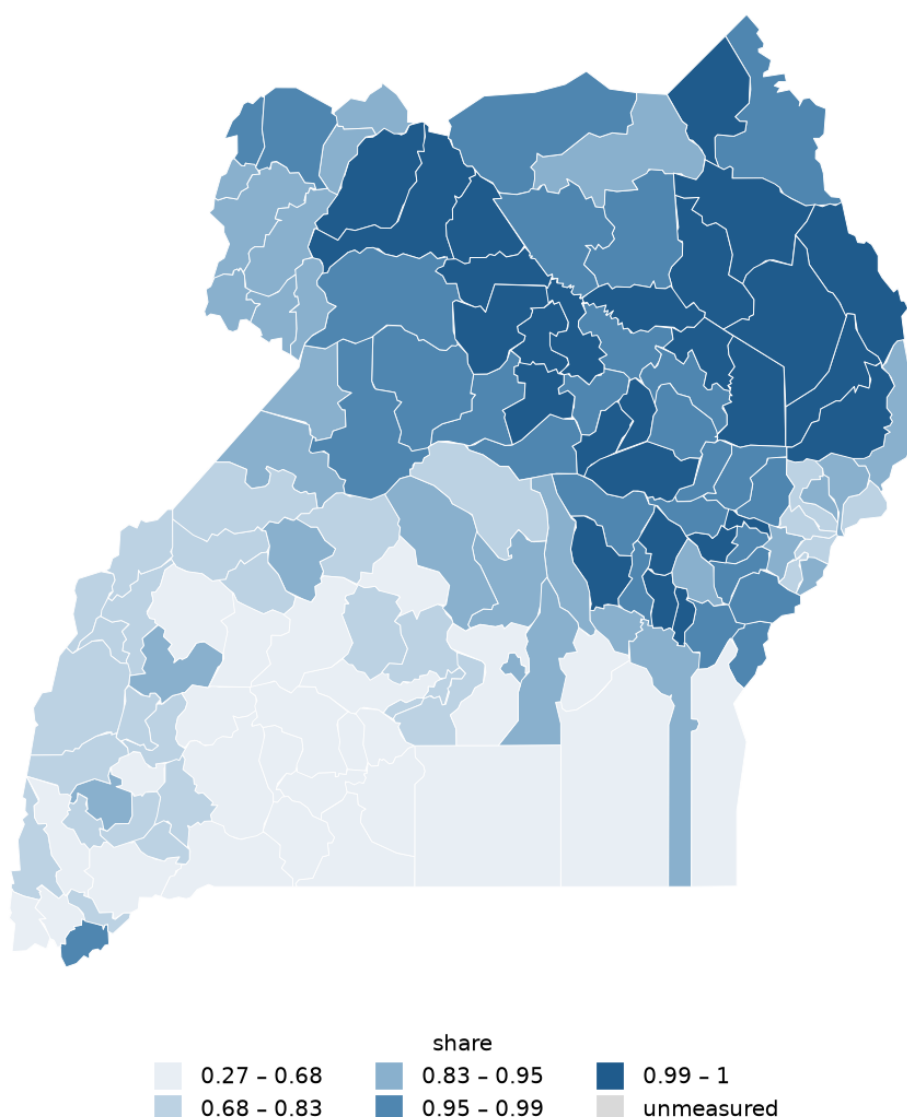


Figure 7.11: Government primary schools on an improved drinking-water source (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The geography is not the geography of the other gaps, and that is the reason to map it separately (Figure 7.10, Figure 7.11). Table 7.10 lists the fifteen districts where the share of government primary schools with no hand-washing facility is highest: **Karenga at 0.524 and Kotido at 0.500** head it, which is the Karamoja pattern familiar from participation, but the list then runs through **Buvuma, Lamwo, Pakwach, Bukomansimbi, Apac and Kween** — a set with little else in common. Water is different again: the lowest improved-water shares are in the central and south-western districts of **Rakai (0.266), Lwengo (0.293), Kisoro (0.329)** and the islands of **Kalangala (0.348)** and **Buvuma (0.350)**, none of which is poorly served on places or teachers. Twenty-six districts have every one of their government primary schools on an improved source. A district can be comfortably off for classrooms and badly off for water, and only separate reporting shows it.

Waste disposal is the one dimension where almost nothing is in place. Only **156 of 12,557 government primary schools — 1.2 per cent — 53 of 3,193 government pre-primary units (1.7 per cent) and 58 of 1,484 government secondary schools (3.9 per cent)** dispose of waste by a method the census counts as proper (Figure 7.12). The primary figure comes from the census's sub-region table rather than its district annex, because waste disposal is

the one condition the census does not publish by district at primary; it is reported nationally here and is not mapped. Private schools do better — 7.6 per cent of all primary schools and 9.4 and 9.8 per cent at pre-primary and secondary across all ownership — and the proper-disposal share is concentrated almost entirely in Kampala, where 21 of 23 government secondary schools qualify. This is a near-universal deficiency rather than a distributional one, which is also why no map of it would guide an allocation.

Government secondary schools disposing of waste properly

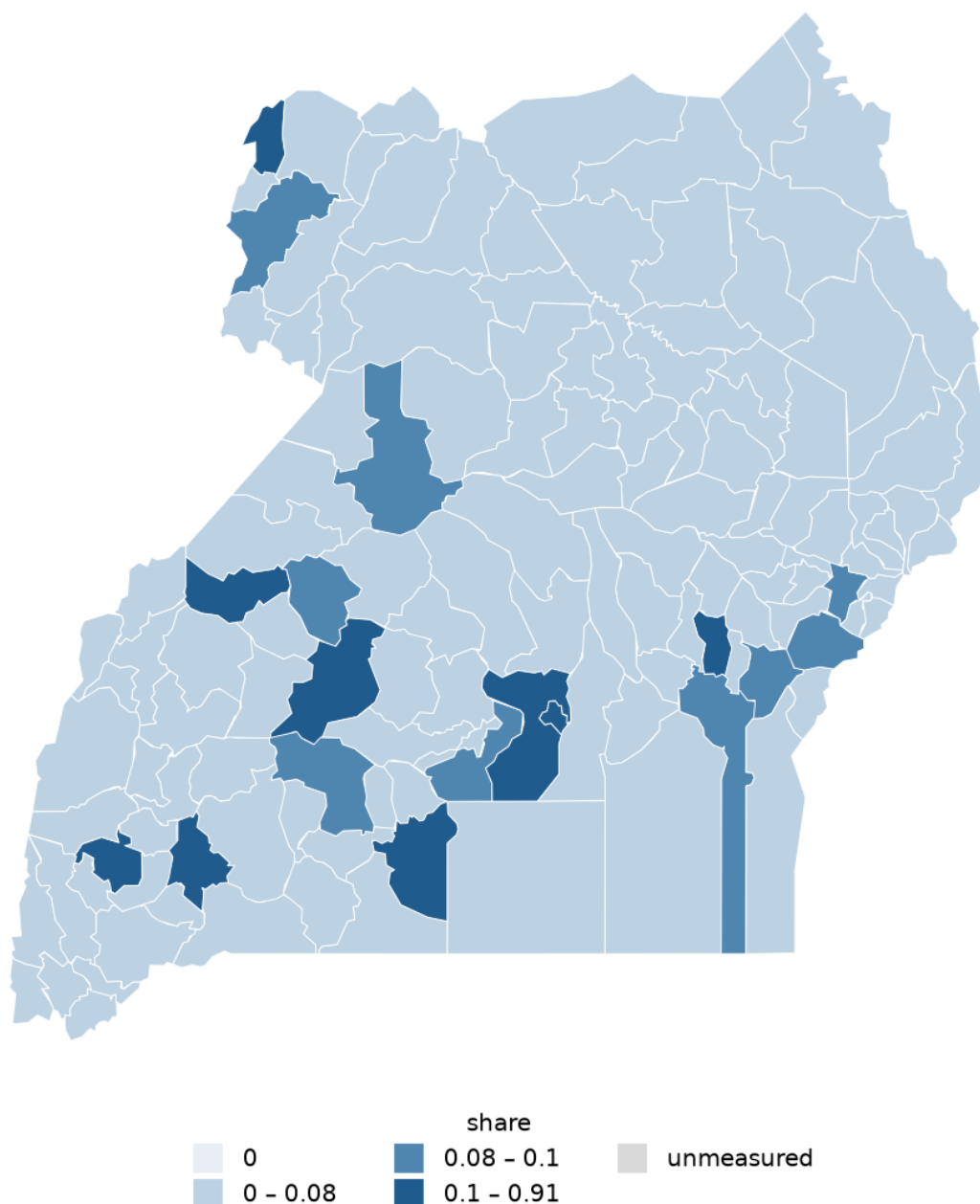


Figure 7.12: Government secondary schools disposing of waste properly (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

None of these three dimensions is costed in this report, and the reason is a missing standard rather than a missing count or a missing table. The engine's data model already carries a water point among the facility inputs a school's estate can hold, and its capacity-standard table is keyed on exactly that column. What is absent is a row in it: a basis, a quantity and a published source. The engine's capital norms cover classrooms and latrine stances,

because the Local Government Planning Guidelines set a stance norm this analysis can difference a count against (MoES 2022). There is no equivalent published norm for a water point, a hand-washing station or a waste facility per school or per learner, and §2 forbids inventing one: a gap computed against an assumed standard would carry the standard's authority and have none. So the counts are reported, mapped and left out of the five gap dimensions, and SRC_BEC_WASH records exactly that. What this chapter can say is that the requirement is now *countable* the moment a standard exists — which is a different position from the previous edition, where neither existed.

7.10 Boarding, single-sex schools, and the people who are not teachers

Three more things the census counted bear directly on what the public system costs, and none of them was available by district before.

Table 7.11: The fifteen districts where boarding is most common in government primary schools

District ID	Schools	Boarding Any	Boarding Any Share
Kotido	20	14	0.7
Amudat	18	11	0.611
Napak	30	17	0.567
Moroto	21	11	0.524
Kalangala	23	9	0.391
Abim	37	13	0.351
Nakapiripirit	28	7	0.25
Kaabong	32	7	0.219
Mbarara	148	31	0.209
Sheema	131	26	0.198
Karenga	21	4	0.19
Dokolo	60	11	0.183
Apac	64	11	0.172
Kalaki	49	7	0.143
Kazo	64	9	0.141

Boarding-only plus day-and-boarding, as counted. A boarding place costs more to provide than a day place, and this engine's unit costs are for day provision, so these districts are costed as though their boarders were day learners. Source: EPRAS run 6b2afc6 (report/build/data/t_boarding_top.csv).

Government primary schools taking boarders

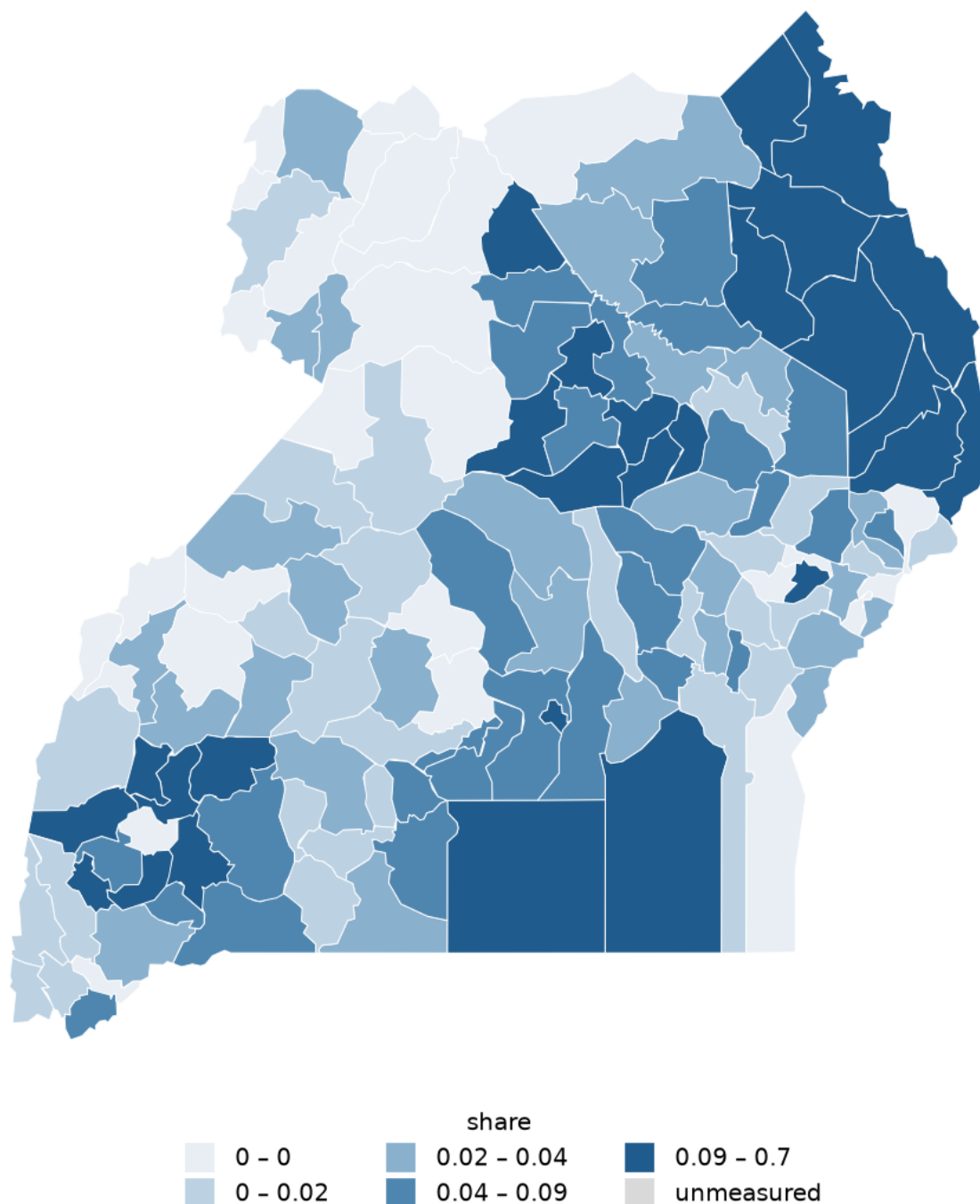


Figure 7.13: Government primary schools taking boarders (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Boarding at government primary level is a Karamoja institution. Nationally it is marginal: 47 government primary schools are boarding-only and 543 take both day and boarding learners, so **590 of 12,556 schools — 4.7 per cent — take boarders at all**, and 27 districts have none. (The denominator is 12,556 rather than 12,557 because the boarding annex and the school-count annex classify three schools differently — one school each in Bunyangabu and Kole is government in Table 3.A1 and private in Table 3.A3, and in Kikuube the reverse. Every district total agrees in both. The shares here use each table's own denominator and the discrepancy is recorded under SRC_BEC_BOARDING_OWNERSHIP rather than reconciled.) But the distribution is extreme (Table 7.11, Figure 7.13). In

Kotido 70.0 per cent of government primary schools take boarders; in **Amudat 61.1, Napak 56.7, Moroto 52.4, Abim 35.1, Nakapiripirit 25.0 and Kaabong 21.9 per cent**. These are, almost exactly, the districts with the lowest net attendance in the country. Boarding in Karamoja is not a premium service; it is how a pastoralist district keeps children in school when the household moves.

That has a consequence this report should state plainly. **The unit costs in EM-06 are for day provision**, built from capitation, salary and a day learner's share of the facility; a boarding place carries feeding, bedding, dormitory space and supervision that none of those lines includes. The engine therefore costs Karamoja's boarders as day learners, which **understates what it actually costs to school a child in Kotido or Amudat** — in the districts where participation is weakest and the political priority highest. No adjustment is made, because this system holds no boarding unit cost with a source behind it. It is named here as a known downward bias with a known location, which is the most useful form an uncostered finding can take.

Table 7.12: Primary schools by the sex of the learners they admit

Mixed	Males Only	Females Only	Total
43415	94	58	43567

Counted by the census. Single-sex provision is marginal at primary and is reported, not modelled: the demand model places a child in the nearest school of the right level and does not know the child's sex. Source: EPRAS run 6b2afcf6 (report/build/data/t_school_sex_composition.csv).

Single-sex provision at primary is negligible, and now measured rather than assumed. Table 7.12 records **43,415 mixed schools, 94 boys-only and 58 girls-only** out of 43,567. The demand model places a child in the nearest school of the right level and does not know the child's sex; with 152 single-sex schools in the country, that simplification costs nothing it can be held to account for. Before the census it was an unexamined assumption; it is now a checked one.

Table 7.13: Non-teaching staff, counted for the first time

Level	Government	Private	Male	Female	Total
PRE			7,671	16,459	24,130
PRI	17,433	60,875	29,131	49,177	78,308
SEC	10,402	19,174	15,571	14,005	29,576

UBOS Baseline Education Census 2025, national totals. The teacher requirement in EM-03 is built from the timetable and covers teaching staff only. These people are paid from the same school budgets, and no norm for them exists in this engine, so they are reported and not costed. Source: EPRAS run 6b2afcf6 (report/build/data/t_non_teaching_staff.csv).

The census also counted the staff who are not teachers, and this engine does not pay them. Table 7.13 records **17,433 non-teaching staff in government primary schools and 10,402 in government secondary** — 27,835 people in the public system, plus 24,130 across pre-primary. The teacher requirement in EM-03 is built from the timetable: classes × curriculum periods ÷ teaching load, by subject. It computes **teaching** posts, and by construction says nothing about a bursar, a cook, a matron or a security guard. Those people are paid from the same school and local-government budgets this report's envelope describes.

The honest statement is that the public wage bill supports a workforce **about a fifth larger than the teaching establishment this report costs** — 27,835 people against 131,756 teachers in post across both cycles, 21 per cent — and that the difference is invisible in every cost figure here. It is not an error in the teacher requirement, which is a requirement for teachers and correct as such; it is a boundary of what EM-06 covers, and the first time the census has made the size of what lies outside it measurable. A norm for support staff per school — which the Ministry does not publish — would close it.

7.11 What the census still does not give

Supply observations now carry **measured** for schools, learners and teachers and **imputed** for classrooms and stances, where the previous edition held no **measured** supply at all. Four absences remain.

Teachers by qualification. The 2017 abstract carried a trained/untrained split; the census does not publish one. Rather than delete the only evidence the system has on the qualification gap, the engine carries the **2017 trained share forward as a share**, not as a count, merged onto the census rows and flagged as carried. A share moves far more slowly than a stock, which makes the carry defensible, but it is nine years old and applied to a teacher population a third smaller than the one it was measured on. The untrained-teacher gap of 13,871 EM-05 reports is accordingly the softest gap figure at primary.

Classroom condition. The census counts rooms and does not grade them, so Equation (7.1) remains an identity and construction cannot be separated from rehabilitation.

School-level data. The census publishes district aggregates. Without school rows there is no within-district deployment index, no utilisation measure per school and no way to place the counted schools on a map, which is why access still runs on the OSM point layer.

The rest of the estate. Desks, textbooks, specialist rooms and electricity are not published by district, so the material gap is reported as requirement-only. Water, hand-washing and waste disposal now *are* published by district and are reported above — what they still lack is a standard to be differenced against, not a count.

7.12 Implications for planning

The binding constraint should govern the instrument, district by district, and it now genuinely binds on both sides. The most actionable output of this chapter is not the 4,689,263 primary places; it is the 66 districts in Table 7.5 whose capacity is limited by staff. EM-05 reports a primary place gap of 1,194,733, a classroom gap of 47,657 rooms and a teacher gap of 49,841 FTE. On the previous data those numbers were roughly twice as large and pointed unambiguously at construction; they now point at a classroom programme and a recruitment programme of comparable size, and the only thing that says which belongs where is the argmin in Equation (7.4). A classroom block is capital with an induced recurrent tail; a teacher is recurrent expenditure that runs for a career. The same test now works at secondary, which the seed-school and science-block decisions in EM-07 were previously taken without.

The staffing position is worse than the system believed. There are 48,623 fewer government primary teachers than the carry-forward assumed, against a wage bill that pays for 27,641 more people than the census found at school. The two should be investigated together, because they have opposite budget implications: the first argues for recruitment, the second that part of the existing wage bill is already spent on people who are not in classrooms. Both are resolvable from one payroll extract, and neither from this evidence base.

The plan finances a smaller public system than previous editions modelled. With 42.8 per cent of primary learners in private schools, the public requirement is 6.86 million learners rather than 9.51 million. The right reading is not that the problem shrank but that it was being attributed to the wrong provider: a plan built on the old shares would have financed places for children already seated, on a geography that does not match where the public system is.

Do not net the surplus against the gap. EM-05 reports 297,053 primary places of surplus alongside the 1,194,733 place deficit, and the two are never combined: a surplus place in a room-bound district with falling enrolment is not available to a child in a teacher-bound district three hundred kilometres away. The minimum in Equation (7.4) is taken where the child is.

The remaining data requests are short and specific. The census retired the largest of them. What is left, in descending order of value: a payroll or teacher management system extract, which would turn the three teacher counts into three measurements; an establishment register, which would make the recruitment question answerable; a classroom condition split, which would separate construction from rehabilitation; and a friction surface, which already exists inside the EducationModelling accessibility work and would make the middle of the

distribution in Figure 7.7 usable for allocation. Each is a single file, and between them they would leave no inferred quantity here outside the ratio-derived classroom and stance counts.

CHAPTER 8

8 EM-05 The five gaps

EM-03 asked what Uganda's education system would need in 2026 if every child who should be in a public classroom were in one, taught by a teacher with a timetable that fits the curriculum. EM-04 asked what it has; this chapter subtracts.

For the first time, the second half of that identity is counted. The *Baseline Education Census 2025* (UBOS 2026) enumerated every government and private school in Uganda implementing the national curriculum, reference year 2025, published May 2026. The engine now takes its schools, learners, teachers in post, classrooms and latrine stances from that enumeration, for all 135 districts of the pinned geography, with the tier measured. Every previous edition differenced the requirement against a supply carried forward from the 2017 school census, flagged imputed throughout. The gaps below are differences against a count, and in places they do not support the same conclusions.

The design of EM-05 is mostly refusals. Requirement and supply are differenced in **five separate dimensions** — access, places, teachers, materials and quality — never added, never weighted, never averaged into an index, never collapsed into a league table of "need". Gap and surplus are two numbers, not one signed number, and nothing is netted across districts, cycles, subjects or sexes. Counting the supply changes the figures, not the refusals.

8.1 What a gap is, and what it is not

For any dimension k , district d and year t , the engine computes two quantities and stores both:

$$G_{k,d,t} = \max(0, R_{k,d,t} - A_{k,d,t}) \quad (8.1)$$

$$S_{k,d,t} = \max(0, A_{k,d,t} - R_{k,d,t}) \quad (8.2)$$

where G is the gap, the shortfall of supply against requirement in the units of dimension k ; S the surplus; R the requirement from EM-03; A the available quantity from EM-04, now the census count; d the 135 districts of the pinned geography (UGA-UBOS-2022); and t the plan year, 2026.

Both are floored at zero, so a district is the pair (G, S) , not their difference. The national figure is the sum of the district gaps, not the gap of the national sums:

$$G_{k,t} = \sum_d \max(0, R_{k,d,t} - A_{k,d,t}) \geq \max\left(0, \sum_d R_{k,d,t} - \sum_d A_{k,d,t}\right) \quad (8.3)$$

The inequality in Equation (8.3) is the argument against netting, and counting the supply has widened it. At public primary the sum of district place gaps is 1,194,733 places and the sum of district surpluses is 297,053. A netted figure would be 897,680, understating the task by 297,053 places, because the empty seats sit in Mukono, Nakasongola, Sheema and 44 other districts and cannot be walked to by a child in Arua. Forty-seven districts carry a surplus and 88 a gap; none carries both.

Table 8.1: The five gap dimensions, kept separate

Dimension	Item	Gap	Surplus	Learners
access	children_beyond_3km	726,951	0	726,951

Dimension	Item	Gap	Surplus	Learners
access	out_of_school_children	5,994,052	0	5,994,052
material	desks_3seat	0	0	0
material	latrine_stances	55,605	1,430	0
material	textbooks	0	0	0
place	classrooms	54,588	349	0
place	places	1,443,429	317,137	1,443,429
quality	conditions_failing	264	0	5,305,081
teacher	TEACH_SEC_ARTS_required	0	0	0
teacher	TEACH_SEC_SCI_required	0	0	0
teacher	teachers_FTE	72,336	23	0
teacher	untrained_teachers	13,871	0	0

Gap and surplus are stored separately and never netted; there is no total row and no composite score. Source: EPRAS run 6b2afcf6 (report/build/data/t_gap_dimensions.csv).

Table 8.1 is the whole of EM-05 in twelve rows, and is worth reading for what it does *not* contain: no total row, the rows being denominated in children, places, rooms, FTE teachers, stances and failed conditions; no score; no ordering.

8.1.1 Which gaps moved, and in which direction

The public primary system turned out to be *smaller* than the extrapolation implied: 12,557 government primary schools holding 5,211,732 learners against 3,906,582 in private schools, a private share of 42.8%. A smaller public system needs fewer public seats, rooms, teachers and stances, and most of the fall below comes from that.

Gaps that **fell substantially**: the primary place gap, from 3,104,924 places in the previous edition to 1,194,733; the primary classroom gap, from 90,144 rooms to 47,658; the primary teacher gap, from 64,913 FTE to 49,841; the latrine-stance gap, from 79,031 stances to 55,605; the untrained-teacher gap, from 20,613 FTE to 13,871; and failing quality conditions, from 303 to 264, with the learners affected down from 7.81 to 5.31 million.

Gaps that **rose**: the secondary teacher gap, from 9,883 FTE to 22,495, the census counting 22,150 secondary teachers in post against a requirement of 44,622 FTE; the secondary place gap, from 95,596 places to 248,696, secondary classrooms now being measured; the primary place surplus, from 122,848 places to 297,053 and the districts holding one from 15 to 47; the districts with a positive primary teacher gap, from 115 to all 135; and the out-of-school count, which more than triples at primary. One quantity collapsed: the national teacher surplus, 8,923 FTE on the carry-forward, is 23 FTE on the count. The 2017 vintage was carrying teachers the census does not find, and that drives much of what follows. Only the access gap held still, at 726,951 children.

8.2 Why the five are never added

They are in different units. Access counts children who cannot reach a school, places seats, teachers FTE, materials stances, quality conditions that fail. A weighted sum needs an exchange rate between a child beyond the walking norm and a latrine stance, and none exists in policy or in the norm set. Where one does exist it is money, and money enters in EM-06.

They bind in different districts. Figure 8.1 shows the five distributions side by side. The place gap is heavily right-skewed, the top ten districts holding 356,698 places, 29.9% of the national primary total, while the quality gap is a count bounded at four and almost uniformly spread. Wakiso holds 160,072 of the 726,951 children beyond the 3 km norm — 22.0% of the access gap — with a primary place gap of only 7,612; Arua holds the largest primary place gap (48,280 places), classroom gap (1,431 rooms), primary teacher gap (1,625 FTE) and stance gap (1,786 stances), but only 1,160 children beyond 3 km. Averaging the two onto one axis gives two middling scores and hides that they need opposite interventions.

A composite lets a surplus hide a deficit — and counted data makes this starker. All 47 districts with a primary place surplus also have a primary teacher gap, and 35 fail at least one quality condition: Mukono has 23,101 spare places alongside 124 FTE of primary and 593 FTE of secondary teacher gap. Under Equation (8.1) and Equation (8.2) that stays what it is — spare rooms and a staffing problem, a redeployment opportunity rather than a construction site.

The five gap dimensions across districts — never added together

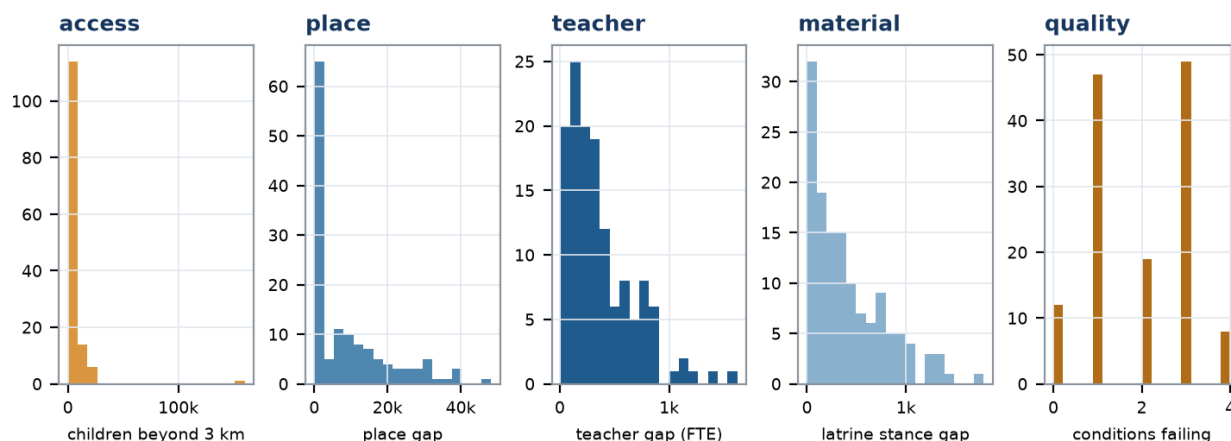


Figure 8.1: The five gap dimensions across districts; they are shown side by side and never added

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

8.3 The place gap, and what binds it

Capacity in EM-04 is the smaller of what the rooms hold and what the teachers can teach:

$$A_d^{\text{place}} = \min(n_d \kappa \sigma u, c_d \kappa) \quad (8.4)$$

$$c_d = \frac{T_d \lambda}{p(1 + \alpha)} \quad (8.5)$$

where n is usable classrooms and T teachers in post, both now census counts; κ is the class-size norm, 53 learners at primary (MoES Local Government Planning Guidelines 2022); σ is shifts per room per day; u is the utilisation target, 0.90 at primary and 0.85 at secondary; c is classes teachable; λ is periods taught per teacher per week; p is periods per week the curriculum demands of a class; and α is the absence allowance.

Because capacity is a minimum, the place gap decomposes into the two constraints that could have produced it:

$$G_d^{\text{room}} = \max(0, C_d - n_d \sigma u) \quad (8.6)$$

$$G_d^{\text{teach}} = \max(0, C_d - c_d) \quad (8.7)$$

with C the classes required by EM-03's class-formation step. The binding constraint is whichever term in Equation (8.4) is smaller: *room-bound* when the rooms run out first, *teacher-bound* when the staff do.

Table 8.2: What binds capacity in each district: rooms or teachers

Binding Constraint	Districts
room	69
teacher	66

A teacher-bound district receiving a classroom grant is the defect this table exists to surface. Source: EPRAS run 6b2afcf6 (report/build/data/t_binding.csv).

8.3.1 The binding constraint has shifted

This is the chapter's largest substantive change. The previous edition reported 104 districts room-bound and 31 teacher-bound at primary, on a classroom stock carried forward from 2017 and a secondary stock that was not measured at all. On counted data the split is close to even: Table 8.2 gives 69 room-bound and 66 teacher-bound, so teachers bind in about half the country.

Three measurement changes produced it, none of them policy. First, the carry-forward overstated teachers: the census counts 109,606 government primary teachers in post, where the FY2025/26 primary wage bill divided by the average scale cost supports 137,247 posts, a difference of 27,641 the engine refuses to reconcile. Fewer teachers means a smaller c in Equation (8.5), so Equation (8.7) now bites where Equation (8.6) used to. Second, the carry-forward credited every district with nine years of notional grant-funded construction, where the census counts the rooms. Third, secondary classrooms are measured for the first time, so secondary capacity is no longer teacher-bound by construction.

Figure 8.3 draws a different map from the previous edition's. Karamoja is no longer uniformly teacher-bound: Kaabong, Kotido, Karenga, Napak and Amudat are, Moroto, Nabilatuk, Nakapiripirit and Abim are not. The teacher-bound group is now a western and central band, most of the south-west, the districts around the capital and most of West Nile, Arua included — which on the carry-forward read as room-bound. The room-bound group has consolidated in Bukedi, Bugisu, Teso and Lango, with Wakiso and Mubende.

The 66 teacher-bound districts carry a combined classroom gap of 18,536 rooms, 38.9% of the national primary classroom gap of 47,658; the room-bound districts hold the other 29,122. On a place-gap formula all 66 would receive classroom money against a shortfall classrooms cannot close — nearly two-fifths of the apparent need, against the twelfth the previous edition implied. Agago has a place gap of 17,447 places and a classroom gap of 593 rooms, but is teacher-bound: the 714 FTE it is short of release the capacity it already owns.

Crowding: public learners per available place

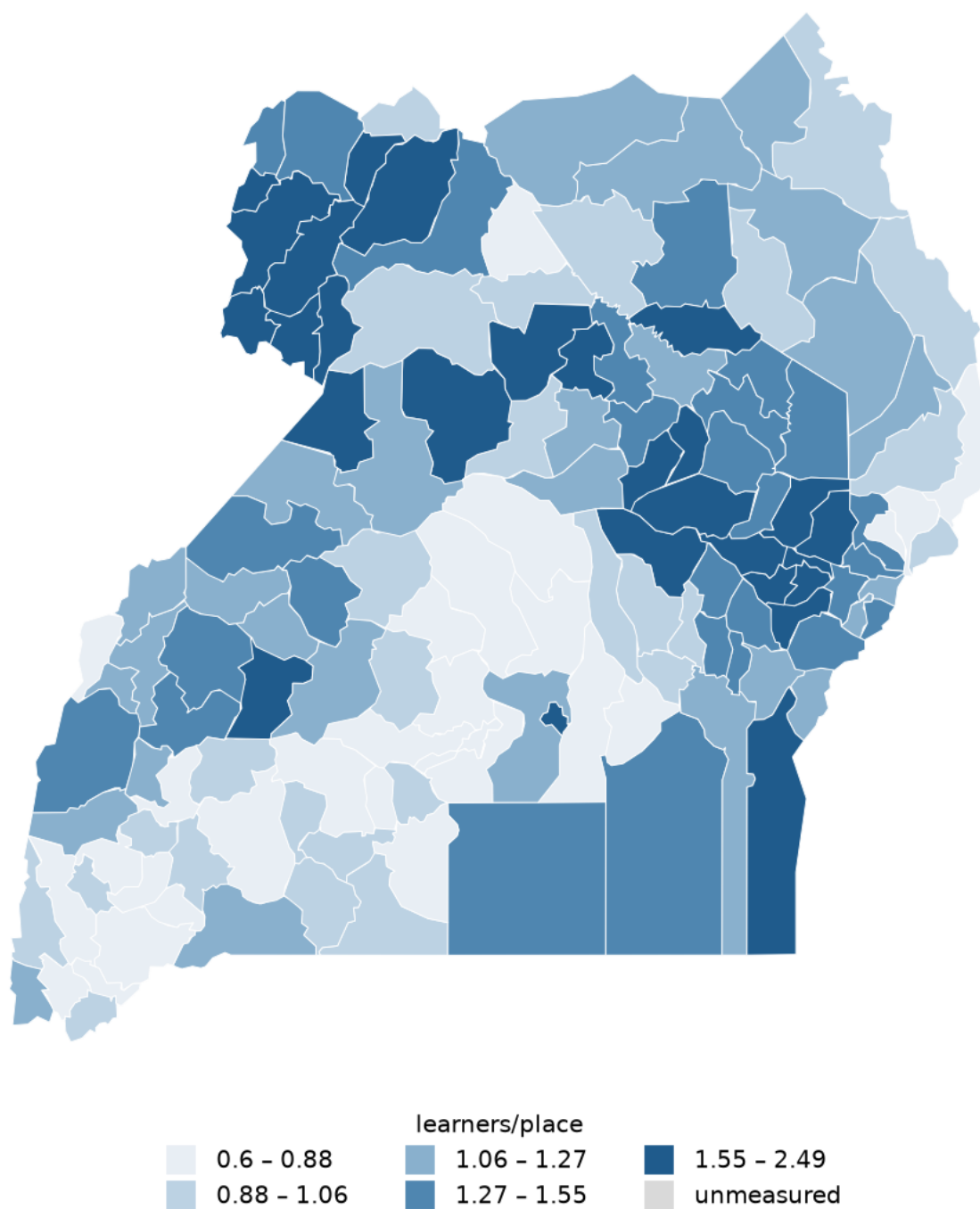


Figure 8.2: Crowding: public primary learners per available place

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

What binds: rooms or teachers

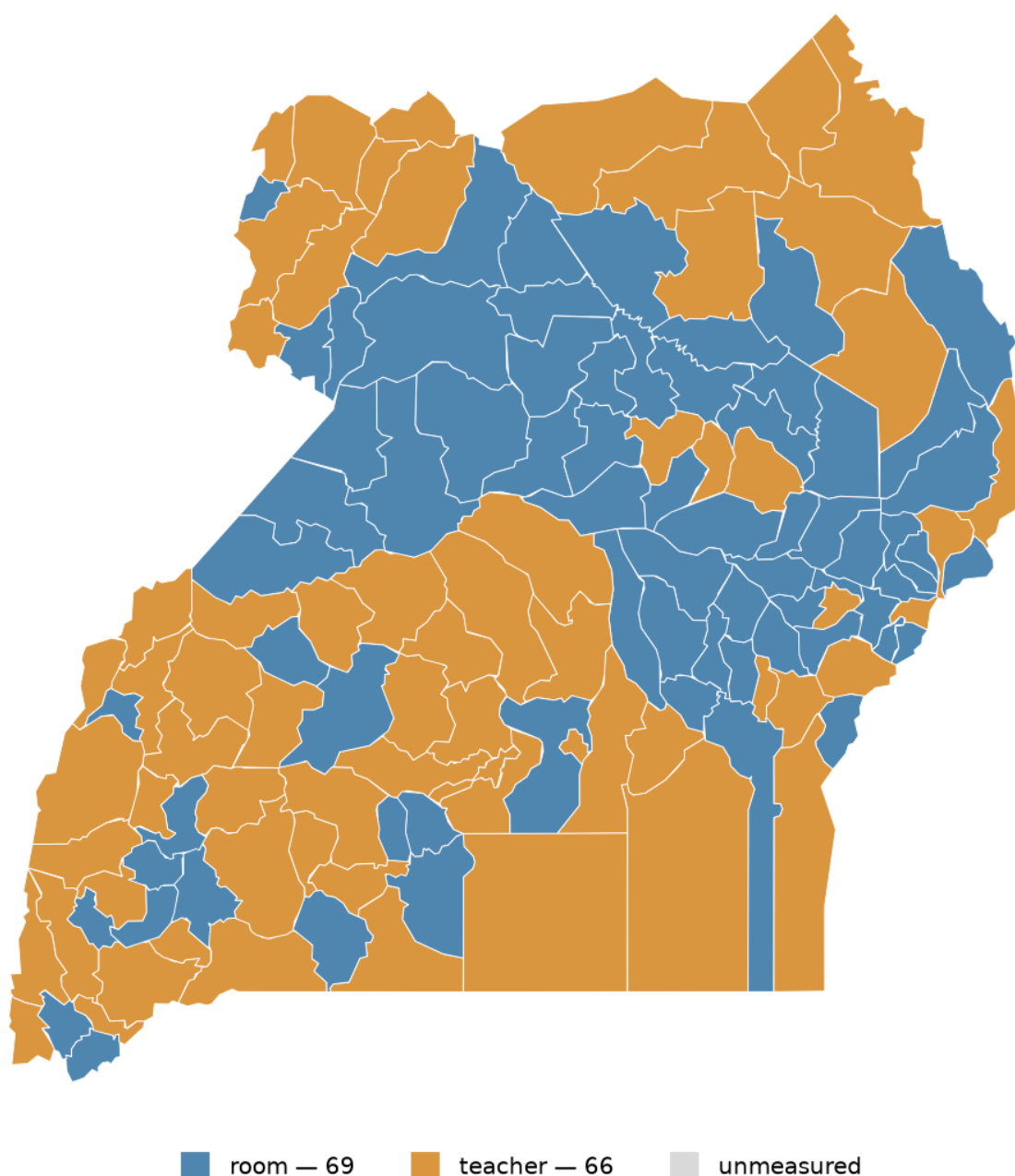


Figure 8.3: What binds capacity in each district: rooms or teachers

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 8.2 shows the crowding behind these gaps: Arua (48,280), Butaleja (39,162), Tororo (38,452), Oyam (37,620) and Nebbi (36,405) — and not one problem, since the last four are room-bound and Arua teacher-bound.

8.3.2 Secondary places and rooms, gapped on both sides

Until this edition the secondary classroom row carried a requirement and no availability: the MoES annexes never published secondary classrooms by district, the engine refused to fill the column from a norm, and secondary capacity was teacher-bound *by construction*. The census counts 44,679 secondary classrooms and 50,885 stances, so that side now exists.

In Table 8.1 the classroom row carries a gap of 54,588 rooms against a surplus of 349, of which 47,658 rooms of gap are primary; the remaining 6,931 are the first measured secondary classroom gap in this report. The place row carries 1,443,429 places of gap against 317,137 of surplus, of which 1,194,733 and 297,053 are primary; the other 248,696 places of deficit and 20,084 of surplus are secondary, now computed on both sides of Equation (8.1). Secondary stances are counted too, but the norm set carries a stance standard only for primary, so that row has an availability and no requirement, and is not formed.

The non-netting argument changes shape here. On the carry-forward a netted secondary total was *negative*: it read as "no secondary place problem" while 95,596 places of real shortfall sat in real districts. On counted data it is positive, 248,696 less 20,084 leaving 228,612. The inversion is gone; the understatement is not. Netting still hides 20,084 secondary and 297,053 primary places in the districts that have them.

8.4 The teacher gap: how many, of what kind, and how qualified

The teacher gap is the one number only EM-03's load-based method can produce, because the requirement is $\text{classes} \times \text{curriculum periods} \div \text{teaching load}$, not a pupil–teacher ratio. Against the census count of teachers in post, Equation (8.1) gives a national teacher gap of 72,336 FTE and a surplus of 23 FTE (Table 8.1), of which 49,841 FTE is primary and 22,495 FTE secondary. Both sides are measured for the first time. Figure 8.4 maps the primary gap per 1,000 public learners: all 135 districts have one, where on the carry-forward twenty did not, the deepest being Arua (1,625 FTE), Tororo (1,359) and Kasese (1,256).

Primary teacher gap per 1,000 public learners

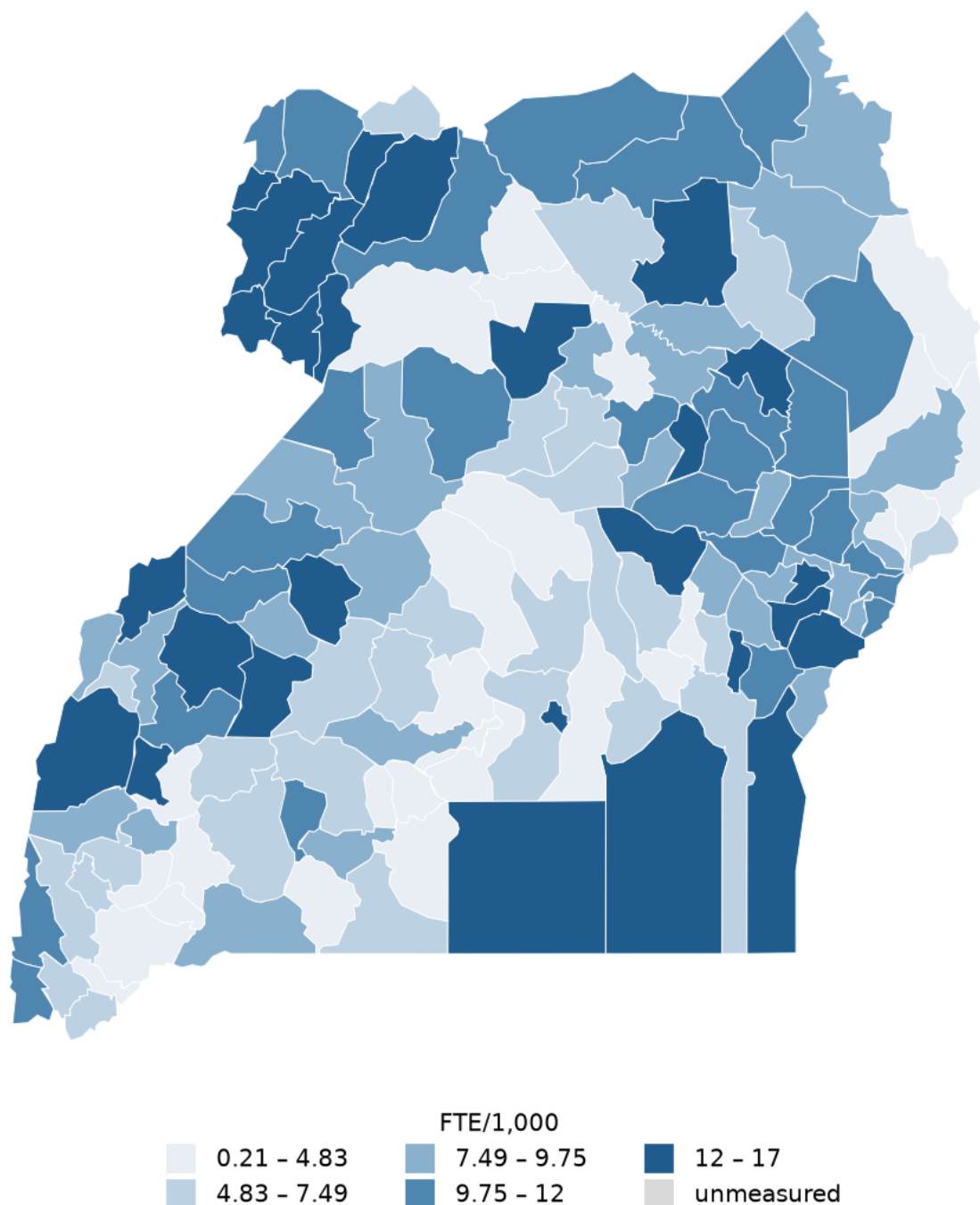


Figure 8.4: Primary teacher gap per 1,000 public learners

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

At secondary the requirement is resolved by cadre — 24,523 FTE of arts teaching and 20,098 FTE of science — but the gap by cadre **cannot be formed**. Neither the MoES annexes nor the census publishes secondary teachers by subject, so the two cadre rows carry a requirement, no available quantity, no gap and the tier *unmeasured*. This is the one supply column the census did not close, and netting would be at its most dangerous here: 40 surplus humanities teachers beside 25 missing science teachers is a gap and a deployment problem, not a surplus.

The **qualification gap** is a different object: not teachers the system lacks, but teachers it has who are not trained.

$$G_d^{\text{untrained}} = T_d(1 - \theta_d) \quad (8.8)$$

where θ is the trained share of primary teachers in post. The two vintages mix here: T is counted by the census, θ is not, because the census does not publish teachers by qualification, so the 2017 share is carried forward onto a counted head. The result is 13,871 FTE, in 134 of the 135 districts and heaviest in Wakiso (554), Luwero (387) and Ntungamo (381). What Equation (8.8) does *not* do is add 13,871 to the 49,841 FTE recruitment gap: those are different people needing different money.

The **deployment gap** — teachers sitting in the wrong schools — needs school-level establishment data neither source publishes, so it is not computed. The estimation library computes the *between*-district version, and on a counted pool it is materially different: redeploying the 109,606 primary teachers in post towards the 53:1 standard would move 14,722 of them and cut the spread of district pupil–teacher ratios from a standard deviation of 15.91 to 4.07 — both roughly half what the carry-forward implied.

8.5 The material gap: stances measured, books and desks not

Material gaps are computed input by input, never as a total:

$$G_d^{\text{stance}} = \max\left(0, \frac{E_d}{40} - s_d\right) \quad (8.9)$$

where E is public primary enrolment on the target path, 40 the MoES stance norm of one stance per 40 learners (Local Government Planning Guidelines 2022, p.23, tier normed), and s stances in place — now from the census, which counts 214,569 primary stances. The national sanitation gap is 55,605 stances against a surplus of 1,430, and 119 of the 135 districts are short. Figure 8.5 maps the shortfall per 1,000 learners; the heaviest are Arua (1,786 stances), Tororo (1,431), Mbale (1,320), Butaleja (1,319) and Wakiso (1,293).

Latrine stance gap per 1,000 public learners

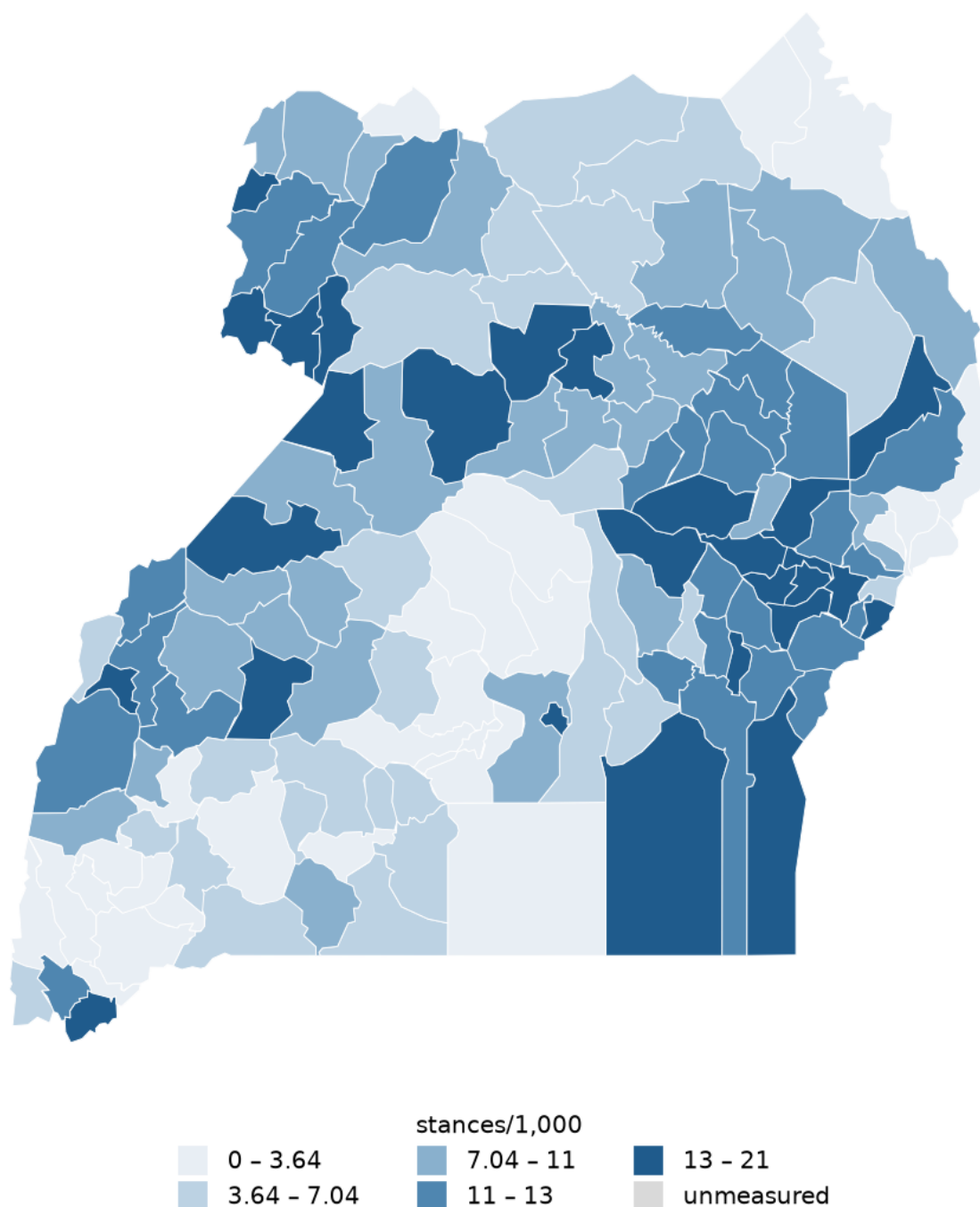


Figure 8.5: Latrine stance gap per 1,000 public primary learners

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The specification requires sanitation to be gapped **by sex**, because a combined ratio meeting the norm with no separate facilities for girls has not met it. This run still cannot: the stance series is a single district total, so 55,605 is a lower bound and no claim is made about girls' facilities.

Desks and textbooks carry a requirement and no availability at all. The base year requires 2,021,416 three-seat desks and 24,143,893 textbook copies, and no stock of either is published by district, so both rows are *unmeasured*: gap and surplus are missing, not zero, and Table 8.1 shows them at zero only because a missing value cannot be summed. **These are not met needs.**

8.6 The quality gap: a count of conditions, never a score

Quality here is not an average of the other four dimensions and not a weighted index. It is a count of conditions failing:

$$Q_d = \sum_{j=1}^4 I_{j,d}, \quad I_{j,d} = 1 \text{ if condition } j \text{ fails, } 0 \text{ otherwise} \quad (8.10)$$

where j indexes four stated conditions evaluated at district level: learners per usable classroom above 53; learners per stance above 40; trained-teacher share below 80%; learners per teacher in post above 53. Q is an integer from 0 to 4 and nothing else — not normalised, not weighted, not a percentage, because as a score it invites a comparison the conditions do not support.

Three of the four are now evaluated on counted quantities: classrooms, stances and teachers in post come from the census, and only the trained-teacher share is still a 2017 ratio on a counted head. Across the 135 districts 264 conditions fail, and the learners where at least one fails number 5.31 million. Twelve districts fail none; 47 fail one, 19 two, 49 three, and 8 all four — Agago, Amuru, Buyende, Kakumiro, Kamwenge, Kibuku, Kyegegwa and Kyenjojo. Figure 8.6 maps the count from Equation (8.10). The condition failing in most districts is sanitation: at the same 1:40 norm as Equation (8.9) it fails in the 119 districts with a positive stance gap, and knowing which condition drives the count is what turns it into a procurement decision.

Quality conditions failing (of four)

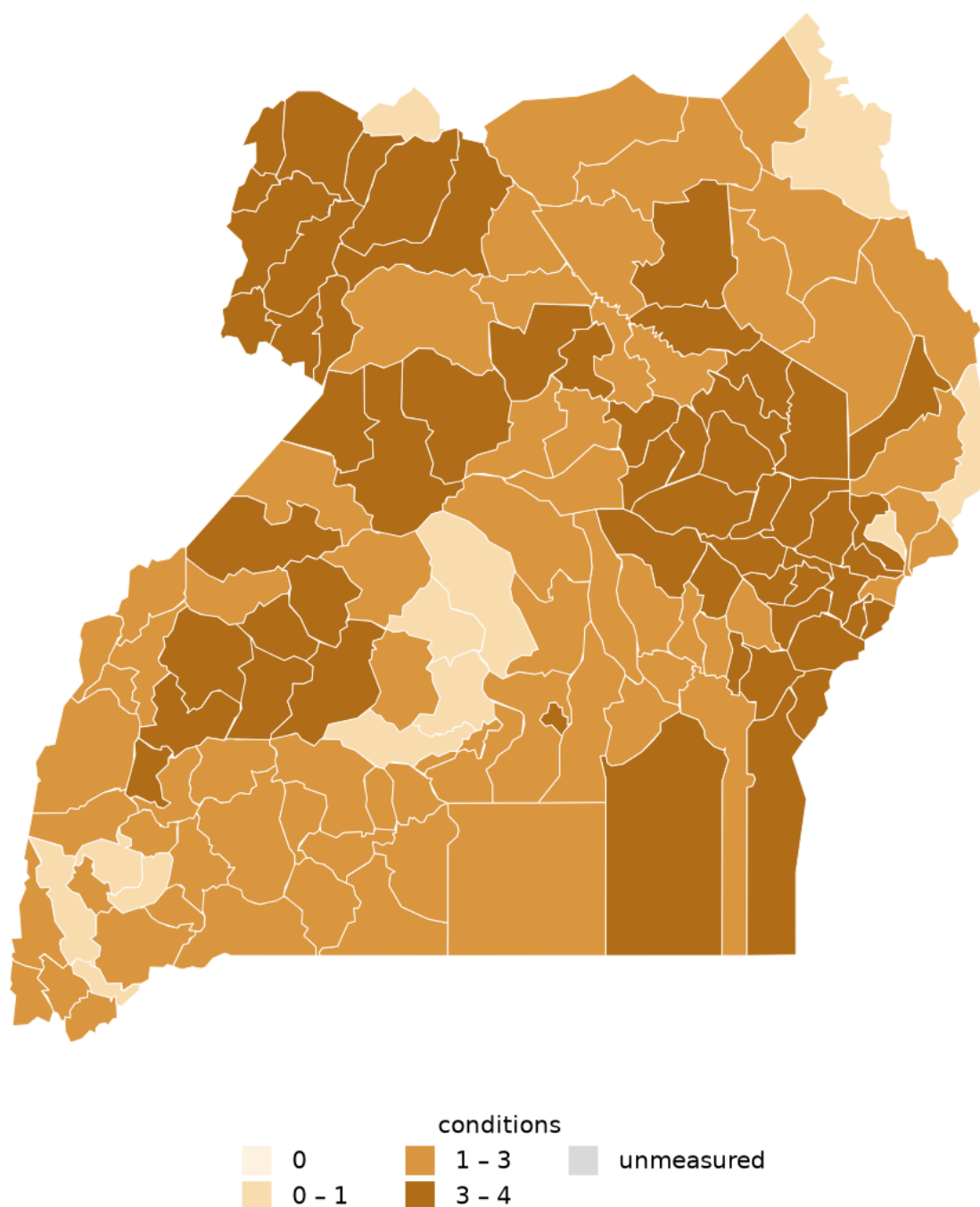


Figure 8.6: Quality conditions failing, of four

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The conditions are evaluated on district averages because school-level records exist in neither source, whereas the specification requires a count of *schools* below threshold: 5.31 million is a ceiling, not a measurement.

8.7 The access gap, and the out-of-school gap beside it

The access gap asks whether a child can reach a school.

$$G_d^{\text{access}} = P_d(1 - a_d) \quad (8.11)$$

where P is the primary school-age population from EM-01 and a is the share of settlements within the 3 km walking norm from EM-04. Nationally a is 0.946 on a places-weighted basis, leaving 726,951 of the 10.92 million primary-age children beyond the norm, and Figure 8.7 maps them. Wakiso alone accounts for 160,072, with Mubende (24,090) and Amudat (23,733) following; 22 districts show none.

Children beyond the 3 km walking norm

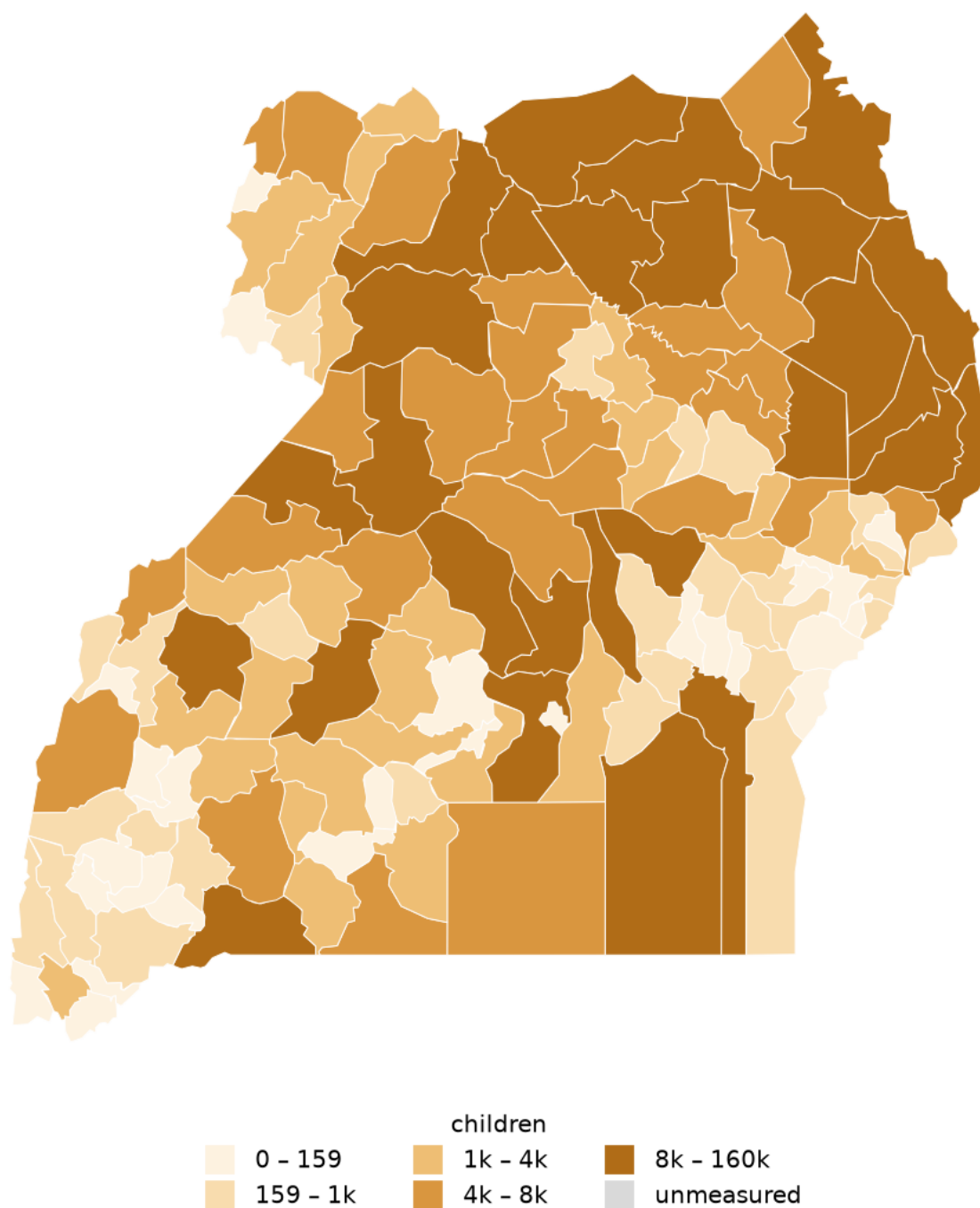


Figure 8.7: Children beyond the 3 km walking norm

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The out-of-school gap changed by more than anything else here. It no longer rests on a national household-survey rate distributed across districts by the inverse of their administrative participation. The census publishes net attendance by district and learners by age and class, so the rate is now one minus the adjusted net attendance rate — counted attendance for a named age group — adjusted by 1.083 at primary and 2.586 at secondary, factors from the census's own age-by-class tables, so that a child of primary age attending pre-primary or secondary counts as in school.

The two measures disagree, materially and in both directions, and the engine reports both rather than averaging them. At primary the census gives 22.6% and 2,467,716 children against the survey route's 6.9% and 753,482 — more than three times larger. At lower secondary, 48.1% and 2,439,735 against 19.2% and 974,315. At upper secondary the direction reverses: 47.3% and 1,086,601 against 52.7% and 1,211,867. Across the three cycles the census route puts 5,994,052 children out of school where the survey puts 2.94 million. The divergence is a recorded data-quality warning, and the data chapter sets the two side by side with what each is conditional on.

Access and out-of-school are reported alongside and never merged: 726,951 children are too far from a school and 2,467,716 primary-age children are not attending one, distance explaining only part of the second. Of that total 987,086 have never attended and 1,480,630 have dropped out on an assumed 40/60 split, the one part of the row which is not counted.

Two limitations attach to Figure 8.7. The distance is straight-line on OSM layers with no friction surface, and settlement points are unweighted by population for 98% of settlements, which is why a district with many mapped settlements can dominate the total. And the gap is **not yet decomposed** into density, sparsity and barrier sub-gaps, so EM-07 sees only a count.

8.8 The district gap matrix

The module's primary output is one row per district, one column per gap: Table 8.3 shows twenty of the 135 rows, the rest being in the district annex.

Table 8.3: The district gap matrix: the twenty districts with the most primary-age children out of school

District ID	Oosc Primary	Oosc Lower Sec	Children Beyond 3Km	Place Gap Primary	Place Surplus Primary	Binding Primary	Classroom Gap Primary	Teacher Gap Primary	Teacher Gap Secondary	Untrained Primary	Stance Gap Primary	Quality Conditions Failing
Yumbe	158,252	106,228	6,005	20,493	0	teacher	649	840	87	57	785	3
Kasese	67,131	57,888	6,487	23,647	0	teacher	740	1,256	245	227	1,209	2
Kyegegwa	54,957	43,979	3,756	25,776	0	teacher	679	777	135	218	986	4
Isingiro	49,897	52,656	18,449	9,315	0	teacher	580	754	345	263	484	1
Kakumiro	49,792	42,103	3,738	12,981	0	teacher	416	526	94	312	430	4
Kampala	48,541	2,191	0	23,261	0	teacher	702	752	930	85	1,229	3
Kyenjojo	48,380	38,283	15,089	18,628	0	teacher	541	782	176	212	549	4
Kotido	45,085	22,483	19,829	1,156	0	teacher	63	87	4	24	94	1
Arua	41,874	65,257	1,160	48,280	0	teacher	1,431	1,625	243	118	1,786	3
Mayuge	39,896	45,237	9,861	14,581	0	room	699	547	281	92	899	2
Kagadi	39,865	31,123	1,575	6,214	0	teacher	447	533	236	334	385	2
Nwoya	39,116	28,158	21,668	678	0	room	138	84	46	81	72	1
Amudat	38,526	19,451	23,733	0	1,997	teacher	0	11	5	0	0	0
Buyende	37,851	44,975	11,614	29,184	0	room	867	817	75	238	1,049	4
Napak	35,952	17,188	22,452	631	0	teacher	20	103	28	34	40	1
Kikuube	35,302	35,065	4,149	12,585	0	room	472	429	82	133	592	3
Mubende	34,420	32,889	24,090	7,154	0	room	469	372	281	346	489	3
Bududa	31,243	26,132	203	3,029	0	teacher	245	320	129	58	212	1
Bugiri	31,142	41,875	577	13,096	0	teacher	632	709	236	78	787	3
Kamwenge	30,591	25,004	1,858	11,250	0	teacher	434	495	124	150	579	4

The matrix has no total column and no rank column; the ranking criterion is a run pin. Source: EPRAS run 6b2afc6 (report/build/data/t_gap_matrix_top.csv).

Three rules govern it, all enforced in code. **There is no total column**, because the columns are in incompatible units. **There is no rank column**, because a rank implies a criterion and an unlabelled rank hides it. Ordering is a user action on a named criterion, pinned in the run manifest — here to `oosc_primary`, which is why Yumbe, Kasese and Kyegegwa head Table 8.3 and the eastern districts that dominate the capacity columns do not. Rank the same rows on the place gap and Arua leads; on children beyond 3 km, Wakiso. Neither answers "which district is neediest", and moving the criterion onto the census out-of-school measure changes the top of the table substantially. **Surpluses are shown and never netted**: the place-surplus column sits beside the place-gap column, so Mukono's 23,101 spare places and Nakasongola's 18,383 stay visible, as does Amudat's 1,997 beside its 38,526 primary-age children out of school.

The matrix omits the cost to close each district's gaps and its recurrent–capital split, which EM-06 produces: closing every gap in this chapter at norm prices costs 4,182.4 bn UGX against a base envelope of 2,441.9 bn.

8.9 Data quality

All 2,295 gap rows this run writes carry a quality tier, and for the first time the majority are `measured`: 1,485 `measured`, 540 `unmeasured` and 270 `imputed`. On the carry-forward none was `measured`.

The `measured` rows are eleven per district: places, classrooms and teachers in post at each cycle, untrained teachers and stances at primary, and out-of-school children at each of the three cycles. The `unmeasured` four are desks, textbooks and the two secondary cadre rows, and an `unmeasured` row is deliberately not a zero; secondary classrooms, `unmeasured` in every previous edition, are no longer among them. The `imputed` two are children beyond 3 km and the quality count.

The tier describes the availability column; five things these gaps rest on are not counted.

1. **The grade profile and the flow rates come from 2017.** The census publishes learners by class nationally but not by grade and district, so the grade distribution within a cycle and the promotion, repetition and dropout rates driving the enrolment path are still the 2017 abstracts'. The requirement side of every gap here inherits that vintage.
2. **Classrooms and stances are derived from published ratios.** The census publishes pupil–classroom and pupil–stance ratios by district rather than counts, so counts are computed per census unit and raked to the published national totals, at a maximum raking factor of 1.0369 — imputed from measured ratios, which is not counted.
3. **Access is straight-line.** Equation (8.11) rests on Euclidean settlement-to-school distance on OSM layers with no friction surface, 98% of settlement points unweighted by population.
4. **Teachers by qualification are a 2017 share.** θ in Equation (8.8) is the 2017 trained share applied to a counted head; the row is tiered on its capacity record, and the share inside it is not.
5. **The geography is reconciled, not identical.** Thirteen of the census's 146 units — ten cities, Terego and two spelling variants — are folded into their parent districts to match UGA-UBOS-2022.

8.10 Implications for planning

Allocate against the binding constraint. Sixty-six districts cannot convert a classroom grant into one additional taught class, yet they carry 18,536 rooms of apparent classroom gap — 38.9% of the national primary total — that a place-gap formula would fund. On the carry-forward that leakage was 7,168 rooms in 31 districts, so counting the supply has more than doubled the money at risk. For a teacher-bound district the sequence is recruitment or posting first, construction second; the districts that moved, Arua above all, are those a 2017-based formula would mis-serve.

Recruitment is now the larger half of the capacity problem. The primary place gap fell by more than half when the supply was counted, but the teacher gap reaches all 135 districts and the national surplus has gone to 23 FTE, so the redeployment calculation — 14,722 teachers moved, the spread of district pupil–teacher ratios cut from 15.91 to 4.07 — is about equalising a shortage, not distributing a sufficiency. Secondary is sharper still: 22,495 FTE short against 22,150 in post. The 13,871 untrained primary teachers are a separate, cheaper queue — training rather than recruitment, reaching learners in the year it is funded and adding no payroll head.

Commission the remaining stock counts. The census closed the two largest holes here and left four. The base year requires 2,021,416 desks and 24,143,893 textbook copies and Uganda cannot state a gap against either, so the next round should count both, by subject and grade for books. It should also split stances by sex, without which the 55,605-stance gap is a lower bound of unknown depth, and publish secondary teachers by subject and by qualification, without which the 24,523 FTE of arts and 20,098 FTE of science requirement have no gap and 0 stays a nine-year-old ratio.

Settle the out-of-school question before it settles a budget. The census says 2,467,716 primary-age children are out of school; the survey series says 753,482. Neither is averaged into the other, but a plan cannot size a re-entry programme against a range of that width, so reconciling them is a research task with a deadline.

Do not let the national totals travel alone. 1,194,733 places, 49,841 FTE, 47,658 rooms and 55,605 stances are sums of district gaps, and districts are not interchangeable. The maps show three geographies — a room deficit across the east and Lango, a staffing constraint across the west, West Nile and the centre, an access deficit in peri-urban Wakiso and the pastoralist north — and an allocation from national totals will reach none in proportion. A district's Q of 3 is likewise not a rating against a neighbour's Q of 2; it is a list of three things to procure, most often starting with sanitation.

CHAPTER 9

9 EM-06 What it costs

The chapters before this one built a requirement without once mentioning money: EM-03 turned enrolment into classes, teachers, rooms and a bill of materials, EM-04 counted what exists and EM-05 subtracted one from the other. This chapter prices every quantity and reports what the required system costs to run for a year.

That order — needs first, money last — is why the number is worth reading. It is the cost of the system the approved norms describe, at the prices in force, for the learners the projection says will be in public classrooms in 2026, unshaped by what the Treasury is likely to release. On the pinned run that cost is **UGX 4,373.6 bn** a year. The money that actually exists in the same year is **UGX 2,441.9 bn**, of which **UGX 75.9 bn** — 3.1 per cent — is not already committed to salaries and grants that cannot be stopped. What to do about a gap of that shape is the allocation chapter's subject; this chapter's job is to make the 4,373.6 defensible line by line.

9.1 The costing identity and the three views

Every line of cost here is a quantity multiplied by a price: no residual, no balancing item, no uplift on a subtotal. For a district d in year t :

$$X_{d,t} = \sum_r R_{r,d,t} p_{r,t} + \sum_q F_{q,d,t} w_{q,t} \quad (9.1)$$

where

- X is total cost, in constant 2026 UGX;
- R is the effective quantity of non-staff input r required in district d in year t , from the EM-03 bill of materials;
- p is the unit price of input r in the pinned price vintage;
- F is the full-time-equivalent establishment of cadre q required in district d in year t , from the EM-03 timetable calculation;
- w is the annual cost of one FTE of cadre q , from Equation (9.2).

The same priced lines are then aggregated three ways, and the three aggregations are asserted to agree. The **economic** view classifies each line by the kind of input it buys — wages, goods and services, transfers — and feeds the EM-10 chart of accounts. The **programme** view classifies by what the money is for, and feeds the programme budget. The **geographic** view sums to districts, and is what EM-08 rations and what the equity analysis reads. The engine sums each and stops the run if any pair differs by more than one part in ten thousand; on this run all three sum to UGX 4,373,579,856,821. The check catches a line mapped to a programme but not to an economic class, or a district dropped by a join, before anyone sees a number.

Table 9.1: The requirement by economic classification

Economic	Amount
21 Wages and salaries	2,970,497,512,392
22 Goods and services	876,906,752,387
26 Transfers to schools	280,878,079,613

The economic, programme and geographic views reconcile to 0.01 per cent or the run fails. Source: EPRAS run 6b2afcf6 (report/build/data/t_cost_economic.csv).

Table 9.2: The requirement by programme

Programme	Amount
1.1	1,457,996,262,670
2.1	1,512,501,249,721
1.2	554,309,082,844
1.3	125,063,772,674
2.2	394,518,104,696
2.3	57,417,729,787
7	26,476,142,000

Source: EPRAS run 6b2afcf6 (report/build/data/t_cost_programme.csv).

9.2 The wage bill

Wages and salaries are **UGX 3,037.8 bn**, 69.5 per cent of the requirement (Table 9.1) — just below the 70–85 per cent band the specification expects. They are computed from the establishment and the scale, never from an average, with the unit price of a cadre built from the published monthly midpoint of its scale:

$$w_{q,t} = 12 b_{q,t}(1 + \kappa) \quad (9.2)$$

where

- b is the monthly basic pay at the midpoint of the scale points for cadre q , from the Ministry of Public Service salary structure for FY2025/26 (MoPS 2025);
- κ is the employer on-cost — pension and gratuity accrual — set at 0.10 of basic pay;
- the factor 12 converts a monthly rate to an FTE-year.

The results are in Table 9.4. A Grade III primary teacher costs **UGX 7,047,810** per FTE-year: a monthly midpoint of UGX 533,925, twelve months, plus ten per cent. A graduate non-science secondary teacher costs UGX 13,453,770. A graduate science teacher, on the science enhancement scale, costs **UGX 52,800,000** — 3.92 times the arts rate for the same qualification and teaching load.

That price does more work in this report than any other. Lower secondary requires 15,698 science FTE and 12,140 arts FTE, so the science establishment — over half that teaching force by headcount — is 84 per cent of its teaching wage bill: UGX 828.9 bn against UGX 163.3 bn. Primary requires 218,211 FTE at a single low rate, for UGX 1,537.9 bn. With pre-primary (14,509 FTE) and upper secondary (5,125 FTE), classroom teaching costs UGX 2,701.3 bn; the remaining UGX 336.5 bn is the 27,108 non-teaching FTE — head teachers, deputies and laboratory technicians — each costed on its own establishment basis.

Two things the specification insists on are missing. Allowances are not applied as a district-varying multiplier: the scale midpoint is used rather than the minimum, which absorbs part of the allowance structure, but it is a national number carrying no hardship or remote loading. And there is no incremental progression — a teacher in 2030 costs the same real amount as in 2026, which on the specification's own estimate understates the final-year wage bill by 5–12 per cent. This wage bill is a floor.

Replacement recruitment is handled more carefully but is not finished. Attrition is applied to the teachers in post:

$$\text{RPL}_{d,t} = \alpha H_{d,t-1} \quad (9.3)$$

where H is the stock of teachers in post at the end of the previous year and α is the annual attrition rate, set at 0.03 pending a teacher management information system extract. On 158,229 primary teachers in post that is 4,747 a year who must be recruited for the system to stand still, before a single additional place is created. These rows are emitted on their own replacement basis, so they cannot be folded into the requirement unnoticed — but at a unit price of zero. **Replacement recruitment is counted and not yet costed.**

9.3 Durables: annualised into recurrent, acquired in capital

A textbook bought in 2026 is used for three years. Charging its whole price to 2026 makes that year look unaffordable and the next two look cheap; charging them nothing makes the system look as though it runs without books. Each line of the bill of materials in Table 9.5 therefore carries four coefficients that fix how much of a durable the system consumes in a year: units per learner, the share of learners who need them, wastage, and lifespan. The effective annual quantity is

$$\bar{R}_{r,d,t} = B_{d,t} n_r s_r \frac{(1+\omega_r)}{L_r} \quad (9.4)$$

where

- B is the base the line scales on — public learners for a learner-driven line, rooms, classes or schools for a shared line such as laboratory apparatus;
- n is the norm quantity per unit of that base;
- s is the share of learners the line applies to;
- ω is the wastage rate, the fraction lost or destroyed before the end of its nominal life;
- L is the lifespan in years.

A primary upper-grade place carries four textbooks at five per cent wastage and a three-year life, so it consumes 1.4 copies a year, not four; a three-seat desk is 0.333 per learner at two per cent wastage over ten years. Wastage enters the quantity, not the price. Annualised charge and acquisition cost are then computed from the same stock and lifespan and reported as two different things:

$$A_{r,d,t} = \frac{S_{r,d,t}}{L_r} p_{r,t} \quad \text{versus} \quad K_{r,d,t} = G_{r,d,t} p_{r,t} \quad (9.5)$$

where

- S is the required **stock** of durable r — what should be standing in the district, quantity $\times$ share $\times$ (1 + wastage);
- A is the annualised capital charge, which belongs in the recurrent budget and answers "what does running this system cost every year";
- G is the **gap** in that stock against EM-04 supply;
- K is the acquisition cost, which belongs in the capital budget and answers "what do we have to buy this year".

The requirement is 221,638 primary classrooms. At UGX 52,711,605 a room over a forty-year life the annualised charge is 5,541 rooms a year, or UGX 292.1 bn; the replacement value of the same rooms is UGX 11,682.9 bn. Adding the two would be adding a rental to a purchase price, so the engine holds them on separate bases — requirement and gap — and labels every total with which one it is. The UGX 4,373.6 bn requirement is a **recurrent** number containing no acquisition; the UGX 5,978.8 bn cost of closing the five gaps is the acquisition number, reported in the investment chapter and never added to this one.

Across the seven durable lines the annualised charge is UGX 735.3 bn a year: primary classrooms 292.1 bn, latrine stances 121.1 bn, desks 111.9 bn, textbooks 91.3 bn, science blocks 57.8 bn, secondary classrooms 33.5 bn and secondary furniture 27.6 bn. The largest non-salary line in the whole requirement is therefore the annualised cost of primary classrooms — larger than the entire capitation transfer to primary schools.

9.4 Maintenance is a norm, not a residual

Maintenance disappears first when a budget is tight, which is why school buildings become temporary structures within fifteen years. It is costed from the value of the estate, not from what is left after salaries:

$$M_{d,t} = \mu \sum_{r \in F} S_{r,d,t} p_{r,t} \quad (9.6)$$

where

- μ is the annual maintenance rate as a share of replacement value, set at 0.02;
- F is the set of facility inputs maintained — primary classrooms, secondary classrooms and science blocks;
- $S \times p$ is the replacement value of the required stock of each.

The replacement value of the required estate is UGX 15,335.5 bn, and maintenance at two per cent is **UGX 306.7 bn** a year: 233.7 bn on primary classrooms, 46.2 bn on science blocks and 26.8 bn on secondary classrooms. The rate sits in the middle of the 1.5–3 per cent band the specification gives for school buildings and is flagged *assumed*, because no Ugandan maintenance norm was found. The point is not precision in the rate but that cutting maintenance now requires writing down a smaller number than 306.7 — a visible decision.

9.5 System services, costed on their own drivers

Inspection does not cost more because a school has more children in it, and the district education office does not get cheaper where there are few learners. These costs must be put on their own drivers rather than spread as an uplift on the per-learner rate, which is wrong for small districts in exactly the direction that harms them.

$$Y_{d,t} = \sum_j D_{j,d,t} p_{j,t} \quad (9.7)$$

where

- Y is the system-service cost of district d in year t ;
- D is the count of the driver for service j — schools for inspection and monitoring, government primary schools for the fixed UPE school grant, the district itself for the education office;
- p is the rate per unit of that driver.

The four costed services are inspection at UGX 112,000 per school-year over 13,048 schools (UGX 1.46 bn), monitoring at UGX 100,000 per school-year (UGX 1.30 bn), the fixed UPE capitation of UGX 1,350,000 per government primary school over 12,036 schools (UGX 16.25 bn), and a fixed block of UGX 48,500,000 per district over 135 districts (UGX 6.55 bn). The total is **UGX 25.6 bn**, programme code 07 in Table 9.2.

That is 0.6 per cent of the requirement, against the 8–15 per cent of recurrent spending the specification expects. The mechanism is right and the coverage is thin: examinations, teacher management, in-service training, EMIS and curriculum development are all named in the specification and none is costed, because no rate for them exists in the catalogue. Every district carries a non-zero system cost, so the structural check holds, but the block is understated by roughly an order of magnitude, and programme 07 is a placeholder rather than an estimate.

9.6 Unit cost per learner-year

Everyone asks for the unit cost, and almost nobody says which one they mean. The engine answers with a breakdown and a basis label, and refuses to export one without either.

$$u_{c,d,t} = \frac{W_{c,d,t} + N_{c,d,t} + A_{c,d,t}}{E_{c,d,t}} \quad (9.8)$$

where

- u is the unit cost per learner-year for cycle c ;
- W is the wage bill of that cycle;

- N is non-salary recurrent — capitation transfers and maintenance;
- A is the annualised capital charge of Equation (9.5);
- E is public enrolment in that cycle on the target path.

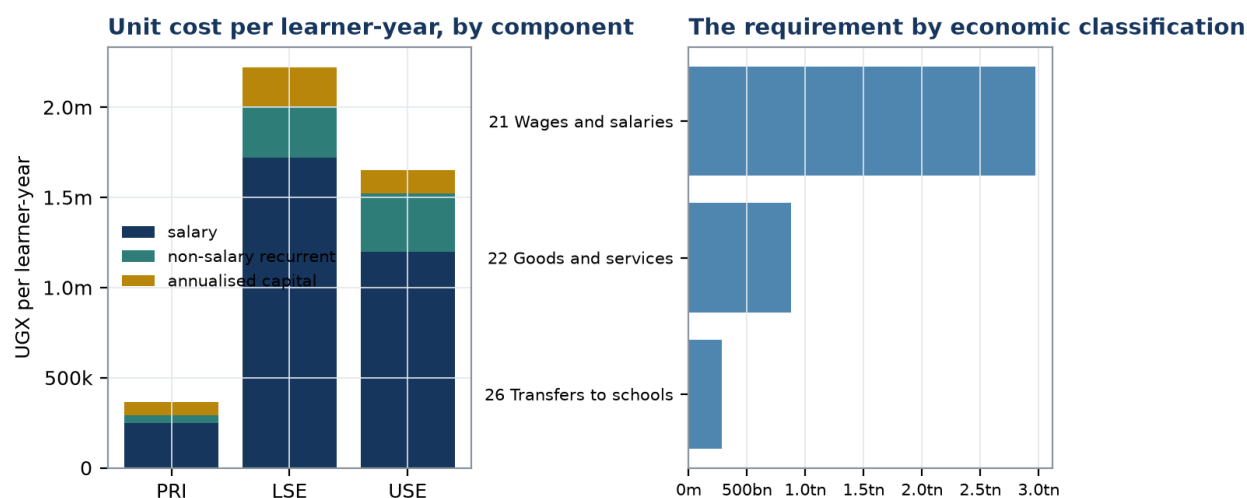


Figure 9.1: ch unit cost

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Figure 9.1 and Table 9.3 give the result. A public primary learner-year costs **UGX 326,552**, of which UGX 215,220 is salary (65.9 per cent), UGX 43,318 is non-salary recurrent (13.3 per cent) and UGX 68,013 is the annualised capital charge (20.8 per cent). Lower secondary is UGX 2,174,631 and upper secondary UGX 1,752,786 — 6.7 and 5.4 times the primary rate. Salary's share rises with the cycle: 65.9 per cent in primary, 77.1 per cent in lower secondary, 73.7 per cent in upper secondary.

Table 9.3: Unit cost per public learner-year, with its breakdown and basis

Cycle	Public Learners	Total	Salary	Nonsalary	Annualised Capital	Unit Cost	Basis
PRI	5,586,942	2,033,477,438,829	1,382,769,113,365	255,067,845,868	395,640,479,597	363,970	normative
LSE	810,130	1,798,322,694,763	1,391,816,346,309	231,409,111,463	175,097,236,991	2,219,795	normative
USE	100,649	166,114,389,441	120,684,903,413	32,357,193,327	13,072,292,701	1,650,425	normative

Every unit cost carries a basis label; an unlabelled unit cost cannot be exported. Source: EPRAS run 6b2afcf6 (report/build/data/t_unit_cost.csv).

The secondary unit costs are large for a reason that belongs upstream. Lower secondary requires 27,838 teacher FTE for 641,417 public learners — one FTE for every 23 learners — because the requirement comes from the subject timetable, and a small school teaching the full curriculum needs a teacher for every subject whether or not the classes are full. Multiply the science half of that establishment by UGX 52.8 m and the arithmetic follows: this is the cost of the curriculum as written, delivered in schools of the size Uganda has.

Two things need stating plainly. First, the basis label on every row reads **`normative`**: this is what the norms imply the system should cost, not what is currently spent per learner. No actual unit cost is produced, because the per-district expenditure data needed for one is not held, and quoting UGX 326,552 in a discussion about current spending would be wrong by the size of the gap. Second, the breakdown has three components where the specification asks for four: system cost is absent, because system services are costed on school and district drivers and are not attributed to a cycle. Programme 07 and pre-primary therefore sit outside Table 9.3, whose rows sum to UGX 4,206.8 bn rather than to the full requirement.

9.7 Prices: policy rates, market prices, and the rule about zero

Table 9.4 is the complete price catalogue for the pinned vintage UGA-2026 — twenty-six prices, each carrying its source document and page. It makes one distinction that matters more than it looks.

A **policy rate** is a number the government has set: a salary scale point, a capitation rate, an inspection allowance. It is in force at its stated value, so it is carried forward at that value and is already a constant-2026 figure. UPE capitation is UGX 17,000 per learner-year because that is the rate in the guidelines, and deflating it would describe a rate nobody pays. A **market price** is what a procured good costs: a classroom block, a desk, a textbook. Those are engineers' estimates or contract prices from an earlier year, rebased to constant 2026 UGX — construction by the GDP deflator from 2022, a factor of 1.245, and the textbook from US\$1.98 delivered in 2014 through the exchange rate and then the deflator, giving UGX 8,789 a copy.

The distinction is not bookkeeping. A policy rate that has not moved in real terms is an erosion of the service it buys, and carrying it forward unchanged makes that erosion visible: the catalogue records press reports of a FY2025/26 UPE rate of UGX 20,000, uncorroborated by any official document, and the engine uses the documented 17,000. A market price that is not rebased under-budgets the purchase outright.

A missing price stops the run. There is no default and no national-average stand-in that fills itself in quietly. If an input in the bill of materials has no price in the pinned vintage, the costing raises `PriceNotFound`, names the input code, and the chain stops. A silent zero is how a plan comes to omit its textbooks and discovers it two years in. Gate G4 enforces the same rule ahead of the run: all 20 norm lines and 4 teaching cadres were priced before costing began.

Table 9.4: Prices in the pinned vintage

Input Code	Cadre Code	Unit	Price	Curr ency	Price Basis	Price Kind	Source
CAPITATION_UPE		learner_year	17,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_LEARNER)
CAPITATION_UPE_SCHOOL		school_year	1,350,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_SCHOOL)
CAPITATION_UPOLET		learner_year	270,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPOLET_GOV)
CAPITATION_USE		learner_year	175,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_USE_GOV)
CLASSROOM		room	52,711,605	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_CLASSROOM_2BLOCK)
CLASSROOM_SEC		room	82,021,551	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_CLASSROOM_2BLOCK_SEC)
DEO_FIXED		district_year	48,500,000	UGX	constant_2026	policy_rate	MoES LG Planning Guidelines 2022 p.19 (monitoring+inspection+top-up)
	DEPUTY_PRI	FTE_year	9,478,372	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	DEPUTY_SEC	FTE_year	22,253,682	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
DESK_3SEAT		desk	373,523	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_DESK_3SEAT)
FURN_SEC		place	390,124	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_CLASS_SET_SEC)
	HEAD_PRI	FTE_year	11,600,972	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	HEAD_SEC	FTE_year	30,498,494	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
INSPECT_SCHOOL		school_year	112,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_INSPECT_SCHOOL)
	LAB_TECH	FTE_year	29,040,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.17 midpoint x12 x(1+0.10 employer on-cost)

Input Code	Cadre Code	Unit	Price	Currency	Price Basis	Price Kind	Source
LATRINE_STANCE		stance	8,056,217	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25-26 (CAP_LATRINE_5)
MONITOR_SCHOOL		school_year	100,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_MONITOR_SCHOOL)
NEW_PRI_SCHOOL		school	842,625,718	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_PRIMARY_SCHOOL_NEW)
NEW_SEED_SCHOOL		school	1,065,207,900	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SEED_SCHOOL_PH1)
SCIENCE_BLOCK		unit	308,785,625	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SCIENCE_BLOCK)
TEACHER_HOUSE		unit	134,564,072	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_HOUSE_2UNIT_PRI)
	TEACH_PRE	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_PRI	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_ARTS	FTE_year	13,453,770	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_SCI	FTE_year	52,800,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
TEXTBOOK		copy	8,789	UGX	constant_2026	market_price	WB_P133780_PAD_2014 p.133 (MAT_TEXTBOOK_PRI)

Price vintage UGA-2026; all amounts constant. Source: EPRAS run 6b2afc6 (report/build/data/t_prices.csv).

Table 9.5: The bill of materials: what one learner-year consumes

Service Code	Input Code	Cadre Code	Quantity	Unit	Share Of Learners	Wastage	Lifespan Years	Source	Source Year	Quality
PLACE_LSE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26 60 sets per classroom	2022	norm ed
PLACE_LSE	TEXTBOOK		8	copy	1	0.05	3	assumed: eight subjects 1:1	2022	assu med
PLACE_LSE	CAPITATION_USE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 USE per learner	2022	norm ed
PLACE_LSE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	norm ed
PLACE_PRI_L Ower	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	norm ed
PLACE_PRI_L Ower	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	norm ed
PLACE_PRI_L Ower	TEXTBOOK		2	copy	1	0.05	3	assumed: literacy + numeracy readers 1:1	2022	assu med
PLACE_PRI_L Ower	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	norm ed
PLACE_PRI_L Ower	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	norm ed
PLACE_PRI_U PPER	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	norm ed
PLACE_PRI_U PPER	TEXTBOOK		4	copy	1	0.05	3	assumed: four examinable subjects 1:1	2022	assu med
PLACE_PRI_U PPER	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	norm ed
PLACE_PRI_U PPER	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	norm ed
PLACE_USE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26	2022	norm ed
PLACE_USE	TEXTBOOK		4	copy	1	0.05	3	assumed: three principals + GP	2022	assu med
PLACE_USE	CAPITATION_UPOLE T		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPOLE T per learner	2022	norm ed

Service Code	Input Code	Cadre Code	Quantity	Unit	Share Of Learners	Wastage	Lifespan Years	Source	Source Year	Quality
PLACE_USE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
SYS_SCHOOL	INSPECT_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 inspection per school	2022	normed
SYS_SCHOOL	MONITOR_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 monitoring per school	2022	normed
SYS_SCHOOL	CAPITATION_UPE_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE fixed per school	2022	normed

Effective annual quantity is quantity x share of learners x (1 + wastage) / lifespan years. Source: EPRAS run 6b2afcf6 (report/build/data/t_norm_lines.csv).

9.8 The geography of cost

Cost of the requirement, base year

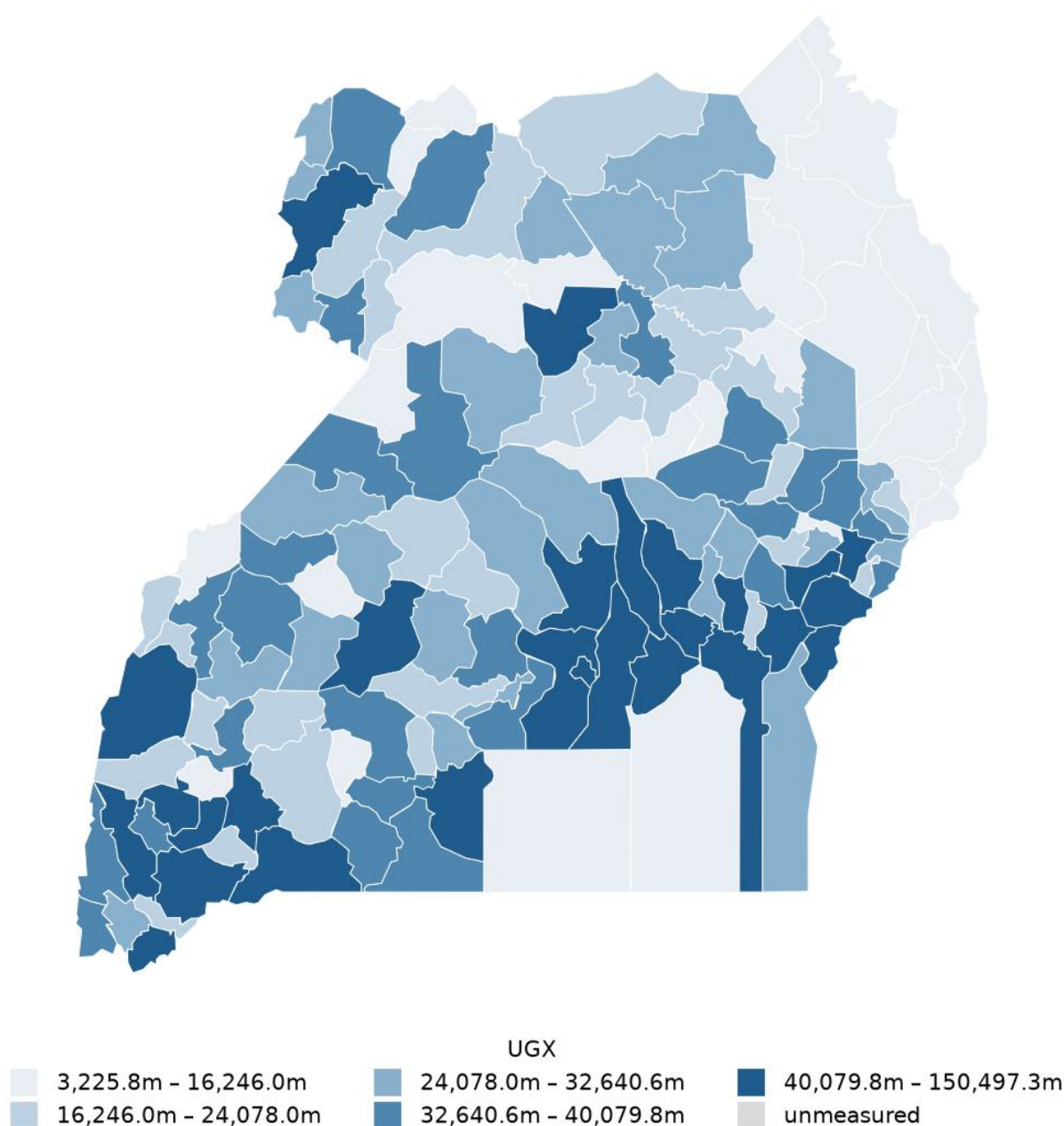


Figure 9.2: Cost of the requirement, base year (UGX), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Requirement per public primary learner

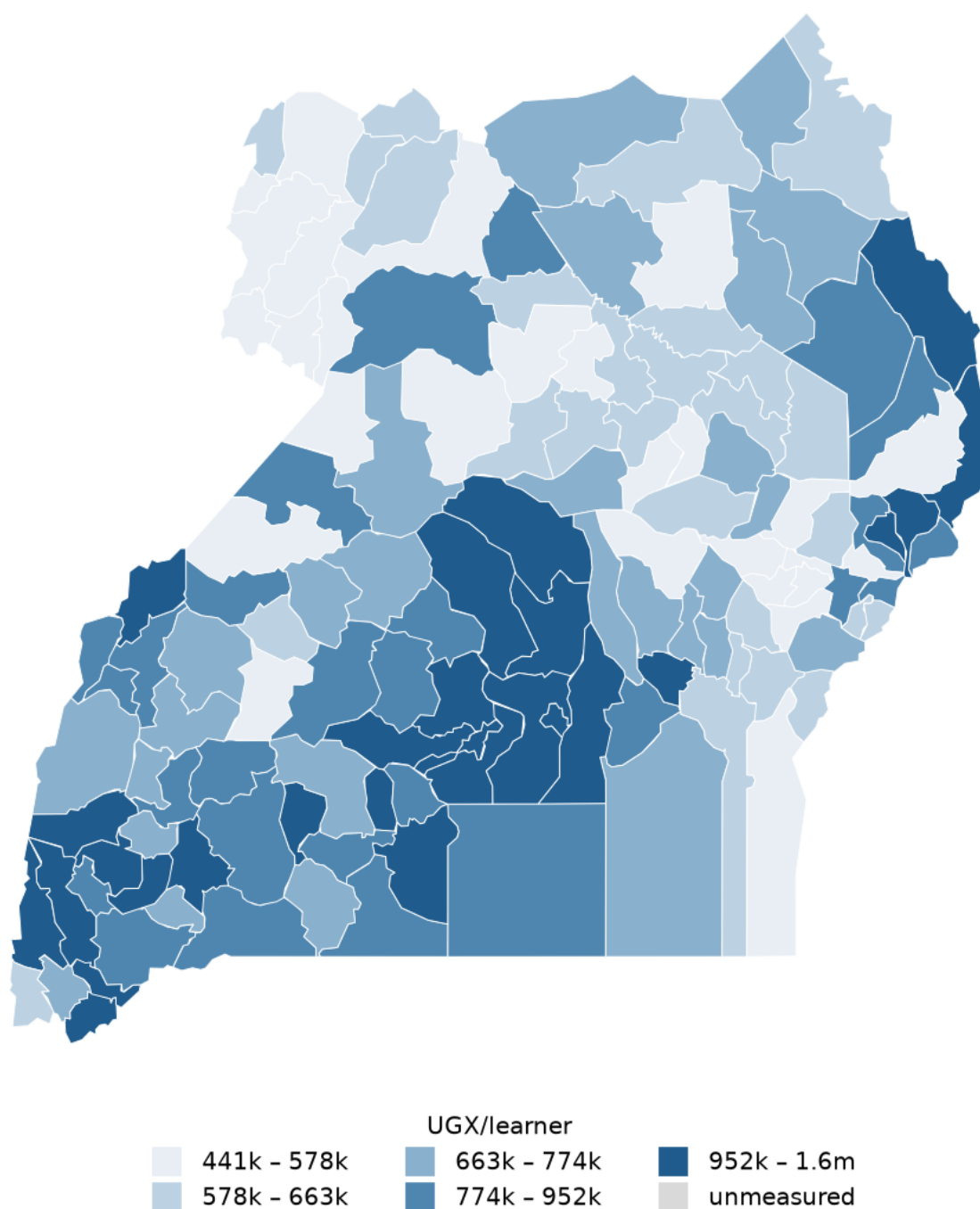


Figure 9.3: Requirement per public primary learner (UGX/learner), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 9.2 is, to a first approximation, a map of where Uganda's children are. The district requirement and district primary enrolment correlate at 0.91 across the 135 districts, which is what should happen when the requirement is built from cohorts and priced at national rates: cost is enrolment multiplied by a number that barely varies in space. Arua is the largest requirement at UGX 144.6 bn, 3.3 per cent of the total, then Tororo at 85.3 bn, Kampala at 82.5 bn, Wakiso at 82.4 bn and Kasese at 80.8 bn; at the other end Amudat requires UGX 5.1 bn, Obongi 6.4 bn

and Kalangala 6.7 bn. The ten largest districts account for 18.0 per cent of the requirement, the sixty-eight smallest for 30.4 per cent.

Dividing out the enrolment, Figure 9.3 leaves only the structure. The requirement per enrolled primary learner ranges from UGX 270,971 in Wakiso to UGX 1,205,461 in Kalangala, a factor of 4.4, around a median of UGX 507,843. The high end is Karamoja and the islands — Kalangala, Nakapiripirit, Nabilatuk, Kotido, Moroto, Karenga — and the mechanism is small schools, not expensive ones. A district with few learners spread over many small schools forms classes below the class-size norm, needs a teacher for each, needs a head teacher per school regardless of size, and carries a fixed district education office over a small base. Each is a genuine cost of serving a sparse population, and each would have been invisible had system costs been spread as a national percentage. What the map does **not** show is any variation in price: Wakiso and Kalangala buy a classroom at the same UGX 52,711,605.

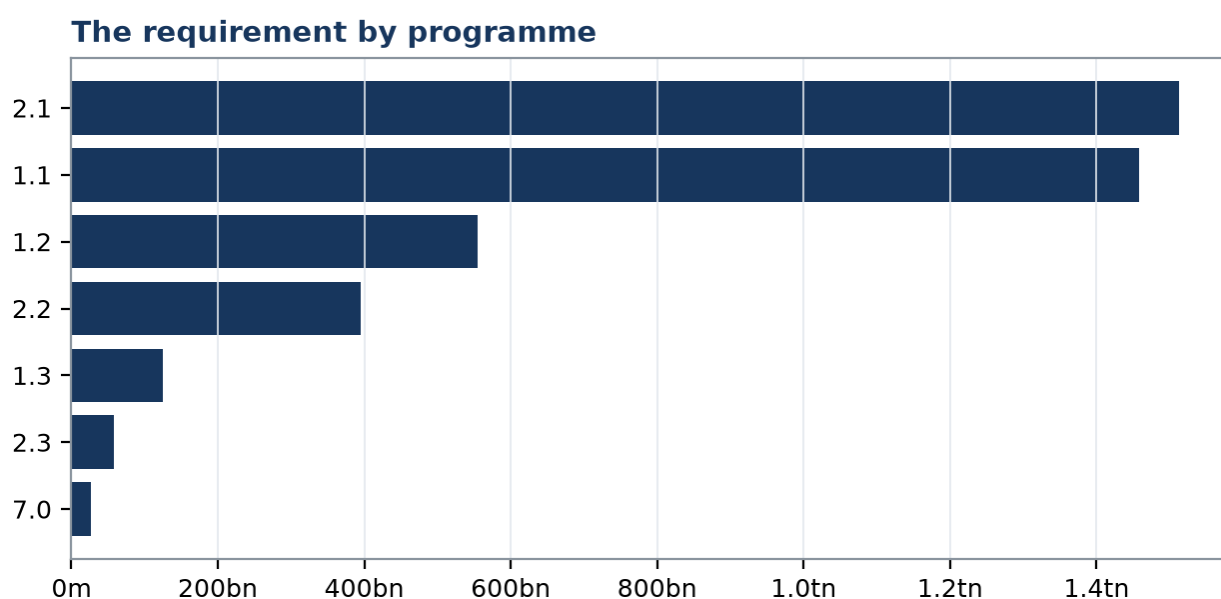


Figure 9.4: ch cost programme

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Figure 9.4 and Table 9.2 give the programme view. Pre-primary and primary together are UGX 2,859.7 bn, 65.4 per cent of the requirement; secondary is UGX 1,488.4 bn, 34.0 per cent; administration is the 25.6 bn already discussed. Within primary, wages are 1,893.9 bn, other non-wage recurrent — capitation, maintenance, annualised rooms and latrines — is 779.0 bn and instructional materials 186.8 bn; within secondary the same three lines are 1,143.9 bn, 300.3 bn and 44.1 bn. Nothing appears under the capital sub-codes, which is correct: on the requirement basis there is no acquisition, only the annualised use of an estate.

9.9 Data quality and what it does to the figure

Every price in Table 9.4 is tiered *measured* — a published rate from a named document and page. The tier describes provenance, not accuracy, and four limits should change the weight a reader puts on the total.

Prices are national. There is no district or locality variation in any price. The specification is explicit that construction in a remote district costs 1.3 to 2.0 times the urban rate for the same classroom, and that a national average under-budgets a remote-district programme by a margin that stops it. Here the annualised classroom charge and the maintenance base in Kotido use the Kampala rate. The recurrent requirement is only mildly exposed — classroom price moves the total by 2.7 per cent at the sensitivity bound — but any capital programme built on these rates will under-budget the hard-to-reach districts, which are exactly the districts the access gap points to.

Construction loadings are absent. The specification carries contingency, supervision, design and tax explicitly, outside the unit rate, so each can be negotiated and audited separately. None is applied: the prices used are the bare Construction Management Unit rates rebased by the deflator, and the catalogue's investment service rate of 5 per cent of capital for bills of quantities and supervision is unused. Any acquisition figure from these prices is low by at least that 5 per cent, and lower once contingency and taxes are added.

There is no salary progression. The average cost per FTE is constant in real terms to 2030, understating the final-year wage bill by 5–12 per cent — of a block that is 69.5 per cent of the total.

Replacement recruitment is unpriced. The 3 per cent attrition rate is assumed pending a TMIS extract, and the rows it generates carry a zero price.

Two caveats belong with the quantities rather than the prices. The base year is a projection: the enrolment driving every learner-scaled line is rolled one year forward from the counted level of the Baseline Education Census 2025 (UBOS 2026), on flow rates that still come from 2017, and is flagged *imputed* for that reason. And the salary figures were read from a scanned PDF with no text layer, flagged *transcribed_from_scan*; the source record advises a reviewer check those first, and since one price — the science teacher rate — carries UGX 828.9 bn, that advice should be taken literally. In the sensitivity analysis class size moves the total by 16.5 per cent, teaching load by 15.4 and teacher salary by 13.9, against 2.7 for classroom price: two of the three largest levers are EM-03 parameters, not EM-06 prices.

9.10 Implications for planning

The first implication is arithmetic. The requirement is UGX 4,373.6 bn a year against an envelope of UGX 2,441.9 bn — the plan as normed costs 1.79 times the money — and UGX 2,366.0 bn of that envelope is already committed, leaving UGX 75.9 bn to direct. A gap of that size is not closed by efficiency or by reallocating the discretionary margin, but by some combination of more money, a longer horizon and a norm that costs less to deliver — and the third is a policy decision to be taken explicitly, not arrived at by under-funding the norm and calling the result a plan. The allocation chapter sets out what the envelope can and cannot buy.

The second is that the wage bill is the plan. At 69.5 per cent of the requirement, with the largest sensitivity parameters feeding the teacher requirement or its price, refining textbook or furniture costs cannot change the answer. Two decisions dominate: the class-size norm and the teaching load, which set how many teachers the timetable demands, and the science enhancement scale. A review of the lower-secondary curriculum load — how many subjects, how many periods, what minimum school size makes the full offer deliverable — would move more money than any procurement reform available to the ministry.

The third is that the annualised view changes what maintenance looks like. UGX 735.3 bn of annualised durables and UGX 306.7 bn of maintenance — together 23.8 per cent of the requirement — is the cost of keeping the physical system usable before a single new classroom is built. That money appears in no budget line labelled "capital", and in practice it is what gets cut. A ministry budgeting less than 306.7 bn for maintenance should see that it has decided to consume part of the estate.

The fourth is that the geography of cost is a geography of learners, so per-learner equity and per-district equity are different questions. The largest requirements are in the populous districts; the highest per learner are in the sparse ones, sparse for reasons no education budget can change. An allocation rule that funds districts strictly per learner will under-fund Karamoja and the islands by something like that factor of 4.4 — and the system-cost block that carries the counter-argument needs its missing services first.

Last, a caution about the number. UGX 4,373.6 bn is a floor, and every known bias runs the same way — no salary progression, no locality loading on construction, no contingency or supervision, unpriced replacement recruitment, and a system-cost block an order of magnitude below what the specification expects. Each has a named fix: a progression path from the establishment's age and grade profile, locality multipliers and the 5 per

cent investment service rate already in the unit-cost catalogue, a TMIS extract, and rates for examinations, in-service training and EMIS. Until those are in, quote this chapter as the minimum defensible cost of the normed system — not as an estimate of what it would take to run it.

CHAPTER 10

10 EM-07 Investment, siting and the teacher pipeline

EM-06 priced the requirement. This chapter asks the question that comes next and is rarely asked in the same document: can it be built, and how fast? A plan that names a number of classrooms and a number of teachers without asking who would build them and who would train them is arithmetic, not a programme. EM-07 converts the gaps into things to do — rooms to build, sites to build them on, teachers to train and deploy — and tests each against the rate at which the delivery system is actually financed to move.

The answer is the most consequential finding in this report, and it is not a finding about money. At the delivery rate that the local government primary development grant finances, the primary classroom gap takes **104 years** to close and the primary teacher gap **30.8 years** (Table 10.4). A financing gap can be closed by a decision taken in one budget cycle; a delivery gap of this shape cannot.

The module follows the principles that capital always carries its induced recurrent cost (P6) and that feasibility constraints are real constraints (P10). It produces the *unconstrained-but-feasible* programme — what is needed and physically deliverable, before the budget is applied. Rationing is EM-08's job.

10.1 The four streams, and the one this build models

The manual defines four investment streams — construction, teacher supply, materials and rehabilitation — planned together because they are complements: a classroom without a teacher is not a place, and a teacher without a classroom teaches under a tree. **This build models two of them.** Materials and rehabilitation are not modelled, for the reason recorded in `data/SOURCES.md`: desk and textbook stock are not published by district, so the material gap is requirement-only, and no district estate condition survey exists from which a rehabilitation programme could be sized. Within construction, only **primary classrooms** are programmed; secondary classrooms by district are not in the extracted annexes, so secondary capacity is teacher-bound only, and the laboratories, latrine blocks and water points the manual anticipates are not generated. What follows is the primary classroom stream alone, not the sector's development budget.

10.2 Construction throughput, calibrated from a budget line

The manual is emphatic that throughput must be calibrated from what a district has actually delivered, not from what the budget allowed. This build cannot: no series of classrooms completed by district exists in the sources held. It calibrates instead from the one delivery-side quantity that is published, the local government primary development grant, and says so.

$$T = \frac{\sigma B_{\text{dev}}}{p_c} \quad (10.1)$$

where T is national classroom throughput in rooms per year; B_{dev} is the local government primary development grant, 75.9 bn UGX in FY2025/26 (MoFPED approved budget); σ is the share of that grant spent on classroom construction rather than other development items, taken as 0.60 and **assumed**, with no document behind it; and p_c is the unit price of a room in a two-classroom block, 52.7 million UGX, a measured market price from the MoES Planning and Budgeting Instructions 2022 (p.26).

The result is **864 classrooms a year** (Table 10.4) — against a standing public primary stock of 123,575 classrooms, an expansion-and-replacement rate of 0.7 per cent a year.

Three things about it must be understood. It is a **financing rate, not an observed delivery rate**: what the grant buys at the published price if fully spent at it, where real delivery falls short whenever development budgets go unspent. It is **local government only**: central government projects, partner and World Bank operations and community construction do not appear in the extracted budget lines and the engine does not assume them, so national delivery exceeds 864 a year by an unknown amount. And it is **national, not district-specific**: the manual specifies a per-district ceiling reflecting the contractors that actually exist there, while this build has one number and shares it out, crediting a district that has never built more than a handful of rooms in a year with the national average. Where district contractor capacity is the real constraint — precisely where delivery has been weakest — this understates the problem.

10.3 The classroom programme, phased against throughput

The programme is phased by exhausting throughput each year and allocating it across districts in proportion to remaining need:

$$b_{d,t} = \min \left(R_{d,t}, T \frac{R_{d,t}}{\sum_e R_{e,t}} \right) , \quad R_{d,t+1} = R_{d,t} - b_{d,t} \quad (10.2)$$

where b is classrooms built in district d in year t ; R is the classroom gap still outstanding in d at the start of t , taken at the base year from EM-05; T is national throughput from Equation (10.1); and the sum runs over all districts with an outstanding gap.

Because the national total outstanding always exceeds T , the minimum never binds and the rule reduces to a strict pro rata: every district's outstanding gap shrinks by the same fraction each year. That is deliberate neutrality — prioritisation is EM-08's decision, taken against an explicit, user-chosen criterion — with one consequence worth holding on to. **Figure 10.1 is not an allocation decision; it is the classroom gap of EM-05 redrawn in money.** District capital runs from 138.9 m to 11,623.0 m UGX across the horizon in the pattern of that gap: the northern and West Nile districts, the Karamoja belt, and the high-fertility districts of the central and eastern crescent. Grey districts are those where the gap is unmeasured.

Capital programme by district

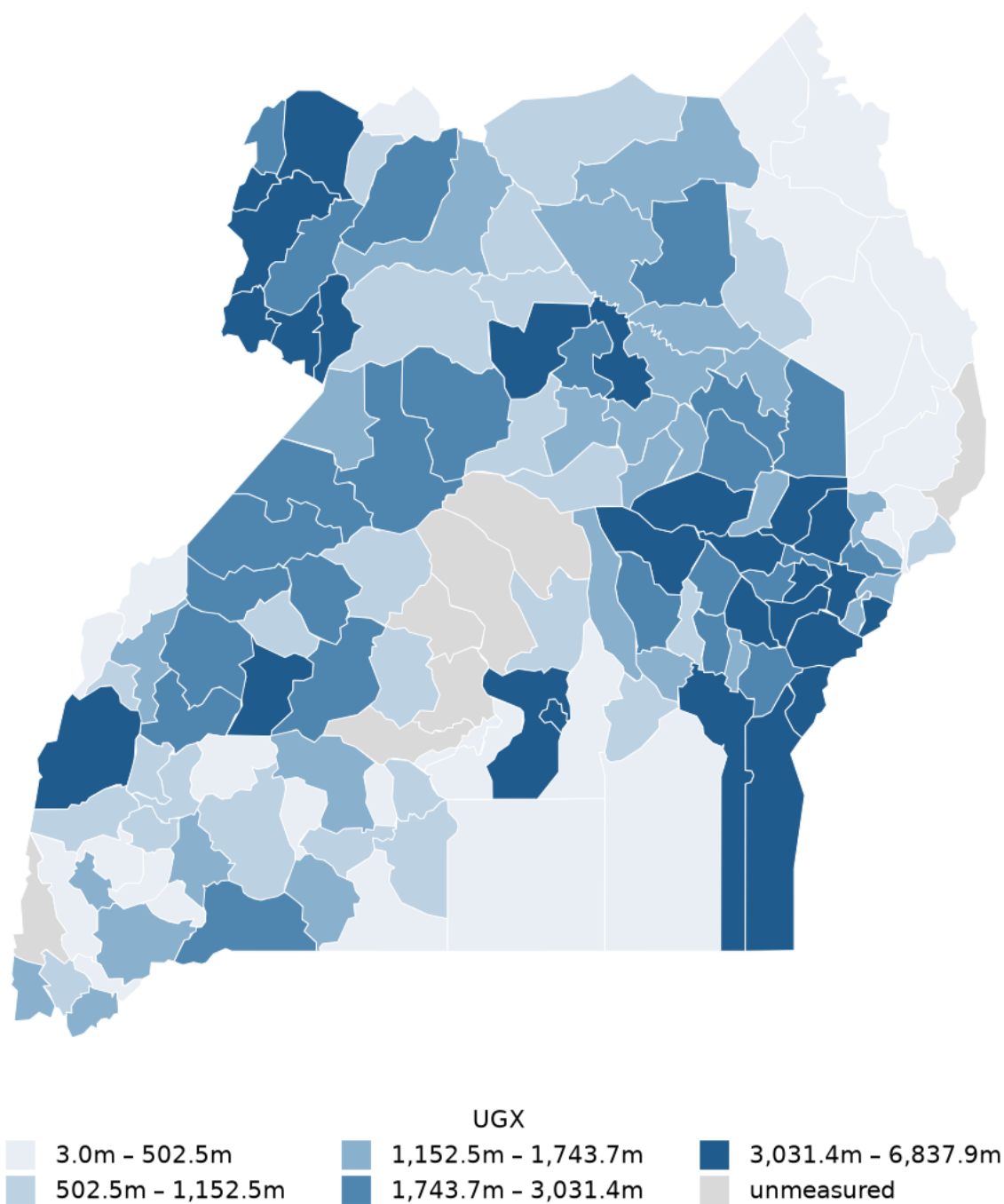


Figure 10.1: Capital programme by district, 2026–2030

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

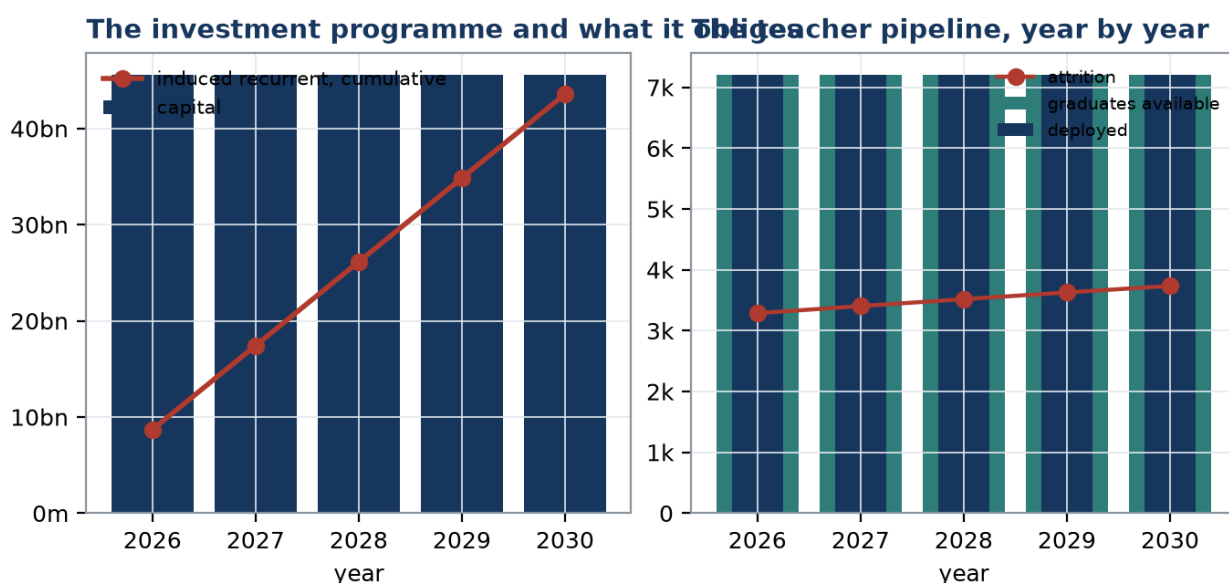
Table 10.1 gives the national programme. It is flat by construction — 864 classrooms, 46 bn UGX of capital and 8.7 bn UGX of newly induced recurrent cost in each of the five years — because throughput does not change and the engine models no intervention that would change it. Over 2026–2030 it builds 4,319 classrooms for 228 bn UGX: **4.8 per cent of the classroom gap**, and 3.8 per cent of the 5.98 tn UGX EM-06 estimates closing all five gaps would cost.

Table 10.1: The investment programme by year, with the recurrent cost it induces

Year	Classrooms	Capital	Induced Recurrent
2026	864	45,540,000,000	8,715,125,636
2027	864	45,540,000,000	8,715,125,636
2028	864	45,540,000,000	8,715,125,636
2029	864	45,540,000,000	8,715,125,636
2030	864	45,540,000,000	8,715,125,636

No capital figure appears without its induced recurrent cost. Source: EPRAS run 6b2afcf6 (report/build/data/t_investment.csv).

Figure 10.2 lays the fact that matters over it. Capital is flat; the induced recurrent line is not, rising by 8.7 bn UGX a year to reach 44 bn UGX by 2030 — a permanent addition to the recurrent budget, acquired in five years, from a capital programme closing less than a twentieth of the gap.

**Figure 10.2:** The investment programme and its recurrent tail, and the teacher pipeline year by year

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

10.4 The recurrent cost that travels with every classroom

A classroom without a funded teacher post and a capitation line is a building, not a place. The engine prices that obligation explicitly:

$$\rho = \frac{H}{L}(1 + \alpha)w + m p_c + \kappa \phi c \quad (10.3)$$

where ρ is the induced recurrent cost of one classroom, in UGX per year; H is the periods per week timetabled for a primary class, 40, from the norm line PLACE_PRI_UPPER (MoES LG Planning Guidelines 2022 (MoES 2022), p.23); L is the periods per week one primary teacher teaches, 36, under the class-teacher model, flagged assumed and on the ch.15 review list; α is the absence allowance, 0.05, also assumed; w is the full-year cost of one primary teacher FTE, 7.05 million UGX, from the MoPS salary structure (MoPS 2025) for FY2025/26 at scale midpoint over twelve months plus a 10 per cent employer on-cost; m is the annual maintenance charge as a share of replacement value, 0.02, assumed within the manual's 1.5–3 per cent band; p_c is the classroom price; κ is the class-size norm, 53 pupils; ϕ is an occupancy factor of 0.9 applied to that norm before capitation is charged, which is hard-coded in the engine and carries no source; and c is UPE capitation, 17,000 UGX per learner-year, from the same MoES instructions.

The result is **10.1 million UGX a year for every classroom built** (Table 10.4) — 81.5 per cent of it the teacher, 10.5 per cent maintenance and 8.0 per cent capitation. Two ratios follow, neither intuitive: the induced cost is **19.1 per**

cent of the room's capital cost, every year, and the cumulative recurrent cost overtakes the cost of building it in a little over five years, within the horizon of the plan that builds it.

Figure 10.3 draws that obligation across the country, from 26.6 m to 2,224.3 m UGX a year. It is by construction Figure 10.1 scaled by the constant ratio of p to p_c , and is shown separately because planning practice routinely reports the first map and not the second. The districts carrying the largest capital numbers acquire the largest permanent claims on the wage bill — and those are the districts where the wage bill is already hardest to fill.

Induced recurrent cost of the capital programme

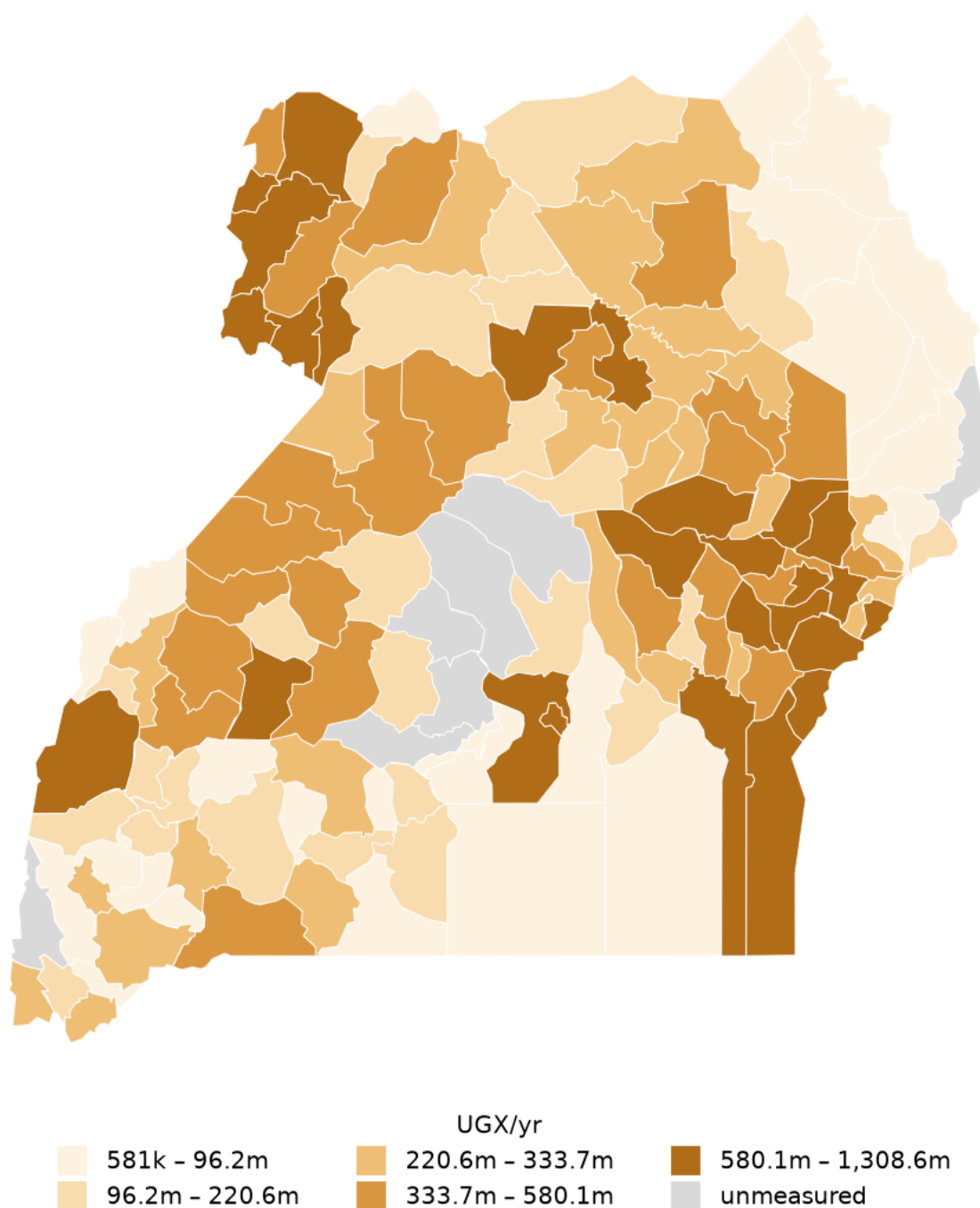


Figure 10.3: Induced recurrent cost of the capital programme, UGX per year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

This is where the complementarity rule does real work, and where this build falls partly short. Teacher and capitation are bundled into every room, so no capital figure is reported without its recurrent tail; but the rule that no place counts as created unless classroom, teacher **and** capitation are funded in the same or an earlier year is not enforced as a gate — capitation enters as a price, not a condition. And the pipeline is solved nationally, so nothing tests whether the teacher who goes with a room built in Kotido in 2028 is one the system could put in Kotido in 2028.

10.5 The teacher pipeline as a state variable

The manual calls the teacher pipeline the constraint that most often makes an education plan fiction. It is modelled here as a state that rolls forward year by year:

$$S_t = S_{t-1} - \delta S_{t-1} + D_t, \quad C_t = C_{t-1} + D_t - \delta S_{t-1} \quad (10.4)$$

$$D_t = \min(Gh, \delta S_{t-1} + \max(N - C_{t-1}, 0)) \quad (10.5)$$

where S is the stock of primary teachers in post at the end of year t , starting from the 158,229 EM-04 counts; δ is annual attrition, 0.03, assumed pending a TMIS extract that is not held; D is teachers deployed in year t ; C is the cumulative net addition since the base year; N is the primary teacher gap from EM-05, 64,914 FTE; G is Grade III graduates entering the market each year, 12,000, **assumed** because college output is not held; and h is the share of those graduates the public payroll absorbs, 0.60, also assumed.

Table 10.2 traces it, and the reading is stark. In every year the system deploys 7,200 teachers — the whole of the assumed graduate supply — and in every year attrition takes back most of it: 4,747 in 2026, rising to 5,028 by 2030 as the stock it applies to grows. Net additions fall from 2,453 in 2026 to 2,107 at the closing stock of 2030 (Table 10.4), and the cumulative net addition after five years of deploying every available graduate is **11,551 teachers, 17.8 per cent of the gap**. The binding constraint recorded in every year is college output and absorption: never the requirement, never money.

Table 10.2: The teacher pipeline as a state variable, and what binds it each year

Year	Stock	Attrition	Graduates Available	Deployed	Cumulative Net	Binding
2026	113,518	3,288	7,200	7,200	3,912	college output / absorption
2027	117,312	3,406	7,200	7,200	7,706	college output / absorption
2028	120,993	3,519	7,200	7,200	11,387	college output / absorption
2029	124,563	3,630	7,200	7,200	14,957	college output / absorption
2030	128,026	3,737	7,200	7,200	18,420	college output / absorption

Source: EPRAS run 6b2afcf6 (report/build/data/t_pipeline.csv).

The right-hand panel of Figure 10.2 shows why this does not improve with time: deployment is flat because supply is flat, attrition rises because the stock rises, and the two converge. The recursion in Equation (10.4) has a fixed point — a system adding $G \cdot h$ teachers a year and losing a fraction δ of its stock converges on $G \cdot h \div \delta$, which on these constants is **240,000 primary teachers**. The stock the requirement implies, 158,229 in post plus a gap of 64,914, is 223,143: inside that ceiling, but approached asymptotically. The 30.8-year figure in Table 10.4 divides the gap by the net addition rate at the end of the horizon and therefore *understates* what the engine's own recursion would take, which on the same constants runs closer to five decades than three.

Two ceilings, not four. The manual requires four independent ceilings: college capacity, training lag, payroll headroom, and deployment and absorption. This build represents college capacity and absorption, collapsed into the single product $G \cdot h$ under one binding label. Training lag is not modelled, so a cohort enrolled in 2026 is not held back until it certifies and the first years are optimistic by the length of the certificate. Payroll headroom is not modelled either, because the establishment ceiling is not held; EM-04 derives a payroll teacher count of 137,247 from the wage bill, 20,982 *below* the in-post count — a finding about payroll this chapter cannot resolve and does

not use as a constraint. Take-up in hard-to-reach districts, the ceiling the manual says is always omitted and always bites, is not modelled at all, though in Karamoja and the north it is likely the one that governs. Nor is college expansion a decision variable, so the plan stays capped by a college system sized for the last decade's enrolment.

10.6 Siting: the maximal-covering solve

National access within 3 km is 94.6 per cent; the complement is the 726,951 children for whom new schools, not expansion, are the only answer. New schools are for *access*, not capacity, and where to put them is a facility-location problem. The engine takes the eight districts with most children beyond the norm and solves a maximal-covering problem in each:

$$\max \sum_i y_i \quad \text{subject to} \quad \sum_j x_j \leq n_d \quad (10.6)$$

$$y_i \leq \sum_{j \in N(i)} x_j, \quad |N(j)|x_j \geq c_{\min} x_j, \quad x_j \in \{0, 1\}, \quad 0 \leq y_i \leq 1 \quad (10.7)$$

where i indexes settlement points whose nearest existing school is more than 3 km away; j indexes candidate sites, which in this build are the same points; y is 1 when settlement i ends up within the norm of an opened site; x is 1 when a site opens at candidate j ; $N(i)$ is the set of candidates within 3 km of i ; $|N(j)|$ is the number of settlements within 3 km of j ; $c_{\min}$ is the minimum catchment, 3 settlements; and n_d is the district's site budget, one site per 40 uncovered settlements, capped at 5.

The objective is a **count of settlements, not of children**. The manual requires the school-age population of each cell as the weight; that population is missing for 98 per cent of the OSM points, so the weight is set to 1 throughout and a large village and a hamlet count the same. This is recorded in the run's data-quality register as SRC_ACCESS_EUCLID and is the most important qualification on the results.

The problem is solved with HiGHS at a relative MIP gap of 0.005 under a 600-second time limit, both run pins — a different gap or limit is a different run. Where the solver returns no usable incumbent the engine falls back to a greedy repair on the relaxation, repeatedly taking the candidate covering the most not-yet-covered settlements, and **writes the method into every row it produces**, so a worse answer is visible as one rather than as a silently skipped district. In this run the fallback was not needed: every row of Table 10.3 records the MILP solved to optimality at the stated gap.

The solve returned 26 sites across the eight districts; Table 10.3 lists the first twenty and Figure 10.4 plots them over the access gap. They fall into three geographies: the central belt west of Kampala, where Wakiso and Mubende settlements have outgrown a school network laid down for a smaller population; the pastoral north and north-east, where Amudat, Napak, Kotido and Nwoya settlements are simply far apart; and Isingiro in the south-west, where refugee-hosting settlement has moved faster than the network. The twenty listed sites carry coverage counts summing to 187 settlement points; because the coverage sets of nearby sites can overlap, that is an upper bound on the distinct settlements brought within the norm rather than a count of them.

Proposed new school sites (maximal covering)

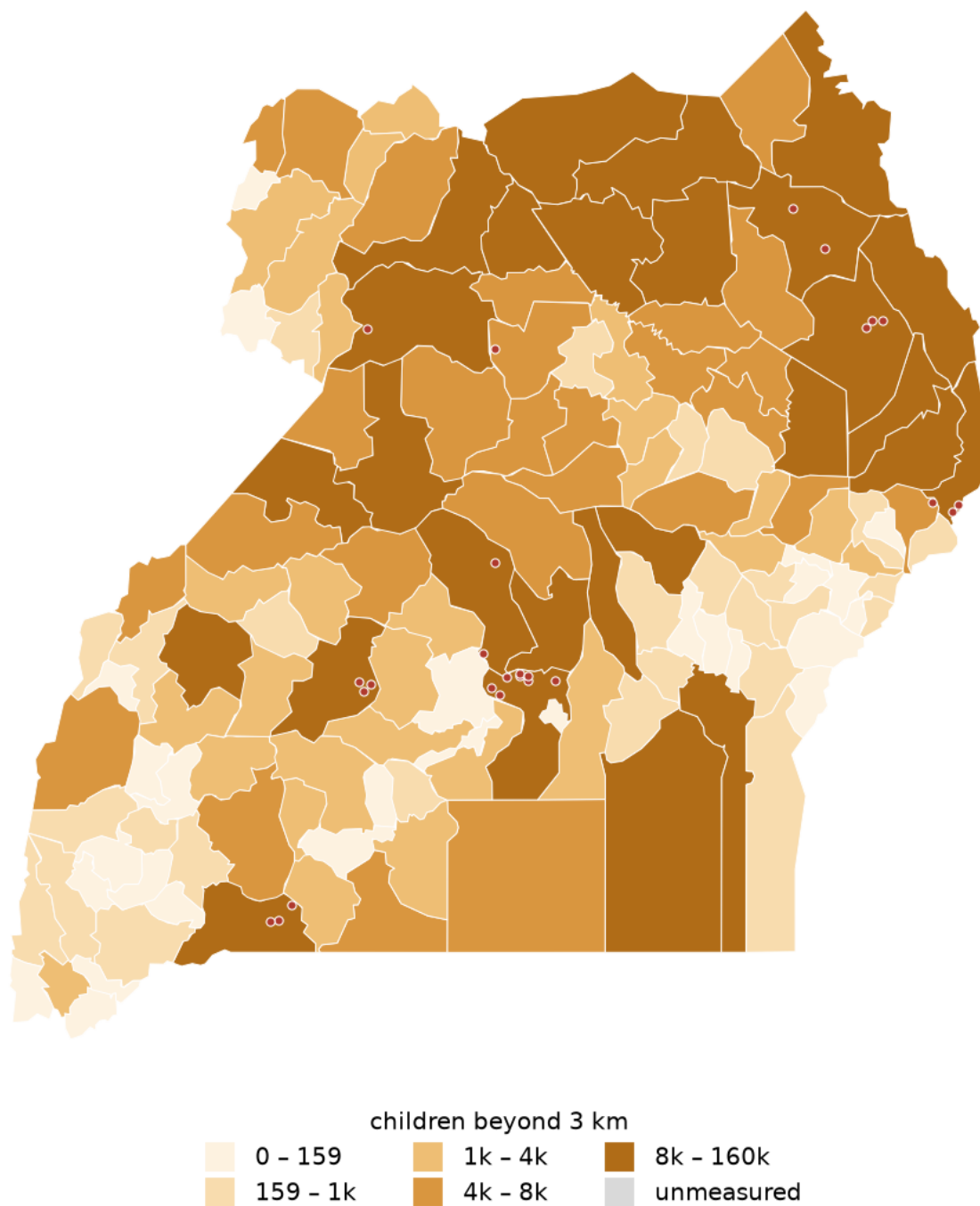


Figure 10.4: Proposed new school sites over the access gap

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Table 10.3: Proposed new school sites from the maximal-covering solve (the first 20 of 26 rows)

District ID	Site Settlement ID	Site Name	Lat	Lon	Settlements Covered	Method	Provenance
Wakiso	25001	Naggamba	0.5 12	32. 595	15	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)

District ID	Site Settlement ID	Site Name	Lat	Lon	Settlements Covered	Method	Provenance
Wakiso	25154	Lulagala	0.51	32.447	12	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Wakiso	26134	Kitayita	0.473	32.247	11	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Wakiso	26148	Nsanvu Kagoma	0.434	32.293	13	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Wakiso	26165	Kasambya	0.537	32.398	12	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Mubende	4841	Kitovu	0.45	31.533	9	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Mubende	37175	Kyenda	0.501	31.51	7	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Mubende	37282	Kyakatule	0.488	31.576	9	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Amudat	5269	Lokales	1.45	34.8	7	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Amudat	35623	Kaptenis	1.501	34.69	7	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Amudat	42515	Morwo	1.485	34.832	5	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Napak	67743	Lotaba	2.511	34.356	11	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Napak	67785	Loparipari	2.507	34.412	11	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Napak	67837	Kaluku	2.471	34.322	12	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Nwoya	3393	Got-Apwoyo	2.463	31.557	3	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Nwoya	47862	Coo-rom	2.354	32.261	5	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Kotido	36545	Nasiriamoru	3.132	33.912	5	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Kotido	36677	Naadoi	2.908	34.092	6	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Isingiro	27920	Keitagura	-0.821	31.064	14	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)
Isingiro	27936	Kakiika	-0.825	31.019	13	maximal covering MILP, Euclidean 3.0 km, unweighted settlements, gap $\leq$ 0.005 (exact)	candidate = OSM settlement beyond walking norm (land not verified)

Candidates are settlements beyond the walking norm; land is not verified. Source: EPRAS run 6b2afcf6 (report/build/data/t_siting.csv).

What a candidate site is, and what it is not. Every row of Table 10.3 carries the provenance string *candidate = OSM settlement beyond walking norm (land not verified)*. The manual's order of preference is ministry-identified sites with land secured, then existing lower-cycle schools, then settlement centroids above a population threshold. This build has only the third, and without the threshold, because land tenure is not held in any source available to the run. **These coordinates are a shortlist for a land search, not a construction schedule** — and the engine's contribution is to say so in the output row rather than a footnote.

Three further limits are structural. Distance is **Euclidean**, not travel time on a friction surface, so a settlement 2.8 km away across a swamp counts as covered. The candidate set is drawn from a bounding box around the district's school points rather than the district polygon, so cross-border catchment coverage is not attributed district by district as the manual requires, and border districts remain at risk of being over-built. And the engine does **not** test the spacing rule — no new school within the minimum spacing of an existing under-capacity school without a recorded override — the check that prevents the most expensive siting failure there is. Siting runs in only eight of 135 districts, so Table 10.3 illustrates the method rather than constituting a national programme.

10.7 The central finding: delivery capacity binds before money does

$$Y_{\text{rooms}} = \frac{N_c}{T} \quad , \quad Y_{\text{teachers}} = \frac{N_t}{Gh - \delta S_{2030}} \quad (10.8)$$

where N_c is the primary classroom gap, 90,144 rooms; T is throughput, 864 rooms a year; N_t is the primary teacher gap, 64,914 FTE; and the second denominator is net teacher additions per year at the end of the horizon, 2,107. The results are 104 years and 30.8 years.

Table 10.4: Feasibility: how long the gaps take to close at the delivery rates observed

Item	Value	Basis
classroom need (PRI)	47,658	EM-05
construction throughput per year	864	60% LG primary dev grant FY2025/26 / CMU price
years to close classroom gap	55.2	derived
teacher need (PRI FTE)	49,841	EM-05
net teacher additions per year	3,359	assumed college output × public share – attrition
years to close teacher gap	14.8	derived
induced recurrent per classroom (UGX/yr)	10,087,577	EM-06 norms

This is the finding that money is not the first constraint. Source: EPRAS run 6b2afcf6 (report/build/data/t_feasibility.csv).

What these numbers mean. They are the ratio of a stock to a flow: the gap divided by the current annual delivery rate, holding both constant. They say that if Uganda goes on financing primary classroom construction out of the local government development grant at the FY2025/26 level, and goes on recruiting from a college system producing 12,000 Grade III graduates a year of whom the payroll absorbs 60 per cent, the gaps as measured today do not close within any horizon a government plans over.

What they do not mean. They are not a forecast. A forecast would carry the growth of the requirement — and it is growing, because EM-01 projects the school-age population upward, so the gap widens at a constant delivery rate, which makes 104 years optimistic. It would carry the construction this build cannot see — central government, partner-financed and community — which makes 104 years pessimistic by an unknown amount. It would carry price change, attrition that responds to conditions and college output that responds to policy. It does none of these. The gaps in the numerators are themselves imputed, projected from the 2017 district EMIS, the last one Uganda publishes.

They are an indictment of the delivery rate, not a prediction of the future. The correct reading of a 104-year figure is not "the gap will close in 2130"; it is that *the rate is wrong by orders of magnitude, and no amount of care in allocating it will fix that*. EM-06 says closing the gaps costs 5.98 tn UGX. EM-07 says the binding constraint is not the 5.98 tn — it is that the system in its present configuration absorbs about 46 bn UGX a year of classroom construction and about 7,200 teachers a year, and that raising the money without raising those two numbers produces unspent development budgets and vacant posts, the pattern the sector already has.

The corollary matters as much. **If delivery capacity binds first, the interventions with the highest return are the ones that raise it** — framework and community contracting, prefabrication, expanded college intake, and a posting-and-take-up system that works in hard-to-reach districts. Each is, in the manual's terms, a modelled intervention with its own cost and lead time rather than an assumption, and this build models none of them: the largest distance between what EM-07 specifies and what it does.

10.8 Data quality and limits

On the tiers *measured < normed < imputed < assumed*: the classroom price, the teacher salary cost, the capitation rate and the development grant are **measured**, from the MoES Planning and Budgeting Instructions 2022, the MoPS salary structure and the MoFPED approved budget (MoFPED 2025). The class-size and timetable norms are **normed**, from the MoES LG Planning Guidelines 2022, under a norm version still draft — gate G9 is waived because the ch.15 review has not been held. The gaps that drive everything now rest on **counted** supply — the Baseline Education Census 2025 (UBOS 2026) enumerated the schools, teachers and classrooms this module is trying to add to — but the requirement they are differenced against is still a projection, rolled one year forward from the census on flow rates carried from 2017. Every row the module writes therefore carries the tier *imputed*, and nothing here is an observation of 2026.

Four inputs are **assumed** outright, and the findings are sensitive to all four: the 60 per cent classroom share of the development grant, the 12,000 annual graduates, the 60 per cent public absorption share and the 3 per cent attrition rate. None has a document behind it. A reader who believes national classroom delivery is three times what this grant finances should divide the 104 by three. That does not change the order of magnitude, and the order of magnitude is the finding.

The structural limits, stated where they arise, are collected here. Only the construction and teacher-supply streams are modelled, and only primary classrooms. Throughput is calibrated from a budget line rather than classrooms delivered, and is national rather than per district. The pipeline carries two ceilings rather than four, omitting training lag, payroll headroom and take-up, and college expansion is not a decision variable. Siting is Euclidean on unweighted settlement points, runs in eight districts, proposes candidates whose land tenure is unverified, does not attribute cross-border coverage, and does not test the spacing rule against under-capacity schools. Capitation is priced into every room but is not a gating condition in the complementarity test.

10.9 Implications for planning

Plan the rate, not only the total. The operative numbers here are not the 90,144 classrooms and the 64,914 teachers — EM-05 and EM-06 reported those. They are 864 and 7,200. A sector plan that sets a five-year target for classrooms and teachers without also setting one for *throughput and college output*, backed by a costed intervention, is committing to the 104 years. The first question at the next plan review should be what the classroom completion series actually is — it exists in no source this engine can read — and the second what doubling it costs.

Budget the tail before budgeting the head. Every classroom carries 10.1 million UGX a year, 19.1 per cent of its own capital cost, for as long as it stands, four-fifths of it a teacher's salary. Five years of this programme adds 44 bn UGX a year to the permanent recurrent bill while closing under five per cent of the gap; closing the gap in a generation would scale that tail proportionally. The wage-bill arithmetic in EM-04, where the payroll-derived

teacher count sits 20,982 below the in-post count, suggests the recurrent side is already under strain, and the check of the induced recurrent path against the indicative envelope should be run with the finance ministry before any acceleration is announced.

Treat construction and recruitment as one decision, district by district. Of Uganda's 135 districts, 104 are classroom-bound and 31 teacher-bound, so in every district one of the two binds and neither can be planned alone. Building where the teacher cannot be deployed, and deploying where there is no room, are the two ways to spend money and create no places, and the present build — national pipeline, national throughput — sees neither. A district-resolved pipeline with a take-up rate estimated from posting records is the highest-value addition available to this engine, and it needs a TMIS extract that already exists inside government.

Use the siting output as a land-search instruction. Table 10.3 is a reproducible shortlist of twenty-six places where the settlement pattern says a school is missing, not a construction programme. The next step is administrative: send the coordinates to the district land offices, record what is available, and feed verified sites back as the first-preference candidate class.

Keep the feasible set and the affordable set apart. EM-07 stops before the budget: Table 10.1 is what is deliverable at the rates observed, and EM-08 rations against the envelope. The difference is the financing gap, meaningful only because the deliverable set was computed first. On this run the more uncomfortable comparison is not between the affordable and the needed but between the *deliverable* and the needed — a question for the delivery system, the contracting regime and the colleges, not for the Ministry of Finance.

CHAPTER 11

11 EM-08 The envelope, the scenarios and the optimiser

Every chapter up to this one has answered a question about need, and none of those answers depended on what Uganda can afford. That order is the discipline that keeps a plan from being written backwards from a ceiling. Money enters here, and only here. This chapter splits the budget envelope into the part already spoken for and the part that is not, applies six named allocation rules and two optimiser objectives to the latter, reports what each option buys on one set of metrics, and reports the difference between what the plan funds and what the requirement costs — the financing gap — by district, dimension and year.

The chapter does not endorse an allocation. An allocation rule encodes a judgement about whose children are served first, and that judgement belongs to the ministry and the Cabinet, not to a solver. What the engine owes is a comparison in which every option is costed on the same basis, its consequences for the wage bill and the recurrent tail shown beside its headline gains, and the rules producing nothing shown producing nothing. **The comparison is the product.**

11.1 The envelope, and why it is decomposed first

The envelope is exogenous to EM-08. In the engine's intended design it comes from the fiscal framework of Chapter 13; in this run that interface is a stub, and the envelope is built from the FY2025/26 approved local government education grants — the two wage bills, the two non-wage recurrent grants and the primary development grant — grown at an assumed constant real rate. It decomposes before a shilling is allocated:

$$E_t = C_t + D_t, \quad C_t = W_t + K_t, \quad D_t = E_t - C_t \quad (11.1)$$

where E is the total education envelope in year t in constant 2026 UGX; C is the committed portion, the obligations existing before any decision is taken; W is the existing wage bill, the payroll of teachers already employed; K is capitation for learners already in the public system; and D is the discretionary portion, the only money an allocation can move. The two components are projected separately:

$$E_t = E_0(1 + g)^{t-t_0}, \quad C_t = C_0(1 + \delta)^{t-t_0} \quad (11.2)$$

with E_0 and C_0 the base-year envelope and commitment, t_0 the base year 2026, g the assumed real growth of the envelope, set to 5 per cent, and δ the drift in committed spending, set to 1 per cent, representing capitation growing with enrolment and the replacement of teachers lost to attrition. Both rates are assumed. The module's first gate tests Equation (11.1): if committed spending exceeds the envelope in any year, the run stops and reports a financing crisis.

Table 11.1: The envelope, decomposed before any allocation is computed

Year	Total	Committed	Discretionary	Source
2026	2,441,945,100,000	2,366,045,100,000	75,900,000,000	FY2025/26 approved LG education grants x (1+0.05) ^t — FINEX stub, assumed
2027	2,564,042,355,000	2,389,705,551,000	174,336,804,000	FY2025/26 approved LG education grants x (1+0.05) ^t — FINEX stub, assumed
2028	2,692,244,472,750	2,413,602,606,510	278,641,866,240	FY2025/26 approved LG education grants x (1+0.05) ^t — FINEX stub, assumed
2029	2,826,856,696,388	2,437,738,632,575	389,118,063,812	FY2025/26 approved LG education grants x (1+0.05) ^t — FINEX stub, assumed

Year	Total	Committed	Discretionary	Source
2030	2,968,199,531,207	2,462,116,018,901	506,083,512,306	FY2025/26 approved LG education grants x (1+0.05) ^t — FINEX stub, assumed

Committed is the existing wage bill and capitation; only the discretionary space can be allocated. Source: EPRAS run 6b2afcf6 (report/build/data/t_envelope.csv).

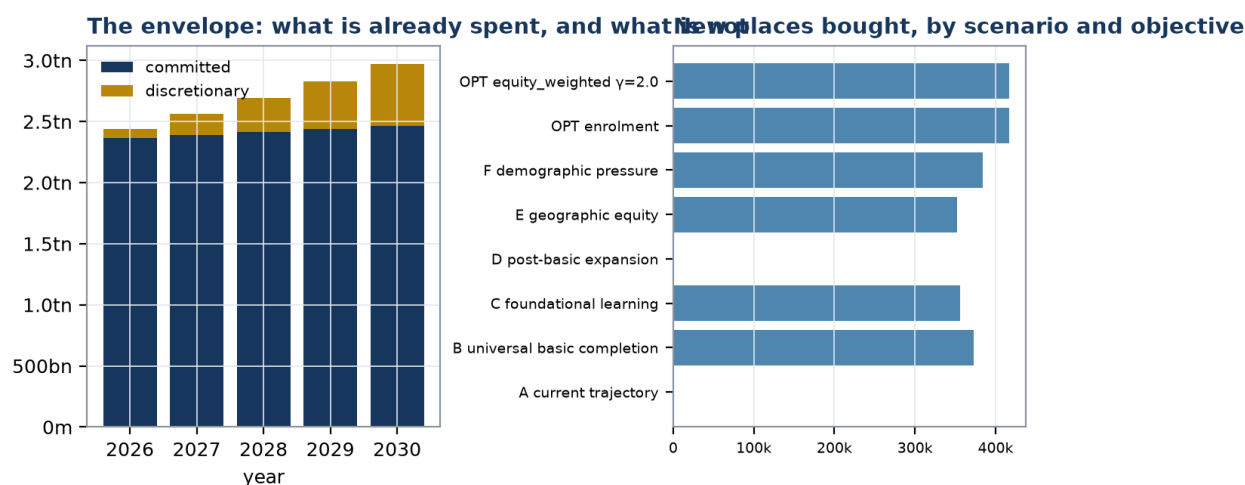


Figure 11.1: ch envelope

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 11.1 and the left panel of Figure 11.1 carry the finding that reframes every other question in the chapter. The FY2025/26 envelope is 2,441.9 bn UGX. Of that, 2,366.0 bn is committed — the two wage bills and the two non-wage recurrent grants — leaving 75.9 bn discretionary. The discretionary share of the base-year envelope is **3.1 per cent**.

That number deserves to be read slowly. Closing the measured gaps costs 5,978.8 bn UGX, from Chapter 9, and a planner setting that against a 2,441.9 bn envelope might conclude the problem is one of reprioritising within a large budget. It is not: what can be reprioritised in the base year is 75.9 bn, a little over one per cent of the cost of closing the gaps.

The discretionary space widens across the horizon, from 75.9 bn in 2026 to 506.1 bn in 2030, cumulating to 1,424.1 bn UGX. That widening is entirely an artefact of the two assumed rates: an envelope compounding at 5 per cent against commitments compounding at 1 per cent opens a wedge, and the wedge is the discretionary space. If envelope growth were lower, or the wage bill grew faster than 1 per cent — as it does whenever government raises the teaching scale — the wedge would close. **The cumulative figure of 1,424.1 bn is the most assumption-sensitive number in this report**, and everything the allocation buys is bought out of it. Recurrent commitments compound too, which Equation (11.2) understates: the engine prices a hire's multi-year cost and reports the recurrent tail each option leaves after 2030, but does not feed that tail back into the committed line, so the series in Table 11.1 is the commitment inherited, not the one the plan creates.

11.2 The six rule-based scenarios

Six named scenarios are computed for every run. They are not optimisations: each is a policy applied mechanically, so a planner can see what an intention produces before any solver is involved. All six spend the same cumulative discretionary budget on the same two instruments — teachers recruited and classrooms built — in the primary cycle, where the district gaps are measured. What distinguishes them is the order in which districts are served and, for one, whether rooms or teachers come first; each works down its priority list until money, the teacher pipeline or construction throughput runs out.

A, current trajectory, funds the existing system and grows it with enrolment, targeting no new input; it is the counterfactual the others are read against. **B, universal basic completion**, orders districts by out-of-school children descending and buys classrooms first, on the logic that a child with nowhere to sit cannot be enrolled. **C, foundational learning**, orders districts by the absolute shortfall of teacher-supported places and splits spending between hiring and building, treating an unstaffed classroom as no classroom at all. **D, post-basic expansion**, directs the money to secondary, on the argument that primary output already exceeds secondary intake capacity. **E, geographic equity**, orders districts by the *relative* place gap, so a small district missing most of its places outranks a large one missing a tenth. **F, demographic pressure**, orders districts by the growth of projected enrolment, funding where the cohort is arriving rather than where the shortfall stands; it is the least intuitive rule and, on this run, the most productive.

11.3 The comparison

Table 11.2: The six rule-based scenarios and the optimiser objectives, side by side

Scenario	New Places	Teachers Hired	Classrooms Built	Districts At Norm	Place Gap Remaining	Cv Place Gap	Wage Increment Final Year	Capital Total	Recurrent Tail After Horizon	Solve	Binding Constraints
A current trajectory	0	0	0	22	2,285,454	0.674	0	0	0	rule-based	
B universal basic completion	372,809	36,000	4,320	31	1,912,645	0.764	253,721,160,000	227,700,000,000	258,275,160,000	rule-based	
C foundational learning	356,321	36,000	4,320	24	1,929,133	0.709	253,721,160,000	227,700,000,000	258,275,160,000	rule-based	
D post-basic expansion	0	0	0	22	2,285,454	0.674	0	0	0	rule-based	
E geographic equity	351,804	36,000	4,320	27	1,933,650	0.709	253,721,160,000	227,700,000,000	258,275,160,000	rule-based	
F demographic pressure	384,348	36,000	4,320	42	1,901,106	0.902	253,721,160,000	227,700,000,000	258,275,160,000	rule-based	
OPT enrolment	416,902	9,006	4,320	31	1,868,552	0.752	63,471,390,680	227,700,000,000	68,025,390,680	OPTIMAL — exact (LP, continuous decisions)	construction throughput
OPT equity_weighted $\gamma=2.0$	416,902	8,899	4,320	33	1,868,552	0.774	62,719,528,741	227,700,000,000	67,273,528,741	OPTIMAL — exact (LP, continuous decisions)	construction throughput

No scenario is marked recommended: the comparison is the product. Source: EPRAS run 6b2afcf6 (report/build/data/t_scenarios.csv).

The scenarios side by side — none is recommended

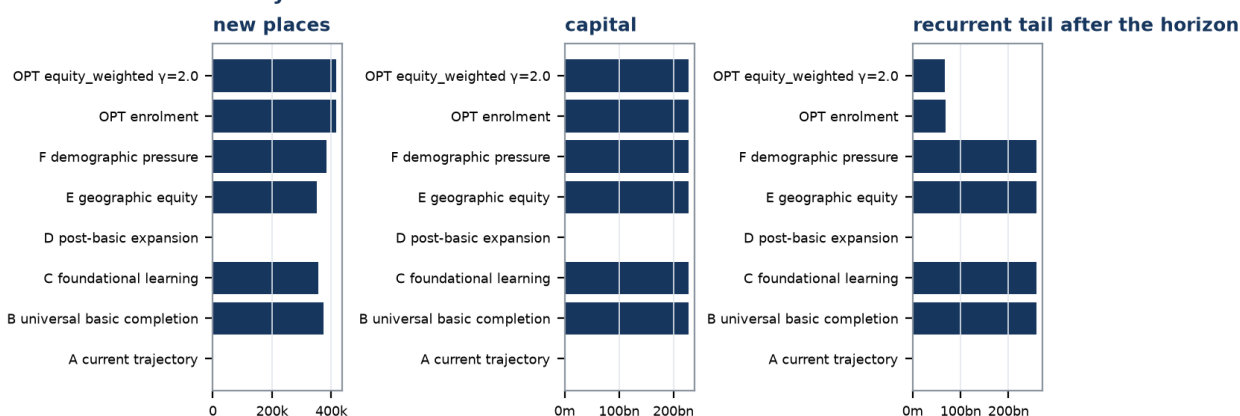


Figure 11.2: ch scenarios

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 11.2 is the module's principal output and Figure 11.2 is the same table drawn. Every row is evaluated on identical metrics, from new places and districts reaching the place norm to the coefficient of variation of the place gap, the final-year wage increment and the recurrent tail. There is no ranking column and no score.

Read across the four rule-based scenarios that spend — B, C, E and F — and their input totals are identical. Each recruits 36,000 teachers and builds 4,320 classrooms, so each carries the same capital total of 227.7 bn UGX, the

same final-year wage increment of 253.7 bn and the same recurrent tail of 258.3 bn. That is not coincidence: both sit at their ceilings. 36,000 is five years of the teacher pipeline at 7,200 publicly absorbable graduates a year, and 4,320 is five years of national construction throughput, calibrated in Chapter 10 from what the development grant buys at the classroom price of 52.7 m UGX a room. The four rules differ only in *where* those teachers and rooms go, and that alone moves new places from 309,855 under B to 419,177 under F — a third more children seated for the same money and the same delivery. Placement, not quantity, is what the rule decides.

The trade-offs do not run in one direction. F creates the most places of the six and brings the most districts to the place norm, 24 against nine in the base case, but leaves the widest dispersion of the remaining gap, 0.66 against 0.52. B creates the fewest of the four that spend, because buying rooms before teachers in the districts with the most out-of-school children sends money to large, already-staffed districts — Wakiso and Kampala take its two largest allocations — where a room adds a place only if a teacher is free to stand in it. C concentrates most narrowly: Arua alone takes 206,051 of its 333,344 new places, which is what ordering by absolute teacher shortfall produces when one district dwarfs the rest. E spreads across fifteen districts and holds dispersion at 0.57, below F, but buys about 88,000 fewer places — roughly 21 per cent fewer for a 0.09 reduction in dispersion, the equity–efficiency trade-off in units a minister can weigh.

One feature should not be smoothed over: every scenario that spends *raises* the coefficient of variation above the base case, including the equity scenario, because concentrating a very small budget closes a few districts' gaps and leaves everyone else's untouched. With 3.1 per cent of an envelope, targeting is unequal treatment by construction — a fact about the envelope, not about the rule.

Two rows buy nothing, and that is a finding about the rule. Scenarios A and D both create zero new places, leave the 2030 place gap at 3,815,601 and bring the same nine districts to the norm as the base case. Neither is a failed run. Scenario A targets no input by construction: it directs the money into the existing system in proportion to what that system already spends, and a proportional top-up creates no place, because places are created by rooms and teachers and A commissions neither. The zero is the answer to the question A asks. Scenario D's zero is different. D spends on secondary, and the metrics are measured on the primary cycle; at the transition rates carried from Chapter 6, teacher-supported secondary places already exceed the public secondary requirement, so money spent there relieves no binding constraint and creates no primary place. D is therefore not a spending rule but a transition policy: it needs a change to the progression assumptions in EM-03, not a larger share of the envelope. A model reporting D as "underperforming" would hide that distinction.

11.4 The optimiser

For a planner who wants a stated objective rather than a named rule, the module builds a mathematical programme over the same two instruments. Its decision variables are, for each of the 135 districts, teachers recruited, classrooms built and new places delivered, all continuous and cumulative. The objective is a weighted sum of new places:

$$\max \sum_{d=1}^N w_d p_d \quad (11.3)$$

where p is new places delivered in district d , N is the number of districts and w the district weight. Two objectives are solved for every run, and both reported:

$$w_d = 1 \quad (\text{enrolment}), \quad w_d = \left(\frac{R_d - b_d}{\max(R_d, 1)} \right)^\gamma \quad (\text{equity}) \quad (11.4)$$

where R is the district's 2030 requirement for public primary places, b is what its existing rooms and teachers already deliver — so the ratio is the relative place gap — and γ is the equity aversion exponent, fixed at 2. Under the first objective a place is a place wherever created; under the second, a place in a district missing four-fifths of its requirement counts nearly twice one in a district missing three-fifths.

Four constraints bind the programme. The budget applies to the discretionary envelope only:

$$\sum_d h_d \pi_h \frac{T}{2} + \sum_d c_d \pi_c \leq B \quad (11.5)$$

where h is teachers recruited in district d , c is classrooms built, π_h is the annual cost of a teacher at 7.0 m UGX inclusive of employer on-costs, π_c is the capital cost of a classroom at 52.7 m UGX, T is the number of years in the horizon and B is the cumulative discretionary envelope of 1,424.1 bn UGX. The factor $T/2$ charges a hire the average salary years it consumes within the horizon. Second, the teacher pipeline:

$$\sum_d h_d \leq G \sigma T \quad (11.6)$$

with G the annual output of Grade III teacher-training graduates, assumed at 12,000, and σ the share the public payroll can absorb, assumed at 0.6 — the 7,200 a year of Chapter 10's pipeline table, and a five-year ceiling of 36,000. The third is construction throughput:

$$\sum_d c_d \leq \Theta T \quad (11.7)$$

with Θ the national classrooms-per-year delivery rate, calibrated from the share of the primary development grant spent on classrooms divided by the classroom price, giving the ceiling of 4,320 rooms. The fourth caps delivery at need, so the optimiser cannot bank places a district does not require:

$$p_d \leq R_d - b_d \quad (11.8)$$

11.4.1 The complementarity that makes a place a place

The constraint carrying the education content is the pair tying places to both inputs at once:

$$p_d \leq r_d + \kappa_r c_d - b_d, \quad p_d \leq q_d + \kappa_t h_d - b_d \quad (11.9)$$

where r is the places the district's existing classrooms can host, q the places its existing teachers can staff, and the coefficients convert an input into places:

$$\kappa_r = s u, \quad \kappa_t = \frac{L}{P(1+a)} s \quad (11.10)$$

with s the normed upper-primary class size of 53, u the classroom utilisation target of 0.90, L the periods a primary teacher actually teaches each week, P the periods in the timetable week and a the absence allowance: the first gives the places a new room can hold, the second the places a new teacher can staff.

Because delivery is the *minimum* of the two, a room built where teachers bind buys nothing, and a teacher hired where rooms bind buys nothing. Chapter 8 found 104 districts room-bound and 31 teacher-bound, and Equation (11.9) is what makes that finding bite: it is why B converts less of its spending into places than F , which reaches districts where the missing input is the one bought.

11.4.2 What the solver did

Both objectives are solved with HiGHS through JuMP under the run's solver pins: a relative gap tolerance of 0.005 and a time limit of 600 seconds. Both terminated with the status *OPTIMAL*, and the solve method travels with the row in Table 11.2 as *exact (LP, continuous decisions)*, so no reader need guess whether it was solved or rounded.

Both deliver 464,027 new places, the largest figure in the comparison and about 12.2 per cent of the 2030 place gap, using 4,320 classrooms — throughput is the reported binding constraint for both — and far fewer teachers than the rules: 7,286 under the enrolment objective and 9,594 under the equity-weighted one, against 36,000 under B, C, E and F. The optimiser does not exhaust the pipeline because Equation (11.9) tells it not to: it hires only where teachers bind, whereas the rules hire to the ceiling because they never ask which input binds. That is why the last two columns of Table 11.2 are not optional. The enrolment objective leaves a final-year wage increment of 51.3 bn UGX and a recurrent tail of 55.9 bn, roughly a fifth of the 253.7 bn and 258.3 bn each spending rule commits the Treasury to paying every year after 2030.

The two objectives are not interchangeable despite the identical place count. The equity-weighted solve brings 24 districts to the place norm against 21, and sends its largest allocation to Maracha, 113,392 places, where the enrolment objective sends its largest to Arua, 109,435. It pays with 2,308 more teachers and a recurrent tail 16.3 bn UGX a year higher. The same number of places, different children, a different bill in perpetuity; choosing between them is a political act, and the engine presents both and stops.

11.5 Infeasibility as a finding

A model that cannot be solved has told the planner something, and the module is built to say what. On infeasibility it walks a relaxation ladder in a fixed order — construction throughput, then the teacher pipeline, then the discretionary budget — re-solving after each rung and reporting the first relaxation that admits a solution. The result is not a plan but a sentence of the form "infeasible until construction throughput was relaxed", and the rung named is the binding physical reality.

The order is deliberate: throughput first, because it is the constraint a ministry can most plausibly move within a plan period; the pipeline next, because college expansion has a lead time in years; the budget last, because relaxing it is not a plan but a request to the Ministry of Finance. If no rung restores feasibility, the module returns an empty allocation rather than a silently relaxed solution.

Neither objective was infeasible here, so the ladder was not walked. The solved runs instead report the binding constraint at the optimum — construction throughput, for both — which carries the same message one rung earlier: what stands between the envelope and more places is not, on this run, money or teachers. It is how many classrooms Uganda can build in a year.

11.6 The financing gap

The financing gap is the difference between the unconstrained requirement and what the plan funds. It is reported wherever the plan is, because a plan shown without it invites the reader to mistake the affordable for the sufficient.

$$F = \sum_d \sum_k (N_{d,k} - A_{d,k}), \quad F_{d,k,t} = \frac{N_{d,k} - A_{d,k}}{T} \quad (11.11)$$

where N is the unconstrained cost of closing district d 's measured gap in dimension k , carried from Chapter 9 as capital plus one year of induced recurrent cost; A is what the chosen scenario funds in that district and dimension, at the same prices; F is the national gap; and the per-year quantity spreads both sides evenly across the T years, since the allocation is cumulative and EM-07 holds the phasing.

Table 11.3: The financing gap: the requirement against the discretionary envelope

Item	Value
cost to close measured gaps (capital + 1 yr recurrent)	4,182,413,936,295
cumulative discretionary envelope 2026-2030	1,424,080,246,358
financing gap	2,758,333,689,937

Source: EPRAS run 6b2afcf6 (report/build/data/t_financing_gap.csv).

The national arithmetic is stark. Against a requirement of 5,978.8 bn UGX and a cumulative discretionary envelope of 1,424.1 bn, the financing gap is 4,554.7 bn UGX, or 76.2 per cent of the requirement: five years of every discretionary shilling in the local government education grants, spent perfectly, covers under a quarter of the cost of the gaps this report measures.

Table 11.4: The financing gap by dimension and year

Dimension	Year	Requirement	Funded	Gap
material	2026	89,593,485,537	0	89,593,485,537
material	2027	89,593,485,537	0	89,593,485,537
material	2028	89,593,485,537	0	89,593,485,537
material	2029	89,593,485,537	0	89,593,485,537
material	2030	89,593,485,537	0	89,593,485,537
place	2026	616,108,297,394	0	616,108,297,394
place	2027	616,108,297,394	0	616,108,297,394
place	2028	616,108,297,394	0	616,108,297,394
place	2029	616,108,297,394	0	616,108,297,394
place	2030	616,108,297,394	0	616,108,297,394
teacher	2026	130,781,004,328	0	130,781,004,328
teacher	2027	130,781,004,328	0	130,781,004,328
teacher	2028	130,781,004,328	0	130,781,004,328
teacher	2029	130,781,004,328	0	130,781,004,328
teacher	2030	130,781,004,328	0	130,781,004,328

Source: EPRAS run 6b2afcf6 (report/build/data/t_financing_gap_dimension.csv).

Table 11.4 breaks the gap down by dimension and year. Of the 1,195.8 bn UGX a year the requirement implies, 950.3 bn is the place dimension, with 127.3 bn for materials and 118.1 bn for teachers. Nearly four-fifths of the unfunded requirement is construction and the recurrent obligations following it, consistent with Chapter 8's finding that most districts are room-bound and with the optimiser's report that throughput binds.

Financing gap per year

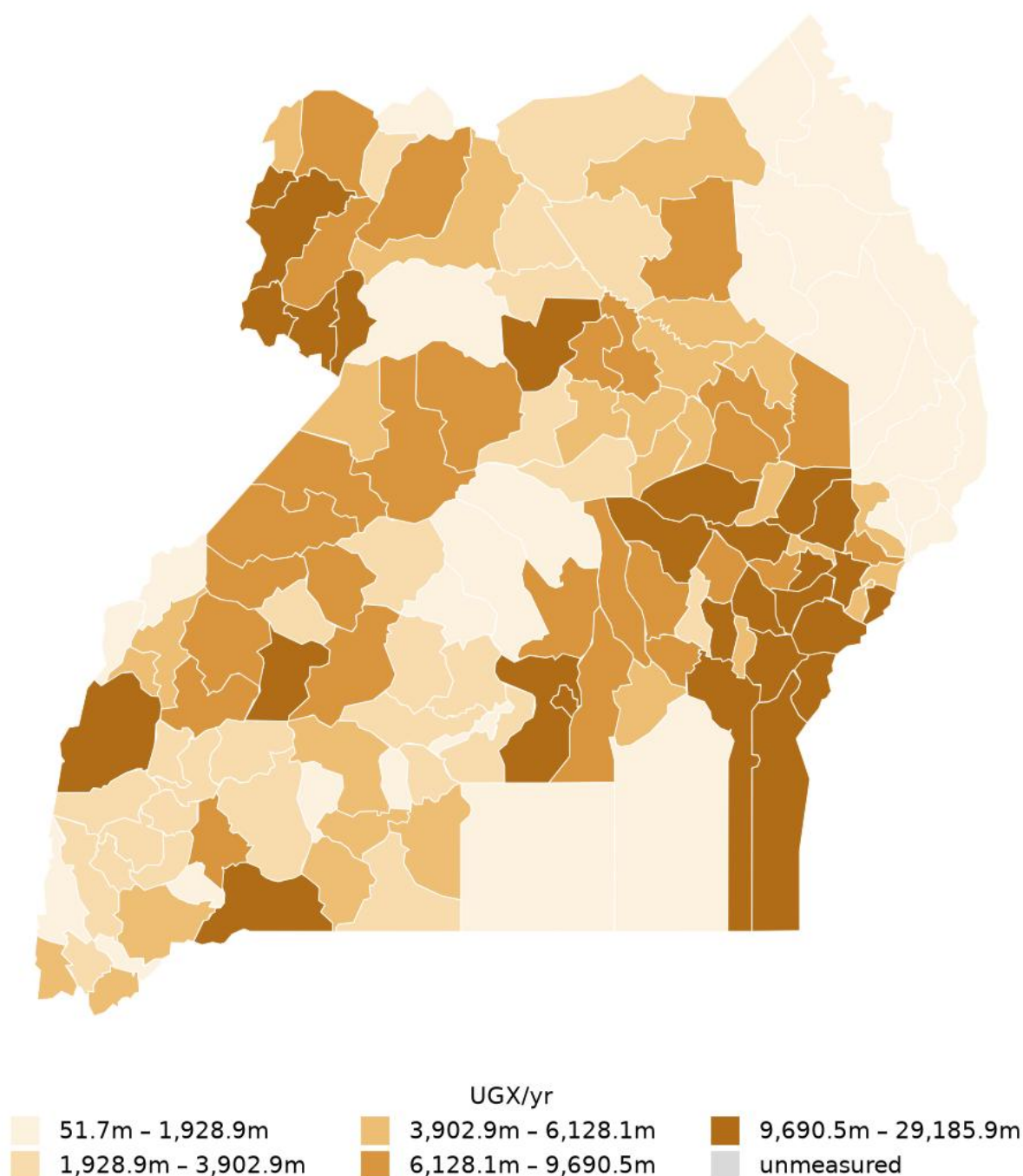


Figure 11.3: Financing gap per year (UGX/yr), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 11.3 puts the same quantity on the ground for the first year of the horizon, and it is not evenly spread. The heaviest band, running to just under 64 bn UGX a year in a single district, is concentrated in West Nile — Arua, Maracha, Nebbi, Yumbe, Koboko and Zombo — with a second cluster in the east around Tororo and Butaleja, a third in Karamoja, and outliers in Kasese and Buyende. It is the geography the maps of Chapters 6 and 9 describe: the financing gap is the gap map priced. Districts shaded grey have no measured gap and are reported as unmeasured, never as zero.

New places bought, the OPT enrolment option (scenario A allocates nothing)

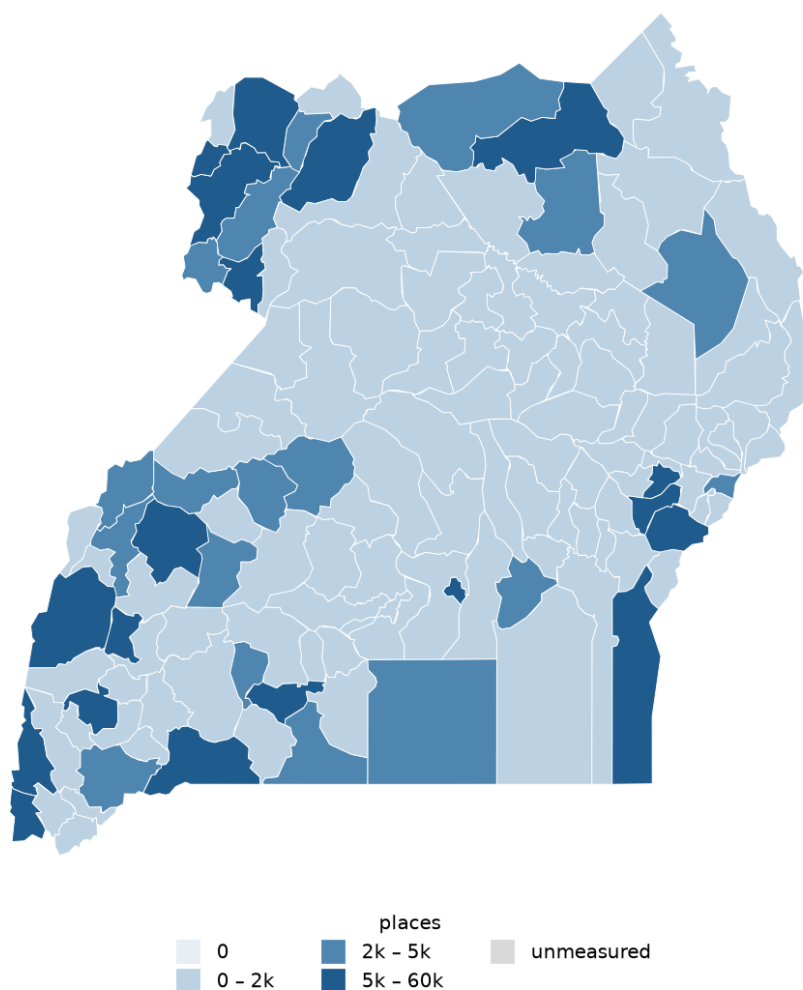


Figure 11.4: New places bought, the OPT enrolment option (scenario A allocates nothing) (places), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 11.4 draws the new places bought, district by district. The run's pinned scenario is A, the current trajectory, which commissions nothing and therefore allocates nothing anywhere; an empty choropleth would read as missing data rather than as a policy that buys nothing, so the map instead draws the option the budget chapter also uses — the optimiser's enrolment objective — and names it in the title. That the pinned scenario allocates nothing is not hidden by this: it is the first row of Table 11.2, it is why the funded column of Table 11.4 is zero in every cell, and it is why the financing gap equals the requirement exactly.

Read against Figure 11.3, the allocation map is a lesson in what a constrained optimiser does with a small envelope. It does not spread the money thinly across the districts with the largest gaps; it concentrates it where a marginal classroom and a marginal teacher convert into the most places, which is where unit requirements are lowest and existing capacity is closest to the threshold. Several of the districts with the heaviest financing gap receive little or nothing, and that divergence between where the need is and where the money goes under a stated objective is the most useful thing in this chapter. It is an argument about objectives, not about arithmetic: the annex table of district allocations carries all eight options, and the district figures quoted above are drawn from it.

11.7 Data quality and its limits

The envelope is **assumed**, and flagged as such on every output row. Its base year is measured — the FY2025/26 approved local government education grant lines, from the MoFPED approved budget (MoFPED 2025) — but its trajectory is not. The 5 per cent real growth rate is a placeholder for the fiscal interface that would derive a consistent envelope from the macro framework, and the 1 per cent drift on committed spending is likewise assumed. Both drive the cumulative discretionary total to which every allocation in Table 11.2 is scaled, so a reader who disagrees with those rates disagrees, proportionally, with every number in the comparison.

The benefit function is linear in places. Equation (11.3) adds places at a constant weight and does not use the concave, piecewise-linear returns the effectiveness table would support. With constant returns an optimiser tips its whole budget into whichever intervention has the highest ratio; here the complementarity constraints and the need cap of Equation (11.8) blunt that, because a district saturates once its gap is closed. But the model still treats the 464,027th place as worth what the first is worth.

The decision variables are continuous and district-level. There are no binary school-opening decisions — siting is handled in Chapter 10 and not fed back as integers — so a fractional classroom is possible and reported as such. There is no grade dimension: places are primary places in aggregate, so the model cannot express a policy of protecting the early grades, which is what scenario C is nominally about. And there is one teacher cadre, the primary Grade III teacher, so secondary subject shortages and the science–arts imbalance are invisible to the allocation even though Chapter 8 measures them.

Two constraints in the specification are absent. There is no wage-bill ceiling, so nothing prevents a solution whose payroll exceeds what public service rules allow; the wage increment column reports that without restraining it. And there is no absorptive-capacity constraint, so the model may allocate to a district several times what it has ever executed in a year, with the implied execution improvement neither flagged nor costed.

Finally, the equity exponent γ in Equation (11.4) is fixed at 2 rather than exposed as a scenario parameter, and scenario E uses no exponent at all: it is a greedy ordering by relative gap, not the weighted allocation the specification describes. A user cannot ask what the allocation looks like at $\gamma = 1$ or $\gamma = 4$, the sensitivity a minister weighing equity against reach would want. The run is a draft, exploratory run with two of eleven gates waived; no figure here is a ministry position.

11.8 Implications for planning

The first implication is the 3.1 per cent. Any discussion of education financing in Uganda that begins from the total envelope is having the wrong conversation, because that envelope is a payroll with a small building programme attached. The productive question is not how to divide 2,441.9 bn but what 75.9 bn can usefully buy, and what would have to change — wage-bill growth, envelope growth or the composition of the grant lines — to make that number materially larger.

The second is that placement dominates quantity at this scale. Four of the six rules buy the same 36,000 teachers and 4,320 classrooms, and the spread in what they deliver — from 309,855 places to 419,177, with two rules delivering none — comes from which districts they reach and whether the input bought is the one that binds there. The instruction falling out of Equation (11.9) is unglamorous: before committing a classroom grant, establish whether the district is room-bound or teacher-bound, because in 31 districts a new room will stand empty and in 104 a new teacher will have nowhere to teach.

The third concerns the recurrent tail, and is for the Ministry of Finance as much as Education. The four spending rules commit the Treasury to 258.3 bn UGX a year after 2030, against a final-year discretionary space of 506.1 bn — half the future room for manoeuvre consumed by the hiring decisions of the plan period. The optimiser's solutions leave tails of 55.9 bn and 72.2 bn instead, because complementarity stops them hiring where hiring buys

nothing. A plan that looks strong on enrolment and hands its successor a wage bill it cannot carry has purchased a crisis.

The fourth is that the binding constraint on this run is construction throughput. Both solves stop at 4,320 classrooms while leaving four-fifths of the teacher pipeline unused, which says the marginal shilling of the envelope is limited by delivery capacity, not by money or teachers — a case for procurement reform, and for bringing central and partner construction, absent from the extracted budget lines and therefore from Θ , into the accounting.

The last implication concerns the gap itself. At 4,554.7 bn UGX, or 76.2 per cent of the requirement, it is not a gap any reallocation of the existing envelope closes. What the district and dimension breakdown offers instead is a basis for sequencing and negotiation: it tells a district education officer in Arua or Maracha or Tororo what their own unfunded requirement is, by dimension and year, in constant prices, and a development partner which districts' gaps, in which dimension, their money would attach to. That is more useful than a single national number, and considerably more useful than a recommendation.

CHAPTER 12

12 EM-09 What the money buys: from places to learning

Every chapter before this one is arithmetic: a reader who disagrees with Chapter 6's teacher requirement can recompute it from the timetable and the teaching load. This chapter is different. It is the only place in the engine making a causal claim — that money spent produces a child enrolled, and that a child enrolled reads better than she otherwise would — and such a claim cannot be checked by re-adding the column. Every step must therefore name its evidence, carry an interval, and, where the evidence does not exist, say so rather than interpolate. The chain that follows is short and loses most of its volume at one link.

12.1 The chain, and where it stops

The specification sets out seven links: money buys inputs, inputs create places, places attract enrolment, enrolment produces attendance, attendance produces completion, completion converts into learning, learning accumulates into human capital. The engine produces six rows of it, in Table 12.1, priced and counted for all eight allocation options.

Table 12.1: The chain from money to learning, link by link

Link	A Current Trajectory	B Universal Basic Completion	C Foundational Learning	D Post-Basic Expansion	E Geographic Equity	F Demographic Pressure	Opt Enrolment	Opt Equity Weighted $\Gamma=2.0$
enrolment (median)	0	308,864	205,125	0	160,327	255,978	214,378	204,499
inputs: classrooms built	0	4,320	4,320	0	4,320	4,320	4,320	4,320
inputs: teachers hired	0	36,000	36,000	0	36,000	36,000	9,006	8,899
learning, net of composition (median)	0	-0	0.004	0	0.008	0.001	0.007	0.006
money: discretionary allocated	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358	1,424,080,246,358
places created	0	372,809	356,321	0	351,804	384,348	416,902	416,902

Each link's output is the next link's input. Source: EPRAS run 6b2afcf6 (report/build/data/t_outcome_chain.csv).

The first link is Chapter 11's budget identity read backwards: the discretionary envelope buys teachers and classrooms at their unit costs.

$$D = \sum_d \left(h_d \pi_h \frac{T}{2} + c_d \pi_c \right) \quad (12.1)$$

where D is the cumulative discretionary envelope, h teachers recruited in district d, c classrooms built there, π_h the annual cost of a teacher, π_c the capital cost of a classroom, and T the five years of the horizon. Every option draws on the same D of 1,424.1 bn UGX.

The second link converts inputs into places, and is Chapter 11's complementarity constraint evaluated rather than optimised:

$$p_d = \min(r_d + \kappa_r c_d, q_d + \kappa_t h_d, R_d) - b_d \quad (12.2)$$

where p is new places delivered in district d, r the places existing classrooms can host, q the places existing teachers can staff, κ_r and κ_t the places a new room and a new teacher respectively add, R the district's 2030 requirement for public primary places, and b what existing rooms and teachers already deliver. No behaviour enters here; it is physical capacity.

The third link is behavioural and is treated below; the fourth and fifth the engine declines to estimate. For attendance the specification's form is

$$\text{att}_d = \alpha_d + \sum_k \beta_k^a v_{k,d}, \quad \hat{\alpha}_d = \text{missing} \quad (12.3)$$

where att is the attendance rate, α the district baseline attendance rate, β^a the attendance effect of intervention k and v its coverage. The effectiveness table carries two attendance coefficients — school feeding at 0.05 pp, sanitation for adolescent girls at 0.02 pp — but α is unavailable: Uganda's administrative system records enrolment, not attendance, at district level. The engine returns `missing` and carries enrolment forward unmultiplied. Completion requires Chapter 6's flow model to be re-run with adjusted rates:

$$\delta'_{g,d} = \delta_{g,d} \prod_k (1 - \beta_k^\delta v_{k,d}), \quad \Delta \text{comp} = \text{missing} \quad (12.4)$$

where δ is the dropout rate in grade g and district d , δ' the rate after the plan's interventions, and β^δ the dropout effect of intervention k . The flow model is not re-run under δ' , and no evidence row links a classroom or a teacher post to a dropout rate, so the row reads "no evidence available: not modelled". The seventh link is absent too. Expected years of schooling and learning-adjusted years,

$$\text{EYS}_d = \sum_g e_{g,d}, \quad \text{LAYS}_d = \text{EYS}_d \frac{\text{prof}_d}{\text{bench}} \quad (12.5)$$

with e the enrolment rate in grade g , prof the proficiency share and bench the benchmark proficiency, are specified but not computed, so no human capital figure passes from this engine to a macro model.

12.1.1 Why `missing` and not zero

An unmodelled quantity written as zero is read downstream — in Chapter 13's results framework, in a spreadsheet built from the export — as the statement "this plan changes attendance by nothing". That is a finding, and not one this engine has made. NaN is worse: it prints as a number in some tools and propagates silently in others. The engine uses `missing`, which the serialiser, the validation gate and the chart code all read as an explicit absence; gate G10, which sweeps every result table for NaN and Inf, passed across 50 tables precisely because absence is recorded as absence.

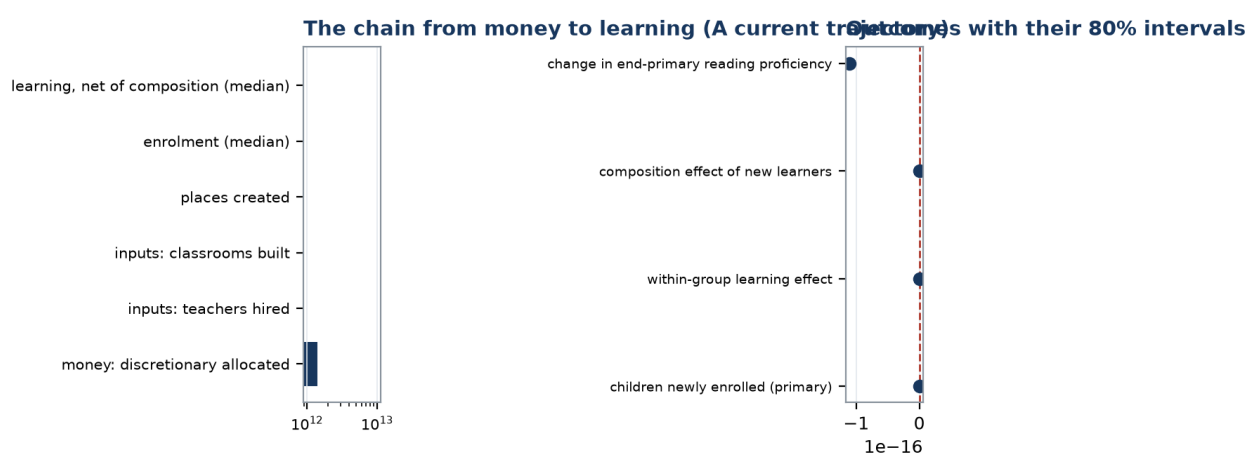


Figure 12.1: ch outcomes

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

The consequence is visible in Figure 12.1, whose right panel drops rows with absent values: four indicators appear where the result table holds six, and the two missing links are not dots on the zero line — the misreading the convention prevents. Both panels draw the chosen scenario, A, which commissions no rooms and no teachers, so

the chain terminates at the first bar and the outcome panel's scale collapses to the residue around zero. It is the counterfactual drawn; the comparison is in the tables.

12.2 From places to enrolled children

The engine's one behavioural step has two parts: a fill rate, and a ceiling.

$$\Delta n_d = \min(f p_d, O_d), \quad f \sim U(0.70, 0.95) \quad (12.6)$$

where Δn is the number of children newly enrolled in district d , f the share of new places taken up, drawn once per replicate and applied to every district, and O the district's out-of-school primary-age population from Chapter 5. The fill rate is not one: a child occupying a new seat must live within reach, be released from whatever work or care the household needs, and afford the fees, uniform and materials that Chapter 3's household survey puts at a median of 300,000 UGX a year. Where the queue at the school gate is long f approaches one; where the constraint was never supply it falls far below. The range 0.70 to 0.95 is **assumed**, not estimated from Ugandan data on new schools, because no such series was located; a declared central value of 0.85 sits in the code but does not enter the simulation, so the effective mean fill rate is 0.825.

The ceiling matters more, and Equation (12.6) enforces it district by district rather than nationally: places built where there is no unmet demand do not borrow capacity from a district where there is. Nationally there are 753,482 primary-age children out of school on Chapter 5's imputed district split, against options creating up to 464,027 places — and the ceiling does most of the work. B creates 309,855 places and seats 165,511 children, a conversion of 53.4 per cent against an uncapped expectation near 256,000; F creates 419,177 and seats 181,330, or 43.3 per cent. Both optimiser objectives create the same 464,027 places, but the enrolment objective seats 158,130 and the equity-weighted one 80,574 — 34.1 and 17.4 per cent. The extremes are C, which creates 333,344 places and seats 34,445, and E, which creates 330,602 and seats 32,621: conversions of 10.3 and 9.9 per cent. Chapter 11 records that C sends 206,051 of its places to Arua alone, and a district's out-of-school population is small beside a place gap that size, so nine places in ten are built where no child waits. The finding depends on no effect size: the difference between options spending the same 1,424.1 bn UGX is geography, not generosity.

Two further terms belong in Equation (12.6) and neither is implemented. There is no access term: the effectiveness table's best-evidenced row, distance within norm at 0.10 participation points per child brought inside the three-kilometre walking norm (Burde and Linden 2013; Muralidharan and Prakash 2017), is never applied, although Chapter 7 counts 726,951 children beyond that norm. There is no demand-side term for feeding, fees or cash transfers. And because only one effect acts on the excluded population, the multiplicative form the specification insists on,

$$x_t = x_{t-1} \prod_k (1 - \beta_k v_k) \quad (12.7)$$

where x is the residual excluded population, β_k the effect of intervention k and v_k its coverage, never has more than one factor to multiply. Read the enrolment figures as the yield of construction and hiring alone, with the module's best-evidenced effect set to zero.

12.3 The learning link

Of the six rows in the effectiveness table the module uses one: class size reduction per ten fewer pupils, at 0.03 SD on a published interval of 0.0 to 0.07, graded *rect*, sourced to Duflo, Dupas and Kremer's 2015 Kenyan extra-teacher programme — where the effect without incentives was small — and carrying a transfer discount of 0.5. Each replicate draws and discounts it:

$$\beta = (\beta^{lo} + u(\beta^{hi} - \beta^{lo}))(1 - \tau), \quad u \sim U(0, 1) \quad (12.8)$$

where β^{lo} and β^{hi} are the published interval bounds, u a uniform draw and τ the transfer discount. The discount states that an effect measured in western Kenya is not one measured in Uganda, and is shown rather than folded into the point estimate: the discounted coefficient runs from 0 to 0.035 SD. The mechanism by which places reduce class size is a crowding-relief ratio, not an observed class count:

$$s_d^0 = \frac{R_d}{\max(b_d, 1)} \sigma, \quad s_d^1 = \frac{R_d}{\max(b_d + p_d, 1)} \sigma \quad (12.9)$$

where s^0 and s^1 are effective class size before and after the plan, R the 2030 requirement for places, b the places already delivered, p the new places and σ the normed upper-primary class size of 53, from the MoES Local Government Planning Guidelines 2022, page 23. The within-group effect is the requirement-weighted mean of the coefficient applied to the relief:

$$\bar{z}^w = \frac{\sum_d \beta \Delta_d R_d}{\sum_d R_d}, \quad \Delta_d = \frac{\max(s_d^0 - s_d^1, 0)}{10} \quad (12.10)$$

with Δ_d the relief in units of ten pupils, the maximum ensuring no district is credited with a place it did not receive.

12.3.1 The composition effect

Enrolling children who have been out of school lowers the learner body's mean even if no individual child learns less, and the engine reports that separately: a model showing enrolment gains and learning gains without their interaction reports an impossibility.

$$\bar{z}^c = -\gamma_0 \frac{\sum_d \Delta n_d}{\sum_d R_d + \sum_d \Delta n_d}, \quad \bar{z} = \bar{z}^w + \bar{z}^c \quad (12.11)$$

where γ_0 is the assumed gap between a newly enrolled child and the existing mean, set to 0.30 SD, and $\bar{z}$ the net mean change. The decomposition is an identity, and both terms appear as their own rows in Table 12.2, never netted silently. Under F the composition effect is –0.006 SD, which by Equation (12.11) means the newly enrolled are about two per cent of the learner body; under C and E it is –0.001 SD.

The term explains an ordering that would otherwise look perverse. E and the equity-weighted objective post the largest net learning change in Table 12.1 at 0.013 SD, and they are the options enrolling fewest children; under B a within-group effect of 0.008 SD is more than half cancelled by a composition effect of –0.005 SD, leaving 0.002 SD net. A reader who wants the learning number large should want the enrolment number small.

12.3.2 Converting standard deviations into proficiency

Effects are estimated in standard deviations of the learning distribution and converted to a proficiency share through the observed distribution, never asserted as percentage points directly:

$$\Delta P = \Phi(z_0 + \bar{z}^w + \bar{z}^c) - P_0, \quad z_0 = \Phi^{-1}(P_0) \quad (12.12)$$

where P_0 is the baseline share of children reaching minimum proficiency in reading at the end of primary, Φ the standard normal distribution function and z_0 that threshold as a z-score. P_0 is 50.5 per cent, the UIS (2025) SDG 4.1.1 figure for 2013, placing z_0 at 0.0125 — almost exactly the median, where the normal density is at its maximum of 0.399. The conversion is therefore as generous as it can be: a shift of 0.01 SD moves about 0.4

percentage points across the threshold, where the same shift in the tail would move far fewer. E's net 0.013 SD becomes a 0.5 point gain, 50.5 to 51.0 per cent.

12.4 Uncertainty, and the rule about zero

Every outcome carries an interval, propagated by Monte Carlo over the fill rate of Equation (12.6) and the effect size of Equation (12.8). The engine runs 1,000 replicates per scenario from a Mersenne Twister seeded with the run seed, 6b2afcf6, so they reproduce exactly on a re-run. The interval is the tenth to ninetieth percentile of the replicates:

$$[Q_{0.10}(X^{(m)}), Q_{0.90}(X^{(m)})], \quad m = 1 \dots M, \quad M = 1000 \quad (12.13)$$

where X is the indicator's value in replicate m and Q_q the q-quantile over the M replicates. The point estimate beside it is the median, not the mean.

Table 12.2: Outcomes by scenario, with intervals and the evidence each rests on

Scenario	Indicator	Value	CI Low	CI High	Unit	Evidence
A current trajectory	children newly enrolled (primary)	0	0	0	learners	fill rate assumed 0.70-0.95
A current trajectory	within-group learning effect	0	0	0	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
A current trajectory	composition effect of new learners	-0	0	0	SD	assumed newcomer gap 0.3 SD
A current trajectory	change in end-primary reading proficiency	-0	-0	-0	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
A current trajectory	completion change				pp	no evidence available: not modelled
A current trajectory	attendance change				pp	unmodelled: no district attendance data
OPT enrolment	children newly enrolled (primary)	214,378	192,954	236,462	learners	fill rate assumed 0.70-0.95
OPT enrolment	within-group learning effect	0.016	0.004	0.029	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
OPT enrolment	composition effect of new learners	-0.009	-0.01	-0.008	SD	assumed newcomer gap 0.3 SD
OPT enrolment	change in end-primary reading proficiency	0.003	-0.002	0.008	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
OPT enrolment	completion change				pp	no evidence available: not modelled
OPT enrolment	attendance change				pp	unmodelled: no district attendance data
B universal basic completion	children newly enrolled (primary)	308,864	269,559	345,795	learners	fill rate assumed 0.70-0.95
B universal basic completion	within-group learning effect	0.012	0.002	0.021	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
B universal basic completion	composition effect of new learners	-0.013	-0.014	-0.011	SD	assumed newcomer gap 0.3 SD
B universal basic completion	change in end-primary reading proficiency	-0	-0.004	0.003	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
B universal basic completion	completion change				pp	no evidence available: not modelled
B universal basic completion	attendance change				pp	unmodelled: no district attendance data
D post-basic expansion	children newly enrolled (primary)	0	0	0	learners	fill rate assumed 0.70-0.95
D post-basic expansion	within-group learning effect	0	0	0	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
D post-basic expansion	composition effect of new learners	-0	0	0	SD	assumed newcomer gap 0.3 SD

Scenario	Indicator	Value	CI Low	CI High	Unit	Evidence
D post-basic expansion	change in end-primary reading proficiency	-0	-0	-0	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
D post-basic expansion	completion change				pp	no evidence available: not modelled
D post-basic expansion	attendance change				pp	unmodelled: no district attendance data
E geographic equity	children newly enrolled (primary)	160,327	146,433	173,573	learners	fill rate assumed 0.70-0.95
E geographic equity	within-group learning effect	0.015	0.003	0.026	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
E geographic equity	composition effect of new learners	-0.007	-0.007	-0.006	SD	assumed newcomer gap 0.3 SD
E geographic equity	change in end-primary reading proficiency	0.003	-0.002	0.008	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
E geographic equity	completion change				pp	no evidence available: not modelled
E geographic equity	attendance change				pp	unmodelled: no district attendance data
C foundational learning	children newly enrolled (primary)	205,125	189,274	217,099	learners	fill rate assumed 0.70-0.95
C foundational learning	within-group learning effect	0.013	0.003	0.023	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
C foundational learning	composition effect of new learners	-0.009	-0.009	-0.008	SD	assumed newcomer gap 0.3 SD
C foundational learning	change in end-primary reading proficiency	0.002	-0.002	0.006	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)
C foundational learning	completion change				pp	no evidence available: not modelled
C foundational learning	attendance change				pp	unmodelled: no district attendance data
F demographic pressure	children newly enrolled (primary)	255,978	228,881	278,912	learners	fill rate assumed 0.70-0.95
F demographic pressure	within-group learning effect	0.012	0.002	0.021	SD	Duflo, Dupas & Kremer 2015 (Kenya ETP, small effect without incentives) [rct], transfer discount 0.5
F demographic pressure	composition effect of new learners	-0.011	-0.012	-0.01	SD	assumed newcomer gap 0.3 SD
F demographic pressure	change in end-primary reading proficiency	0.001	-0.003	0.004	share	via normal distribution from UIS SDG 4.1.1 baseline 50.5% (2013)

An interval that spans zero is no detectable effect at this evidence base. Source: EPRAS run 6b2afc6 (report/build/data/t_outcomes.csv).

Table 12.2 carries every indicator with its interval and the evidence it rests on, in the row itself, and enforces the rule the specification calls the single most damaging thing this module could get wrong: **where the interval spans zero, the result is reported as no detectable effect at this evidence base**, not as a point estimate with a wide interval attached.

Three of the options that produce a proficiency number fall under it. The enrolment objective's change in end-primary reading proficiency is 0.004 on an interval of -0.001 to 0.008; B's is 0.001 on -0.001 to 0.003; F's is 0.002 on -0.002 to 0.005. Two clear the rule: C, at 0.004 on 0.001 to 0.007, and E, at 0.005 on 0.001 to 0.010, whose intervals sit above zero because the composition effect that drags the others down is small when almost no new children are enrolled. The detectable learning gain belongs to the options reaching fewest children, and the two facts must be read together or neither is meaningful. The enrolment intervals are asymmetric — the enrolment objective's runs 145,044 to 163,962 about a median of 158,130 — because as f rises more districts hit the cap.

12.5 Who the plan reaches

The equity measure the engine computes is a single incidence share: the fraction of new places landing in the worst-served fifth of districts by out-of-school rate.

$$S = \frac{\sum_{d \in W} p_d}{\sum_d p_d}, \quad W = (d : \omega_d \geq Q_{0.80}(\omega)) \quad (12.14)$$

where S is the incidence share, ω the district's primary out-of-school rate, W the set of districts at or above the eightieth percentile of that rate, and p new places. Where an option creates no places the share is `missing`, not zero: a share of nothing is undefined.

Table 12.3: The share of new places reaching the worst-served fifth of districts

Scenario	Share To Worst Quintile	New Places
A current trajectory		0
OPT enrolment	0.093	416,902
B universal basic completion	0.295	372,809
D post-basic expansion		0
E geographic equity	0.126	351,804
C foundational learning	0.035	356,321
F demographic pressure	0.257	384,348
OPT equity_weighted $\gamma=2.0$	0.132	416,902

Source: EPRAS run 6b2afcf6 (report/build/data/t_equity.csv).

Table 12.3 ranges from 1.4 per cent to 81.4 per cent on the same 1,424.1 bn UGX. B sends 81.4 per cent of its 309,855 places to the worst-served fifth, because it orders districts by out-of-school children; F sends 57.0 per cent and the enrolment objective 30.8 per cent of its 464,027 places. Two rows sit oddly against their own labels: E, named geographic equity, sends 19.0 per cent — a fifth of its places to a fifth of the districts, which is what an allocation indifferent to the out-of-school rate would do — and the equity-weighted optimiser, at 21.2 per cent, sends less than the plain enrolment objective. Neither is a bug: both rank districts by the *relative place gap*, capacity against requirement, while Equation (12.14) ranks them by the *out-of-school rate*, participation against population, and a district can be badly short of classrooms while having few children out of school. "Equity" must name its variable before it can be a requirement.

Children newly enrolled, the OPT enrolment option (scenario A allocates nothing)

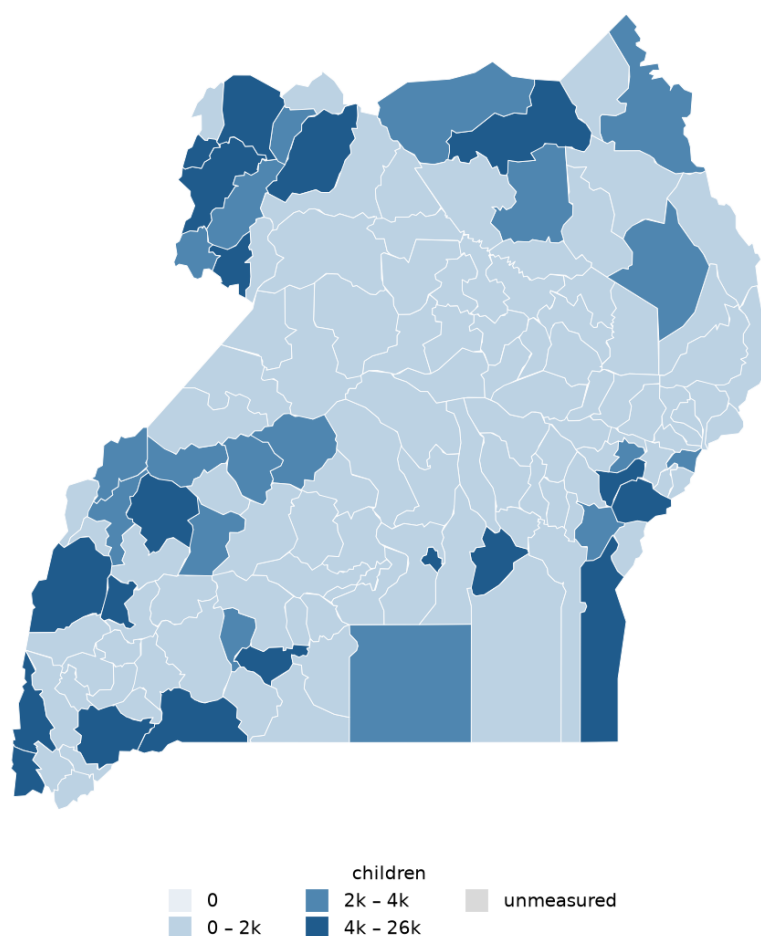


Figure 12.2: Children newly enrolled, the OPT enrolment option (scenario A allocates nothing) (children), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 12.2 draws children newly enrolled by district, applying the central fill rate of 0.85 and the same out-of-school ceiling as Equation (12.6). The run's pinned scenario, A, creates no places and so enrolls no one; the map therefore draws the same option as the allocation map of Chapter 11 and names it in its title, because a uniformly empty map reads as absent data rather than as a policy that changes nothing.

Compared with the allocation map, this one is visibly flatter in the districts that receive most of the places. That compression is Equation (12.6) at work: where the places created exceed the children recorded as out of school, the ceiling binds and the extra places enrol nobody. It is the clearest statement this chapter can make of the difference between building capacity and enrolling children, and it is the reason the engine reports both quantities rather than treating one as a proxy for the other.

12.6 Data quality and its limits

On the tiers — measured, normed, imputed, assumed — this module sits lower than any other in the report.

The chain is six rows against seven links. Attendance is unmodelled for want of a district baseline; completion is not re-projected through the flow model, so no completion claim is made; expected and learning-adjusted years of schooling are not computed. "This plan raises primary completion by x points" is unsupported here.

The effect base is one coefficient, sampled off-centre. Textbook provision at 0.05 SD and teacher training at 0.08 SD are never applied although the programme buys materials and hires teachers, so channels that plausibly exist

are omitted; against that, the coefficient used is applied to every primary learner while its stated population is lower primary. A uniform draw over 0 to 0.07 also has a mean of 0.035, above the point estimate of 0.03, so the simulation's average discounted coefficient is about 0.0175 SD against 0.015 — slightly optimistic, with intervals describing a published interval's width, not a posterior.

Several constants feeding proficiency are assumed, in a draft norm set. The newcomer gap of 0.30 SD in Equation (12.11), which sets the entire size of the composition effect, is assumed; so is the fill-rate range of Equation (12.6). The baseline proficiency of 50.5 per cent is measured but is a 2013 national figure applied without district variation, and Equation (12.12) assumes the learning distribution is normal. The relief in Equation (12.9) is a ratio of requirement to delivered capacity, not an observed class size: where a district delivers half what it requires, s^0 reads 106 pupils against a base-year national mean class size of 42.9. Gate G9 is waived over all of it — 64 of the norm set's 99 coefficients are flagged assumed, and the six effectiveness rows, though graded and sourced, sit in a version the expert review has not approved.

The equity measure inherits an imputation. The out-of-school rate ranking districts in Equation (12.14) distributes the national household-survey rate of 6.9 per cent across districts in inverse proportion to 2017 administrative gross enrolment, and is flagged imputed everywhere. The same imputation sets the ceiling in Equation (12.6), so a district whose 2017 EMIS return understated enrolment carries too high an out-of-school rate, too high a ceiling and too much weight in the equity share.

The other equity measures are absent. The coefficient of variation between districts, the decile ratio, the sex gap and the wealth-quintile gap are not produced, because no sex or wealth dimension reaches this module. Table 12.2 is also printed as a 40-row extract, so the equity-weighted objective's net learning figure is read from Table 12.1; and the scenarios share one generator rather than common random numbers, so a difference between two medians carries simulation noise.

12.7 Implications for planning

The binding constraint on what this money buys is not construction and not hiring but the location of children who are not in school: the 9.9 to 53.4 per cent spread in conversion is the ceiling of Equation (12.6) biting at different strengths. Before a classroom grant is committed, ask how many primary-age children in that district are out of school — a district can be at once the largest place gap in the country and a poor place to build.

The distance effect should be the next thing this engine implements: it has the strongest evidence in the table, a population to act on in the 726,951 children Chapter 7 counts beyond three kilometres, and an intervention in the 26 sites Chapter 10 selects. Leaving it at zero leaves the siting programme's principal justification asserted in Chapter 10 and unmeasured here.

Three of the options that produce a proficiency number have intervals spanning zero, and the correct public statement for them is that no effect is detectable at this evidence base. That is not a reason to avoid the spending — a place for a child who has none is worth buying whether or not a mean test score moves — but it is a reason to stop justifying construction budgets with learning claims.

The composition decomposition is the finding most likely to be misused. Any plan that enrolls previously excluded children will depress the measured mean, and under B more than half the within-group gain is cancelled that way. A results framework setting a target on mean proficiency without a companion target on enrolment creates an invisible incentive to leave the hardest-to-reach children out of school. The decomposition in Table 12.2 is the defence, and should travel with the indicator into Chapter 13 rather than be collapsed into one number. The same applies to equity: name the variable in the terms of reference.

Two links of this chain are blank for want of one survey each. A district-representative attendance module — spot checks in a sample of schools, or a question in the next household survey — would make Equation (12.3) computable and let the engine tell a minister whether school feeding buys learning days. A learning assessment

with district-level results, of the kind Uwezo (2013) has fielded, would replace a single 2013 national proficiency share with a distribution and make Equation (12.12) a measurement. Until then, this chapter reports what the money buys in seats with reasonable confidence, in learning with very little, and in attendance and completion not at all.

CHAPTER 13

13 EM-10 Programme budget and the medium-term framework

Everything in this report until now has been a planning argument: how many children there are, how many places they need, what those places cost, what the envelope can buy and what the purchase is expected to change. None of it can be appropriated. A budget officer cannot carry a gap map to a budget hearing, and a Ministry of Finance desk officer cannot issue a ceiling against a place gap. This chapter is where the chain terminates in the only document the system recognises — a programme budget mapped to the chart of accounts, a medium-term expenditure framework in constant and nominal terms, a reconciliation against the budget in force, and a results framework whose targets are the outputs of the plan the budget finances. The test is whether the numbers arrive in a form that can be submitted rather than retyped.

13.1 From cost rows to a chart of accounts

The programme budget is not computed but re-aggregated from the costs of Chapter 9, deliberately: the sum must not change when the presentation does. Every priced row carries three labels from the moment it is created — an economic code, a programme code and a district — and the rows are then summed three ways:

$$\sum_g B_g = \sum_e B_e = \sum_d B_d = X_{t_0} \quad (13.1)$$

where B_g is the total of programme g , B_e the total of economic code e , B_d the total of district d , and X is the base-year total all three must equal. The engine asserts Equation (13.1) to one part in a million and stops the run if it fails. On this run the three views agree at UGX 4,373.6 bn.

The economic view is what finance controls: **21 wages and salaries**, **22 goods and services** and **26 transfers to schools**, at 3,037.8 bn, 1,051.4 bn and 284.4 bn. The programme view is what the ministry takes to parliament — programme 01 for pre-primary and primary, 02 for secondary, 07 for system and administration, each split into sub-codes for wages (.1), capitation and other non-wage recurrent (.2), instructional materials (.3) and capital acquisition (.4).

Table 13.1: The programme budget: programme by economic classification

Programme	Economic	Amount
1.1	21 Wages and salaries	1,457,996,262,670
2.1	21 Wages and salaries	1,512,501,249,721
1.2	22 Goods and services	459,331,067,263
1.3	22 Goods and services	125,063,772,674
1.2	26 Transfers to schools	94,978,015,581
2.2	22 Goods and services	225,569,990,664
2.3	22 Goods and services	57,417,729,787
2.2	26 Transfers to schools	168,948,114,032
7	22 Goods and services	9,524,192,000
7	26 Transfers to schools	16,951,950,000

Source: EPRAS run 6b2afcf6 (report/build/data/t_programme_budget.csv).

The crossing of the two classifications is the point of Table 13.1, where the codes appear without their leading zeros. The largest cell is programme 01 against code 21 — the primary wage bill at 1,893.9 bn, 43.3 per cent of the whole requirement. Programme 07, the whole of system and administration, is 25.6 bn, a block Chapter 9 has shown to be understated by roughly an order of magnitude because the catalogue holds no rate for examinations, teacher management, in-service training, EMIS or curriculum development. Two absences are correct: there is no code 31 and no .4 sub-programme, because on the *requirement* basis there is no acquisition, only the annualised use and maintenance of an estate. But there are also no separate lines for allowances or employer social contributions, which the specification asks for; the 10 per cent on-cost sits inside code 21 and cannot be pulled out.

Share of the programme budget

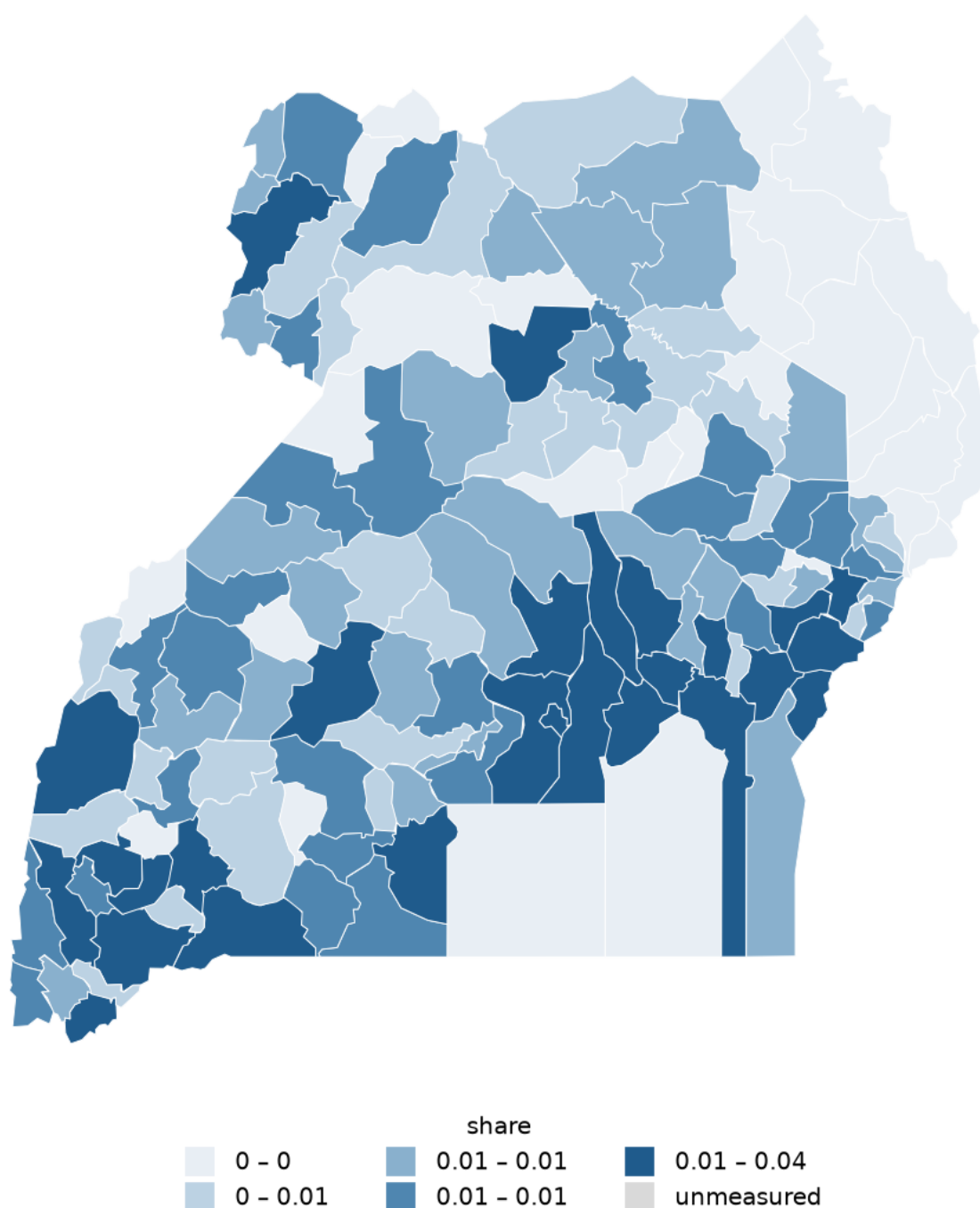


Figure 13.1: Share of the programme budget (share), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 13.1 is the third view — each district's share of the same total. Arua is the largest at 3.3 per cent, followed by Tororo, Kampala, Wakiso and Kasese at between 1.8 and 2.0 per cent; the ten largest districts take 18.0 per cent between them, and the smallest, Amudat, 0.12 per cent. The map distributes *need priced at national rates*, not money released.

One honesty point belongs here. The specification requires every cost row to map to a programme and an economic code, and unmapped rows to fail the run. In the implementation both mappings are functions of a row's cycle, item and kind — a wage is code 21, a capitation item 26, a capital item 31, everything else 22 — each ending in a catch-all branch. No row can be unmapped, so the assertion guarding against it can never fire, which proves the sums agree but not that any row sits in the right programme. A chart of accounts held as data, against which rows are joined and misses reported, would be the stronger design, and this run has none.

13.2 The medium-term framework

The MTEF projects what the plan costs against what the envelope is expected to be, and the engine produces it twice — constant 2026 shillings and nominal shillings — because planners need constant terms to see real change and finance needs nominal terms to issue ceilings. Both are labelled, and the deflator path travels with them.

Table 13.2: The MTEF in constant and nominal terms, with the deflator path

Year	Wage Existing	Wage New Teachers	Nonwage	Development	Maintenance New Rooms	Total Constant	Envelope Constant	Financing Gap Constant	Wage Share	Deflator Index	Total Nominal	Envelope Nominal
2026	1,900,045,100,000	6,347,139,068	466,000,000,000	121,440,000,000	910,800,000	2,494,743,039,068	2,441,945,100,000	52,797,939,068	0.764	1	2,494,743,039,068	2,441,945,100,000
2027	1,919,045,551,000	19,041,417,204	470,660,000,000	121,440,000,000	1,821,600,000	2,532,008,568,204	2,564,042,355,000	32,033,786,796	0.765	1.052	2,663,673,013,751	2,697,372,557,460
2028	1,938,236,006,510	31,735,695,340	475,366,600,000	121,440,000,000	2,732,400,000	2,569,510,701,850	2,692,244,472,750	122,733,770,900	0.767	1.107	2,843,687,771,780	2,979,517,726,970
2029	1,957,618,366,575	44,429,973,476	480,120,266,000	121,440,000,000	3,643,200,000	2,607,251,806,051	2,826,856,696,388	219,604,890,336	0.768	1.164	3,035,499,714,908	3,291,175,281,211
2030	1,977,194,550,241	57,124,251,612	484,921,468,660	121,440,000,000	4,554,000,000	2,645,234,270,513	2,968,199,531,207	322,965,260,694	0.769	1.225	3,239,866,384,923	3,635,432,215,626

Memo: the wage share of the requirement, and the recurrent tail of the capital programme. Source: EPRAS run 6b2afcf6 (report/build/data/t_mtef.csv).

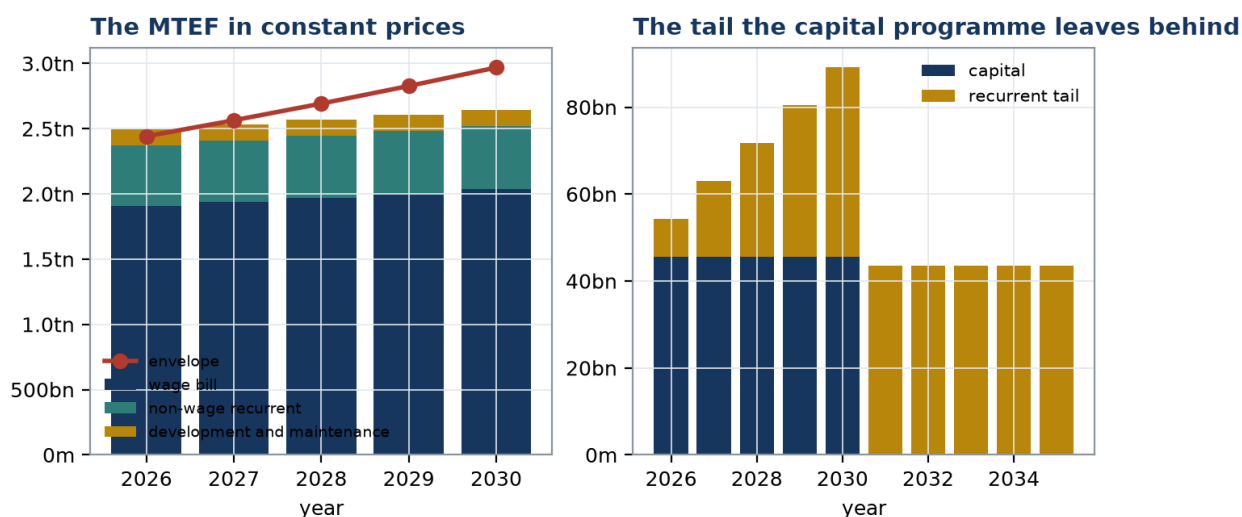


Figure 13.2: ch mtef

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Five lines build the constant-price total. The **existing wage bill** starts at the FY2025/26 approved local government primary and secondary wage grants, 1,900.0 bn UGX, and grows at 1 per cent a year; **non-wage recurrent** starts at the two approved non-wage grants, 466.0 bn, and grows at the same rate. **New teachers** are the plan's hires, spread evenly over the horizon. **Development** is the approved primary development grant of 75.9 bn plus the plan's classroom programme at 45.5 bn a year, a flat 121.4 bn. **Maintenance of the new rooms** accrues at 2 per cent of replacement value as rooms are delivered.

The deployment-timing convention and the wage-share memo line share one expression:

$$\sigma_t = \frac{W_t + \Delta W_t}{M_t^{\text{con}}}, \quad \Delta W_t = (h_t - \frac{n_t}{2})w \quad (13.2)$$

where σ is the wage share in year t ; W the existing wage bill; ΔW the increment from the plan's hires; M the total requirement in constant prices; h the cumulative teachers deployed by the end of year t ; n those deployed during year t ; and w the annual cost of one primary teacher FTE, UGX 7,047,810 at the MoPS FY2025/26 midpoint with the 10 per cent on-cost. Subtracting $n/2$ is the deployment-timing rule the specification demands: a teacher recruited during the year costs half a year then and a full year thereafter, which is why the increment rises from 5.1 bn in 2026 to 15.4 bn in 2027 on an unchanged intake.

Conversion to nominal terms is a single multiplication:

$$M_t^{\text{nom}} = M_t^{\text{con}} \delta_t, \quad \delta_t = (1 + \pi)^{t - t_0} \quad (13.3)$$

where δ is the deflator index, normalised to 1 in the base year $t_0 = 2026$, and π the assumed annual GDP deflator growth of 5.2 per cent, taken from the latest three years of the World Bank series and extended flat. The index runs 1.000, 1.052, 1.107, 1.164, 1.225, and the same index is applied to the envelope so the comparison stays like for like. The plan's total is 2,493.5 bn constant in 2026 and 2,634.3 bn in 2030, a real rise of 5.6 per cent; the same path in nominal terms runs to 3,226.5 bn, a rise of 29.4 per cent. A ceiling negotiated on the first pair and executed on the second will be breached.

The wage share is 76.4 per cent in 2026 and 76.8 per cent in 2030. The specification names roughly 80 per cent as the level past which a ministry has lost the ability to buy books, maintain buildings or train anyone; the sector sits just below it throughout and drifts towards rather than away from it. The drift is mild only because the plan hires few teachers — the enrolment-objective allocation EM-10 budgets adds 7,286 over five years, against the 36,000 that four of Chapter 11's six rule-based scenarios would hire, any of which would show the share crossing the line inside the framework period.

13.3 The MTEF against the last decade of approved budgets

An MTEF built on a stub envelope should be read against what has actually happened to education appropriations, and the engine carries that series.

Table 13.3: The approved budget for education votes, by financial year

Financial Year	Education Votes	Education Bn	All Votes Bn	Education Share
2015/16	10	969	23,972	0.04
2016/17	13	1,288	26,360	0.05
2019/20	13	1,526	40,488	0.04
2020/21	13	1,633	45,494	0.04
2021/22	13	1,056	42,467	0.02
2022/23	14	1,699	43,096	0.04
2024/25	14	1,910	72,126	0.03
2025/26	14	2,079	70,976	0.03
2026/27	14	2,587	84,392	0.03

MoFPED approved-budget workbooks (AICTEM data estate). Education is the sum over central-government votes whose name identifies an education institution - the ministry, the public universities, the examinations board and the training institutions - across every funding line in the workbook. It is therefore a central-government total and does NOT include the local-government education grants that finance most of primary schooling; those are the envelope the plan allocates. The FY2021/22 workbook carries a narrower set of funding lines than its neighbours, which is why its total dips; read the series as a trend, not as nine audited outturns. Source: EPRAS run 6b2afcf6 (report/build/data/t_budget_series.csv).

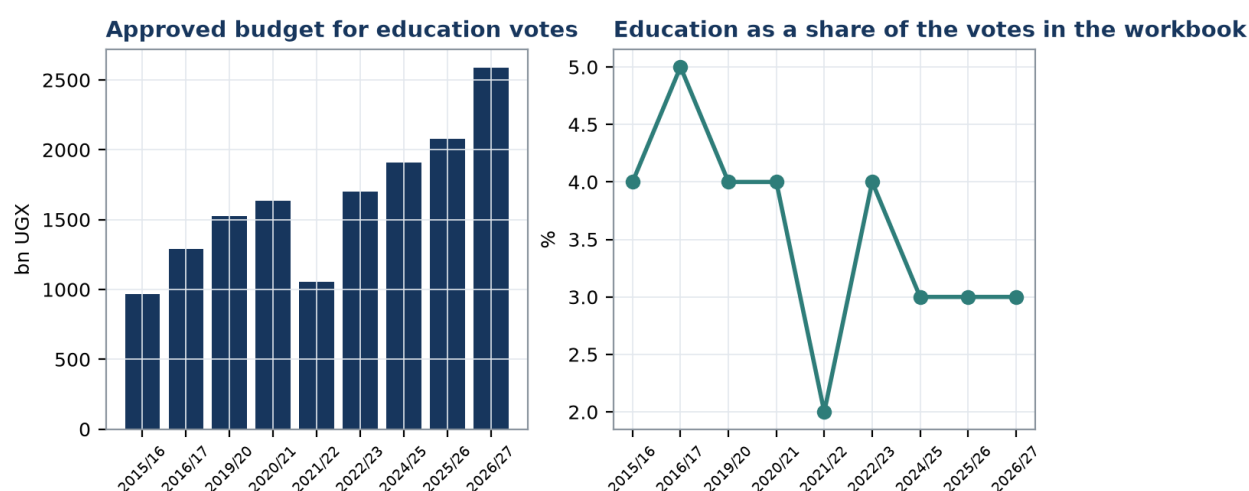


Figure 13.3: ch budget series

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 13.3 and Figure 13.3 cover nine financial years of MoFPED approved-budget workbooks (MoFPED 2015-2026). Education — the sum over every central-government vote whose name identifies an education institution: the ministry, the public universities, the examinations board, the training institutions — rises from 969 bn UGX in FY2015/16 to 2,587 bn in FY2026/27, a factor of 2.67, while all votes in the same workbooks rise by a factor of 3.52. Education's share therefore *falls*, from 4.0 per cent in FY2015/16 and 4.9 per cent in FY2016/17 to 3.1 per cent in FY2026/27.

Three cautions apply. The series is central-government votes only and does **not** include the local government education conditional grants that finance most of primary schooling — exactly the lines this plan's envelope is built from, so the two perimeters are disjoint rather than nested. The FY2021/22 workbook carries a narrower set of funding lines than its neighbours, which is why its total dips to 1,056 bn and its share to 2.5 per cent; that dip is a coverage artefact, not a cut. And these are approved budgets in the prices of their own year, not outturns: read the series as a trend, not as nine audited observations.

Two things follow. The LG grant envelope the plan allocates, 2,441.9 bn in the base year, is larger than the entire central-government education vote total of 2,079 bn in the same year — a reminder of how much of Uganda's education spending is conditional grants rather than ministry votes. And the MTEF assumes that envelope grows at 5 per cent a year in real terms while the decade behind it shows the share declining: nominal growth of 9.3 per cent a year in the education votes, against the 5.2 per cent deflator of Equation (13.3), leaves real growth near 3.9 per cent. The envelope path in Table 13.2 is an assumption the historical series does not corroborate.

13.4 The recurrent tail

A capital programme is a decision about recurrent spending, taken once and paid indefinitely. The module reports it as such, five years past the horizon:

$$T_t = \min(k_t, N) \frac{C}{N} \iota, \quad \iota = fw + mp_c + su c_p \quad (13.4)$$

where T is the annual recurrent obligation in year t ; k the index of that year counted from the start of the plan; N the number of horizon years, five; C the classrooms the plan builds, so C/N is the annual cohort of rooms; and ι the recurrent cost one room induces each year — f teacher FTEs per class at cost w , maintenance at $m = 2$ per cent of the classroom price p_c of UGX 52,711,605, and capitation for $s \times u$ learners, the normed class size of 53 at 90 per cent utilisation, at the UPE rate c_p of UGX 17,000 per learner-year. The $\min()$ in Equation (13.4) is what makes it a tail: once the last cohort of rooms is delivered the obligation stops growing, and does not stop being owed.

Table 13.4: The recurrent tail: what the capital programme obliges after the horizon

Year	Capital	Recurrent Tail
2026	45,540,000,000	8,715,125,636
2027	45,540,000,000	17,430,251,272
2028	45,540,000,000	26,145,376,907
2029	45,540,000,000	34,860,502,543
2030	45,540,000,000	43,575,628,179
2031	0	43,575,628,179
2032	0	43,575,628,179
2033	0	43,575,628,179
2034	0	43,575,628,179
2035	0	43,575,628,179

Source: *EPRAS run 6b2afcf6 (report/build/data/t_recurrent_tail.csv).*

The right panel of Figure 13.2 draws Table 13.4. The plan spends 45.5 bn UGX a year on classrooms for five years, 227.7 bn in all, delivering 864 rooms a year. Each room induces about 10.1 m UGX of recurrent cost a year, so the tail rises in equal steps from 8.7 bn in 2026 to 43.6 bn in 2030 — and then stays at 43.6 bn through 2031 to 2035, the capital column at zero throughout. The five years beyond the horizon carry 217.9 bn UGX of obligation created by the plan, against a construction programme costing 227.7 bn in total: the capital spending is repaid, as a standing charge on future recurrent budgets, roughly once every five years for as long as the classrooms stand. This table, not the construction schedule, is what a finance ministry needs before it approves the programme.

13.5 Reconciling to the budget in force

No budget officer accepts a new number without knowing how it differs from the current one. The specification sets out the decomposition:

$$B_{1,\ell} = B_{0,\ell} + g_\ell + a_\ell + n_\ell - e_\ell, \quad \Delta_\ell = B_{1,\ell} - B_{0,\ell} \quad (13.5)$$

where B_0 is the approved amount on line ℓ in the current year, B_1 the proposed amount, g the effect of enrolment growth at current unit costs, a the effect of price and salary adjustment, n the cost of new policy from the plan, e the saving from efficiency and reallocation, and Δ the difference to be explained.

Table 13.5: The modelled requirement reconciled against the approved budget

Line	Approved FY2025 26	Requirement Base Year	Explanation
wage (LG primary+secondary)	1,900,045,100,000	2,970,497,512,392	requirement = norm FTE × MoPS scale + 10% on-cost; approved = payroll in force
capitation and school grants	466,000,000,000	280,878,079,613	requirement = learners × statutory rates + per-school grants; approved includes other non-wage
development (primary)	75,900,000,000	705,701,782,931	requirement = classroom and stance gap phased evenly over the horizon (not throughput-limited)

Source: EPRAS run 6b2afcf6 (report/build/data/t_budget_reconciliation.csv).

Table 13.5 is what the engine produces: three aggregate lines, each with the approved FY2025/26 figure, the modelled base-year requirement and a sentence on why they are constructed differently.

The **wage line** shows 3,037.8 bn required against 1,900.0 bn approved, 59.9 per cent higher. That is not an error and not, mainly, a pay claim: the requirement is the establishment the timetable demands priced at the published scale, the approved figure is the payroll in force, and the difference is the teacher deficit in money. The **capitation and school grants** line runs the other way — 284.4 bn required against 466.0 bn approved — but the two are not the same object: the requirement is learners times the statutory rates plus per-school grants, while the approved figure is both non-wage recurrent grants together, which fund a good deal besides capitation. It is a perimeter mismatch, and the engine says so rather than presenting the difference as a saving. The **development line** is the one that will be argued about: 1,077.7 bn required against 75.9 bn approved, a factor of 14.2. That is the classroom and latrine-stance gap spread evenly across five years, deliberately *not* limited by what the construction sector can deliver — which is why it stands far above the 45.5 bn a year the plan actually spends.

The implementation stops well short of the specification. It has three aggregate lines, not a per-programme comparison; it reports B_0 and B_1 but does not decompose Δ into g , a , n and e , so Equation (13.5) describes the intent rather than the output; and the explanations are strings written into the source rather than generated from factor traces, so the rule that every difference above 15 per cent carries a generated explanation tests nothing.

13.6 The results framework

Performance information in budget documents is usually written separately, after the numbers are fixed. Here it is generated from the outcome rows of EM-09, so the targets are the outputs of the plan the budget finances, carrying the same scenario, run identifier and intervals.

Table 13.6: The results framework, generated from the outcome rows

Indicator	Target Value	CI Low	CI High	Source
children newly enrolled (primary)	214,378	192,954	236,462	EM-09
within-group learning effect	0.016	0.004	0.029	EM-09
composition effect of new learners	-0.009	-0.01	-0.008	EM-09
change in end-primary reading proficiency	0.003	-0.002	0.008	EM-09
completion change				EM-09
attendance change				EM-09

Source: EPRAS run 6b2afcf6 (report/build/data/t_results_framework.csv).

Six indicators come through in Table 13.6, all traced to EM-09. The headline is **158,130 children newly enrolled in primary**, with an 80 per cent interval of 145,044 to 163,962 — the interval, not the point, being what the uncertainty in the fill rate supports. The learning indicators are small and honest: a within-group effect of 0.014 standard deviations (0.003 to 0.025), a composition effect of -0.005 SD as lower-attaining newcomers enter the measured population, and a net change in end-primary reading proficiency of 0.004 with an interval from -0.001 to 0.008. That interval spans zero and must be read, under this report's own rule, as **no detectable effect at this evidence base**. Completion change and attendance change come through with no value at all, because no evidence base supports them; they are printed rather than dropped, which is the right treatment of an unmodelled indicator in a document used to hold someone accountable.

What the table lacks is the specification's structure: no programme column, so an indicator cannot be attached to the budget line that buys it; no baseline; and no split between a year-1 and a year-3 target. Nor are these the specification's indicators — there is no net enrolment rate, no learners per classroom, no pupil-qualified-teacher ratio and no equity measure, though Chapters 7, 8 and 10 compute all four.

13.7 Data quality and the limits of this module

The inputs are inherited, so the quality tiers are those of the earlier chapters: measured prices over imputed quantities resting on a 2017 EMIS base, and an assumed envelope. What is specific to EM-10 is the distance between specification and implementation.

There is no establishment reconciliation. The specification requires the wage bill as opening establishment, less attrition, plus replacement recruitment, plus net new posts, giving a closing establishment — and beside it an opening cost per post adjusted by incremental progression and approved pay awards. None of that exists. The existing wage bill grows at a flat 1 per cent a year, one assumed rate standing in for both headcount change and pay policy, and the new-teacher line is the plan's hires at a constant unit price. Attrition, modelled at 3 per cent a year in EM-06, never enters the MTEF, so the framework understates the recruitment needed merely to hold the establishment level. Deployment timing and the year-2 full-year effect are present, in Equation (13.2); the rest is not.

The programme budget is the requirement, not the plan. Table 13.1 sums to 4,373.6 bn, the unconstrained base-year requirement, while the year-1 column of Table 13.2 is 2,493.5 bn, the constrained plan. Both are labelled, but the specification asks for a programme budget on the plan basis, and a submission built from this table would be asking for the requirement.

Execution realism is not assessed. Historical execution rates, release rates and the implied execution improvement the plan demands — per programme and district, flagged above about a 20-point improvement — are not computed at all. The estate holds approved budget lines and no execution data, so the engine cannot distinguish a budget that will be spent from one that will be returned.

External financing is not tracked. The MTEF has one development line, not split into domestic and external, and no external commitment carries an end date. Table 13.4 therefore cannot show the cliff the specification's worked example is built around — external money stopping while the domestic obligation it created keeps rising.

The deflator is one assumed number. $\pi = 5.2$ per cent, flat for five years: not a published path, not tied to a macroeconomic framework, and not differentiated between wages, construction and goods, which have not moved together in Uganda in any recent decade.

The budgeted scenario is the optimiser's enrolment objective, not the run's nominally chosen scenario A — defensible, since A buys nothing, but the budget here and the chosen scenario in Chapter 11 are not the same plan. And the geographic view is district shares only: the per-learner column the specification calls for is not generated, though it is the column read in public. Finally, this is a draft, exploratory run with two of eleven gates waived. No figure here is a ministry position.

13.8 Implications for planning

The most important number in the MTEF is negative, and must not be read as headroom. The financing gap — the plan's total less the envelope — is +51.6 bn UGX in 2026 and then turns: –35.7 bn in 2027, –128.8 bn in 2028, –228.1 bn in 2029, –333.9 bn in 2030. On its face the plan is affordable and increasingly so. That reading would be a serious error. The plan spends less than the envelope in the outer years because **delivery capacity binds before money does**: the classroom programme is fixed at 864 rooms a year, which is what national construction throughput supports, and hiring at what the optimiser found worth doing when rooms, not teachers, bind in 104 of 135 districts. The unfunded requirement has not shrunk — Chapter 11 puts it at 4,554.7 bn UGX, 76.2 per cent of the cost of closing the measured gaps. The sector is not adequately funded; it is unable to spend faster.

For a Ministry of Finance official reading Table 13.2, that distinction changes what the table asks for. It is not a request to hold the education ceiling at the envelope and bank the difference, because the difference is not a saving. It is a request for what a ceiling cannot deliver on its own: capacity to convert money into classrooms — procurement reform, contractor capacity, central and partner construction brought into the same accounting. A ceiling set at the plan's out-year total would lock in the delivery constraint as a policy choice.

Budget the recurrent tail explicitly, before approving the capital. Table 13.4 carries 43.6 bn UGX a year from 2030 onward against a final-year discretionary space of 506.1 bn: more than eight per cent of the room for manoeuvre the plan period leaves its successor, committed by a construction decision and payable for as long as the buildings stand. For a plan built on one of the rule-based scenarios the figure would be several times larger.

The wage share is the line to watch, and the framework is not yet good enough at watching it. At 76.4 rising to 76.8 per cent the sector is within a few points of the level at which non-wage spending stops being possible, and it gets there on a plan hiring 7,286 teachers. Before that figure is relied on, the establishment reconciliation should be built: a wage line growing at a flat 1 per cent cannot represent an approved salary adjustment, a progression increment or an attrition-driven recruitment programme. It is the module's highest-value addition, because the wage share decides whether anything else in this report is purchasable.

Reconcile on a common perimeter next. Two of the three lines in Table 13.5 compare objects that are not the same object, and one therefore reads as a surplus when it is a definitional mismatch. The fix is administrative rather than analytical: a mapping from the engine's programme and economic codes to the MoFPED vote and item structure, held as data — which would also give Equation (13.1) something real to test. With it in place the decomposition of Equation (13.5) becomes computable from the factor traces the chain already carries, and the chapter can do what budget officers need: explain every difference above a threshold, line by line, without anyone writing the explanation by hand.

CHAPTER 14

14 Equity and geography: the atlas

Every number in the preceding ten chapters was assembled district by district before it was reported nationally. The 753,482 primary-age children out of school, the 3,104,924 places short at public primary, the 4,373.6 bn UGX requirement in the base year — none was computed nationally and then shared out. Each is the sum of 135 district results on the pinned geography (UGA-UBOS-2022), and each can be taken apart again. This chapter does that.

It answers a question a national plan cannot: where is the system failing, in what way, and does one place fail like another? Across the maps that follow, it does not. The districts with the most children out of school are not those with the largest place gap; those that cannot reach a school are not those that cannot staff one; those where money goes furthest per child are not those needing the most money. A single map of "educational need" would be a lie of composition. There are thirty-seven maps instead, and they disagree on purpose.

14.1 Why geography is first-class in this engine

Three decisions, taken in `docs/00_SCOPE_AND_PRINCIPLES.md`, make the district the unit of account rather than a presentation layer.

14.1.1 National totals are sums of district results

For any quantity x in dimension k and year t :

$$X_{k,t} = \sum_d x_{k,d,t} \quad (14.1)$$

where X is the national figure, x the district figure, d indexes the 135 districts of the pinned geography and t is the plan year — here the base year 2026, with the horizon to 2030. The order of operations in Equation (14.1) is not a convention. For gaps it is substantive, because a gap is floored at zero before it is summed:

$$G_{k,t} = \sum_d \max(0, R_{k,d,t} - A_{k,d,t}) \geq \max\left(0, \sum_d R_{k,d,t} - \sum_d A_{k,d,t}\right) \quad (14.2)$$

where G is the gap, R the requirement from EM-03 and A the availability from EM-04. The base run puts 122,848 places of public primary surplus on the right-hand side of that inequality — empty seats in Sheema, Mpigi, Bugweri and twelve other districts, which a child in Arua cannot walk to. Geography is what makes netting wrong, and Equation (14.2) is where the engine refuses it.

14.1.2 Distance enters the need calculation

Access is not a service-quality footnote but one of the five gap dimensions, and it is computed from distance:

$$G_{d,t}^{\text{access}} = N_{d,t}(1 - a_{d,t}) \quad (14.3)$$

$$a_{d,t} = \frac{m_{d,t}}{n_{d,t}} \quad (14.4)$$

where N is the school-age population of district d , a its access share, m the settlements whose nearest school serving the cycle lies within the 3 km walking norm and n the total settlements. The national access share is 0.946,

which sounds like a solved problem and is not: through Equation (14.3) it leaves 726,951 children beyond the norm, and ten districts hold 46.1% of them.

14.1.3 Every module puts what it computes on the map

The registry in `src/Geo.jl` declares one `MapLayer` per mapped quantity, naming the module that computed it, its unit, its ramp and the caption stating its quality basis. The run exports **37 layers**, from every link in the chain: three from EM-01 (school-age population, density, growth to the horizon), four from EM-02 (gross enrolment ratio, gross intake rate, out-of-school children and rate), three from EM-03 (places, teachers and classrooms required), twelve from EM-04 (schools, capacity, pupil–teacher ratio, children beyond the norm, and the eight condition layers the census added — improved drinking water at three levels, hand-washing with soap and hand-washing absent, proper waste disposal, and boarding), five from EM-05 (binding constraint, crowding, teacher gap, material gap, quality conditions), two from EM-06 (cost and cost per learner), three from EM-07 (capital programme, induced recurrent cost, proposed sites), two from EM-08 (allocation and financing gap), one from EM-09, one from EM-10 and one from the estimation library. Thirty-six are choropleths; the binding constraint is a class map, since "rooms" and "teachers" are not points on a scale.

The eight condition layers are the newest and the ones to read most carefully. They map what the census counted about the state of schools, not a gap: this engine holds no standard for a water point or a hand-washing station, so there is nothing to difference the count against and nothing on those maps should be read as a shortfall against a target. They are included because the pattern is genuinely different from every other map in the atlas — the districts whose schools have no hand-washing facility are not the districts short of classrooms, and the districts on un-improved water are in the centre and south-west rather than the north-east.

Districts with no measurement are hatched, never shaded as zero: a map that cannot distinguish "none" from "not known" is not shippable. The set is written back out as GIS — `districts_results.geojson` carrying all thirty-seven layers as district properties, plus `proposed_sites.geojson`, `school_points.geojson` and `layers.csv` — so the run opens in QGIS without this engine.

14.2 The geography of need

14.2.1 Where the school-age population is

Primary school-age population

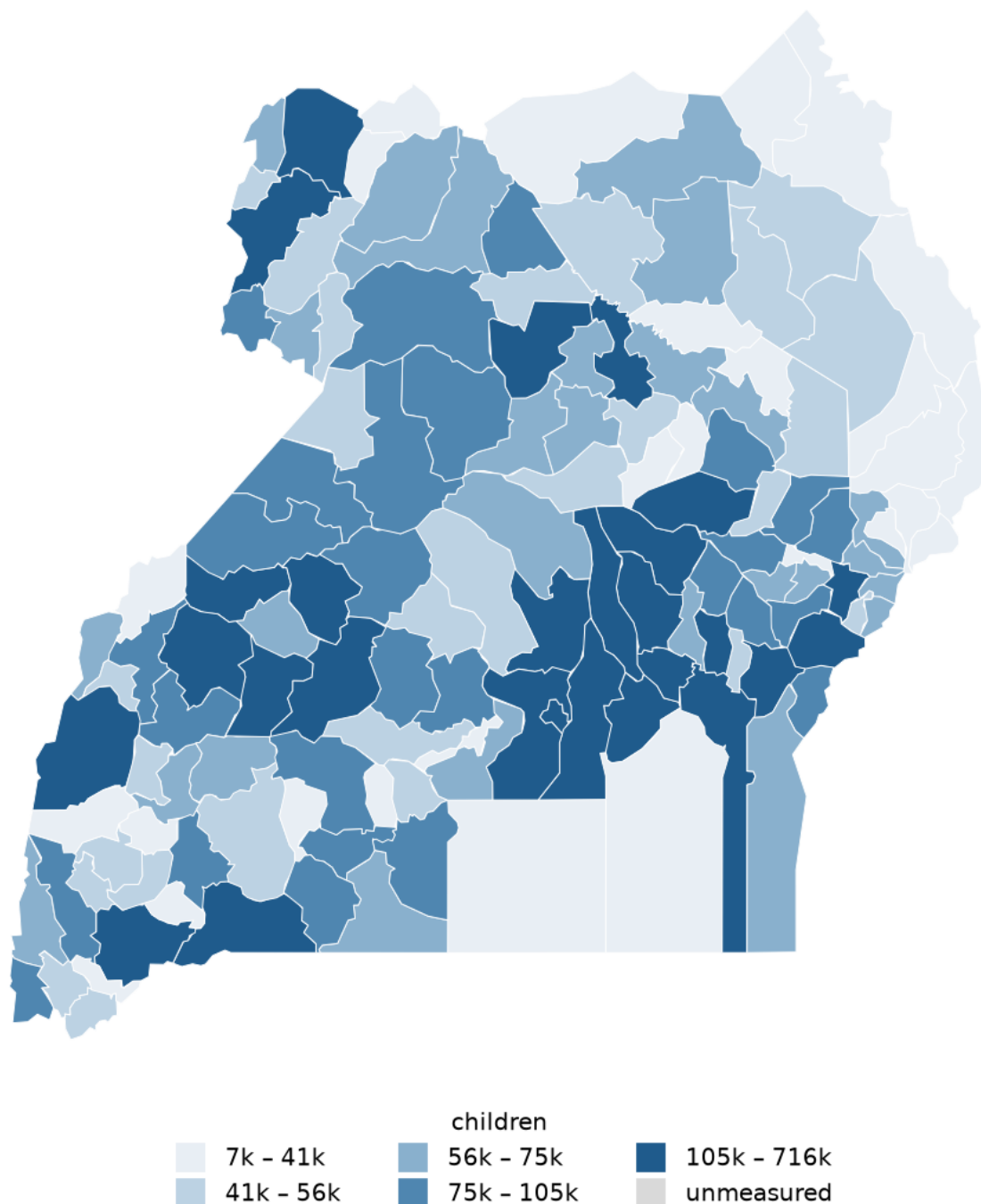


Figure 14.1: Primary school-age population by district, base year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 14.1 is the map every other map must be read against. The base-year primary school-age population runs from **716,074 children in Wakiso** to **7,007 in Obongi** — a factor of 102 between the largest and smallest district on the same administrative tier (Annex C). Kampala follows with 312,799, then Yumbe with 213,525, Kasese with

211,338 and Arua with 190,508; the five largest districts hold 15.1% of the national total. At the other end sit Kalangala with 12,447, Karenga with 19,298, Ntoroko with 19,615 and Moyo with 20,262.

What distinguishes the two ends is not only size. Wakiso and Kampala are the core of a metropolitan area, with a dense child population substantially served by non-state providers; Obongi, Kalangala and Karenga are small, remote and — in Kalangala's case — insular. The same national norm produces a viable school in one and an unviable one in the other — a distinction Figure 14.7 and the cost maps preserve.

14.2.2 Where the population is growing fastest

Growth in school-age population to the horizon

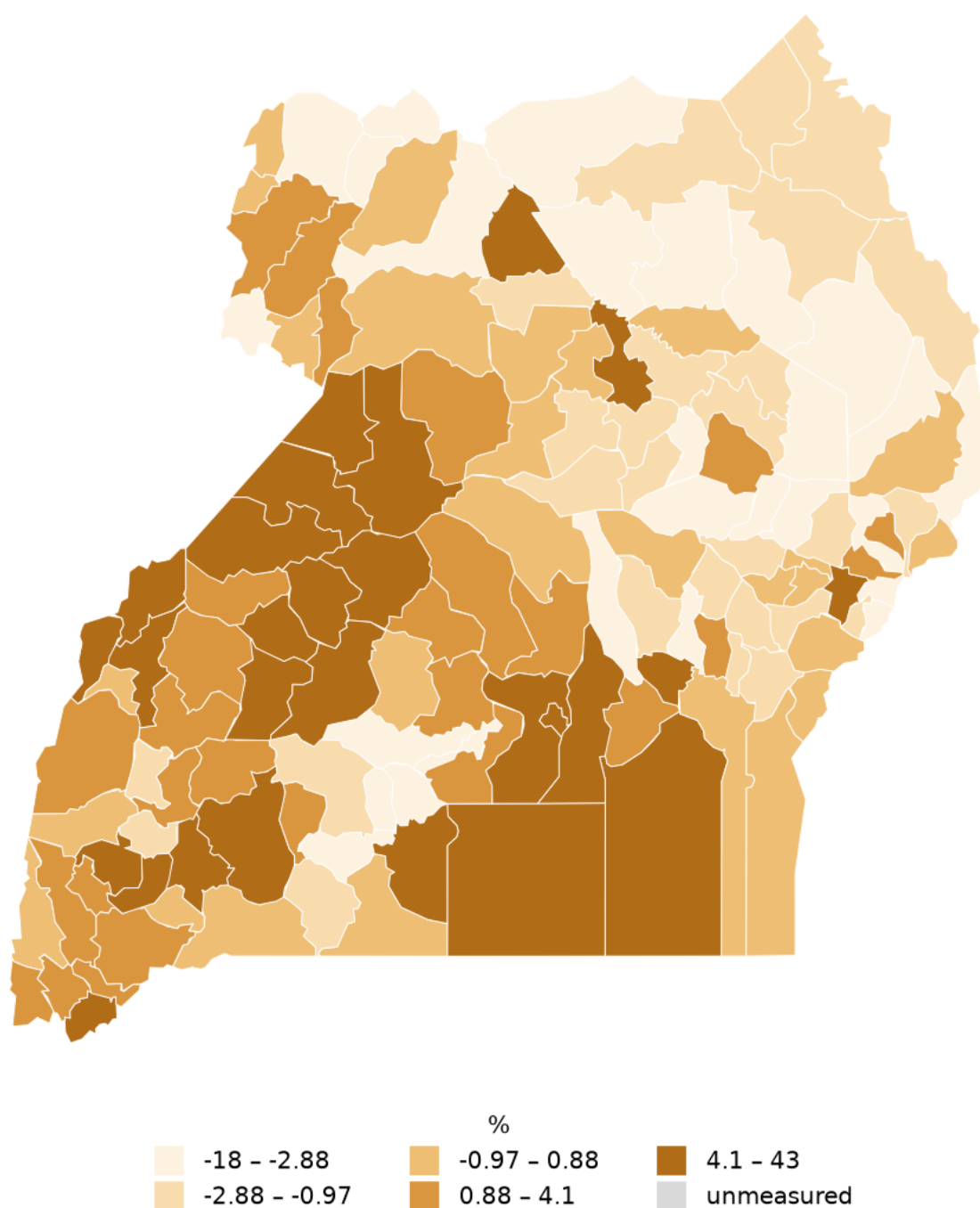


Figure 14.2: Growth in the school-age population to the horizon

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 14.2 draws the percentage change in the 6–12 population between the base year and the horizon, from the cohort-component projection of EM-01. Its planning content is the simplest in the atlas: the classrooms of 2030 are already born, and this map says where they will be sitting. Annex C carries no district growth column, so this chapter names no districts at its extremes and reports the pattern only — a restriction the rule on numbers imposes.

14.2.3 Where children are out of school

Out-of-school rate, primary age

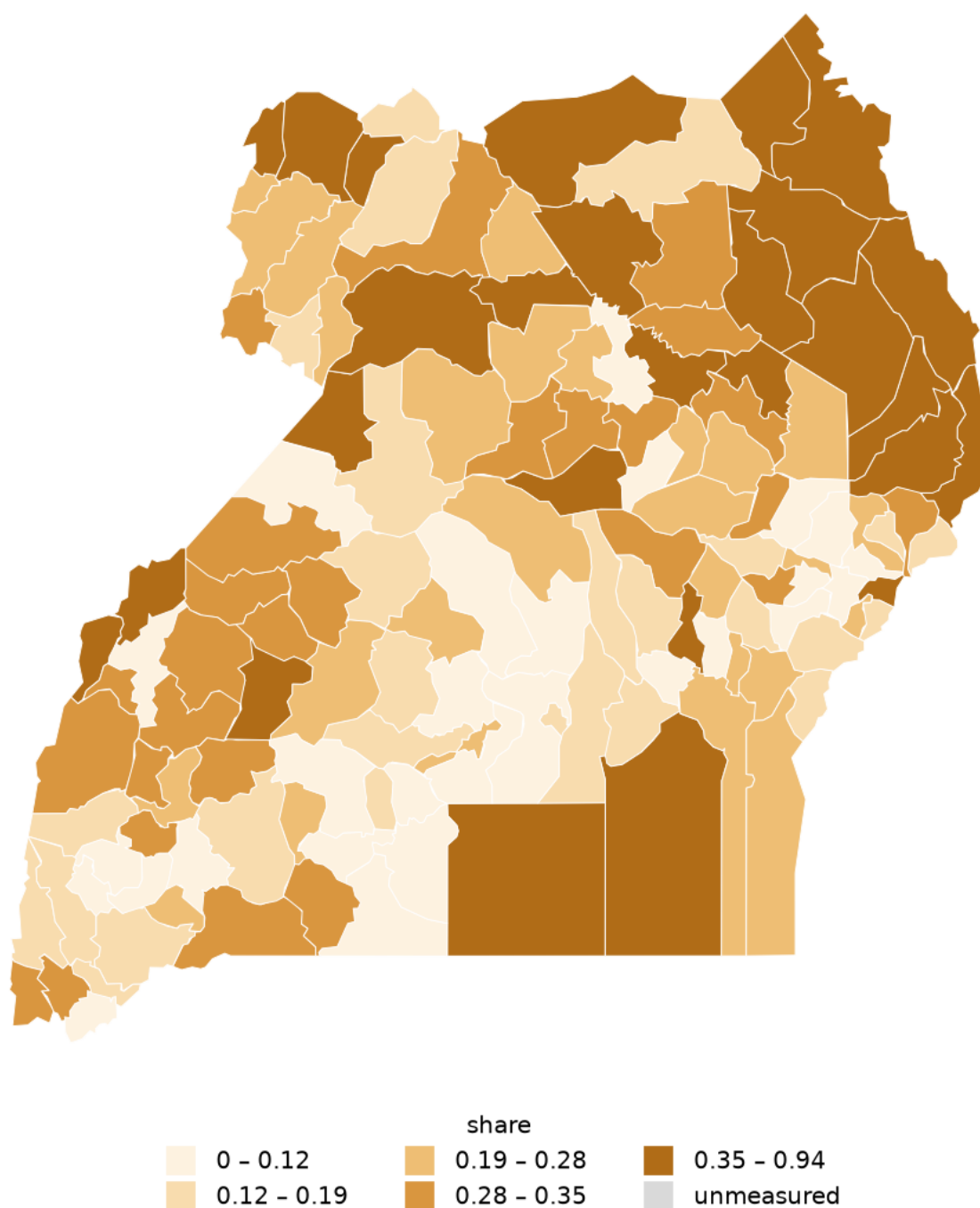


Figure 14.3: Out-of-school rate, primary age

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Figure 14.3 is the incidence map — the same children as the count layer, divided by the age group — and it inverts the population map almost completely. The national primary out-of-school rate is 6.9%. The extremes are **Amudat at 29.7%**, Nabilatuk at 16.1%, Nakapiripirit at 15.7%, Nwoya at 12.7%, Kotido at 11.6% and Wakiso at 11.4%; the lowest are Obongi at 2.9%, Moyo at 3.0%, Pader at 3.4% and Maracha at 3.5% (Annex C). In counts the ordering differs again: Wakiso alone holds 81,877 primary-age children out of school, Kampala 23,690, Yumbe 16,699, Mukono 15,142 and Isingiro 13,502.

Two things distinguish the districts at the top of the rate map. One is real: Amudat enrolls 6,797 primary learners against a 2017 school-age population of 30,964 — a gross enrolment ratio of 0.22, the lowest in the country — from eleven government primary schools. The other is methodological. The out-of-school estimate is a national household-survey rate distributed across districts by inverse administrative GER, and is flagged **imputed**. Districts whose GER exceeds one — Obongi at 2.24, Moyo at 2.16, Pader at 1.90, Maracha at 1.89 — are therefore assigned the lowest rates by construction, and a GER above two signals over-age entry, cross-border attendance or a 2017 register artefact far more readily than a district with almost no excluded children. Figure 14.3 is a defensible allocation of a national total, not a district measurement, and the equity metric in Table 14.1 inherits that status.

14.3 The geography of supply and access

Government primary schools

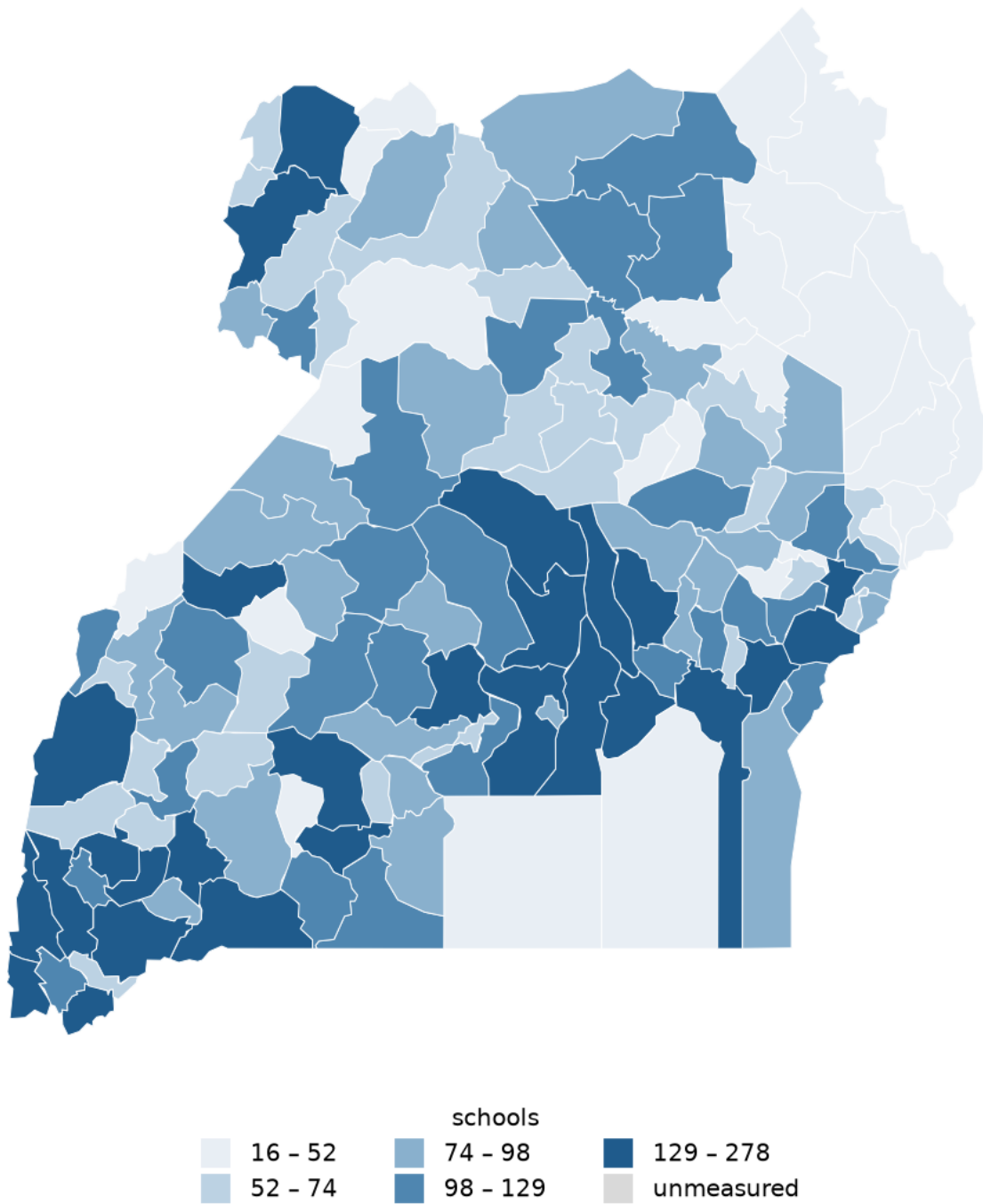


Figure 14.4: Government primary schools by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Primary places available

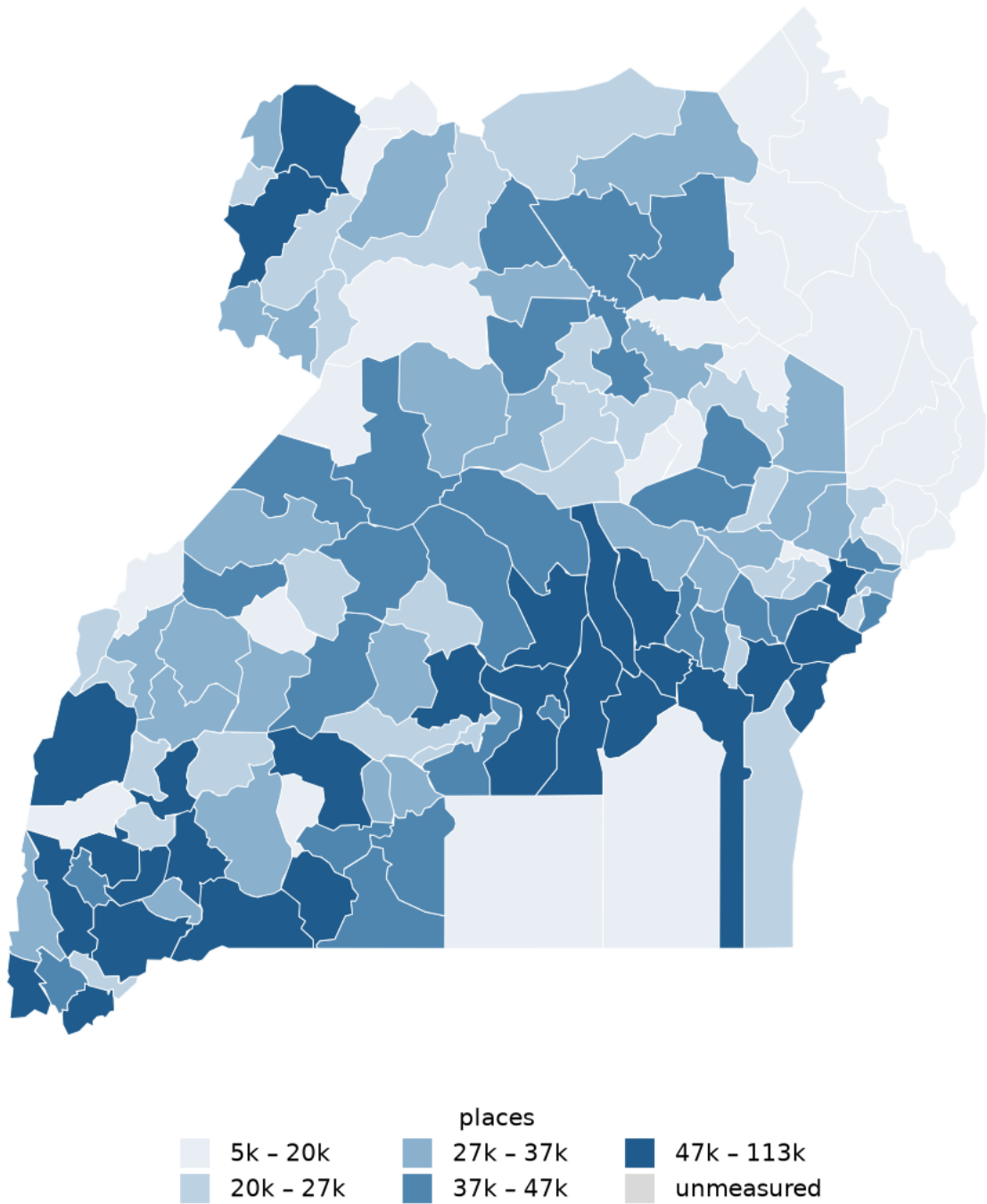


Figure 14.5: Primary places available by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Pupil-teacher ratio, primary

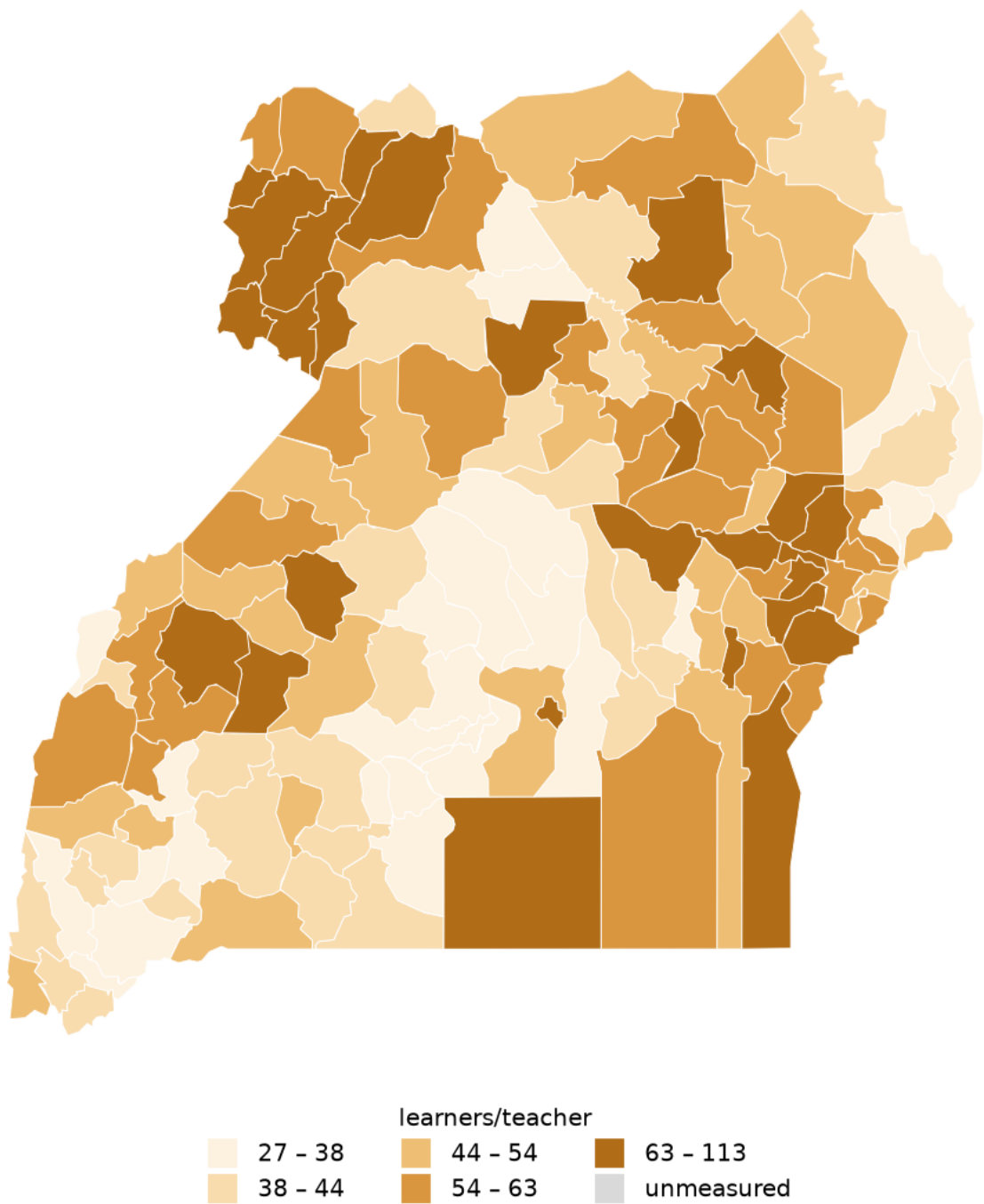


Figure 14.6: Pupil–teacher ratio, primary

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Children beyond the 3 km walking norm

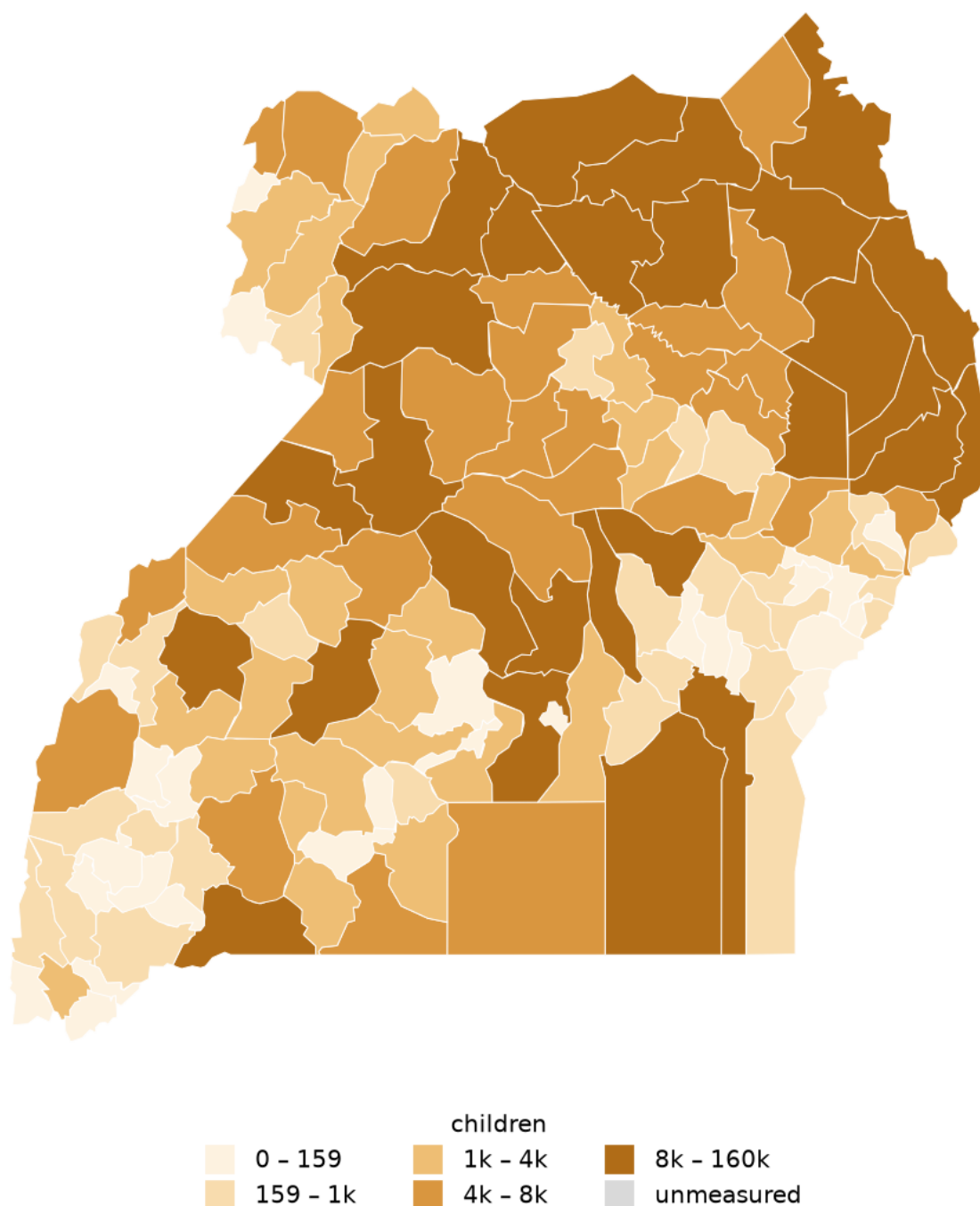


Figure 14.7: Children beyond the 3 km walking norm

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The supply maps come from the 2017 EMIS register, the last district education census Uganda has published, carried forward. Figure 14.4 ranges from **257 government primary schools in Wakiso**, 244 in Kasese and 239 in Ntungamo down to **11 in Amudat**, 16 in Obongi, 17 in Karenga and 20 each in Buvuma and Nabilatuk. Figure 14.5 — places available, the smaller of what rooms allow and what teachers can teach — reorders that list: Arua leads with 114,943, then Kasese with 113,163 and Ntungamo with 109,244, Wakiso only fourth at 107,859 despite the largest network and by far the largest child population. Figure 14.6 sets public learners against teachers in post; its caption records that the payroll count differs from the in-post count by 20,982 teachers nationally, the two

reported separately rather than reconciled. Figure 14.7 makes distance visible: the access share runs from **0.42 in Amudat** through Napak at 0.50, Nabilatuk at 0.56, Kotido at 0.62, Karenga at 0.63 and Kalangala and Lamwo at 0.67, up to a measured 1.00 in Budaka, Bugweri, Busia and three other districts.

14.3.1 Sparsity and density are different problems

Which instrument a district needs depends on which situation its access gap describes, and Figure 14.7 must be read against Figure 14.1 to tell them apart.

Sparsity: few children, spread far. Amudat has 23,733 children beyond the walking norm out of a primary school-age population of 40,919, eleven government schools, 86 usable classrooms and 81 teachers in post; its place gap is 3,066 and its classroom gap 89. Schools built there at the national siting norm would each serve very few children. The gap is soluble, but by satellite classes, multigrade teaching, mobile provision, transport or boarding — not by a standard classroom block. Napak (22,452 children beyond the norm, 28 schools) and Kotido (19,829, 21 schools) are the same shape.

Density: many children, too few places. Wakiso has **160,072 children beyond the norm — 22.0% of the national total** — while operating the country's largest government school network. Its 2017 GER is 0.571, the lowest outside Karamoja, because much of its child population sits in non-state classrooms the public supply register does not count. The instrument is not a satellite class in a rangeland; it is public places in settlements already holding thousands of children within walking distance of each other.

Crowding with no distance problem at all. Arua records an access share of 0.994 and 1,160 children beyond the norm, Maracha 1.000 and zero — yet they carry the largest and second-largest place gaps in the country, 192,059 and 103,602 places. Their problem is entirely inside schools that already stand, and a programme allocating on access alone would send them nothing.

14.3.2 The condition of schools is a different map again

Government primary schools with water and soap for hand-washing

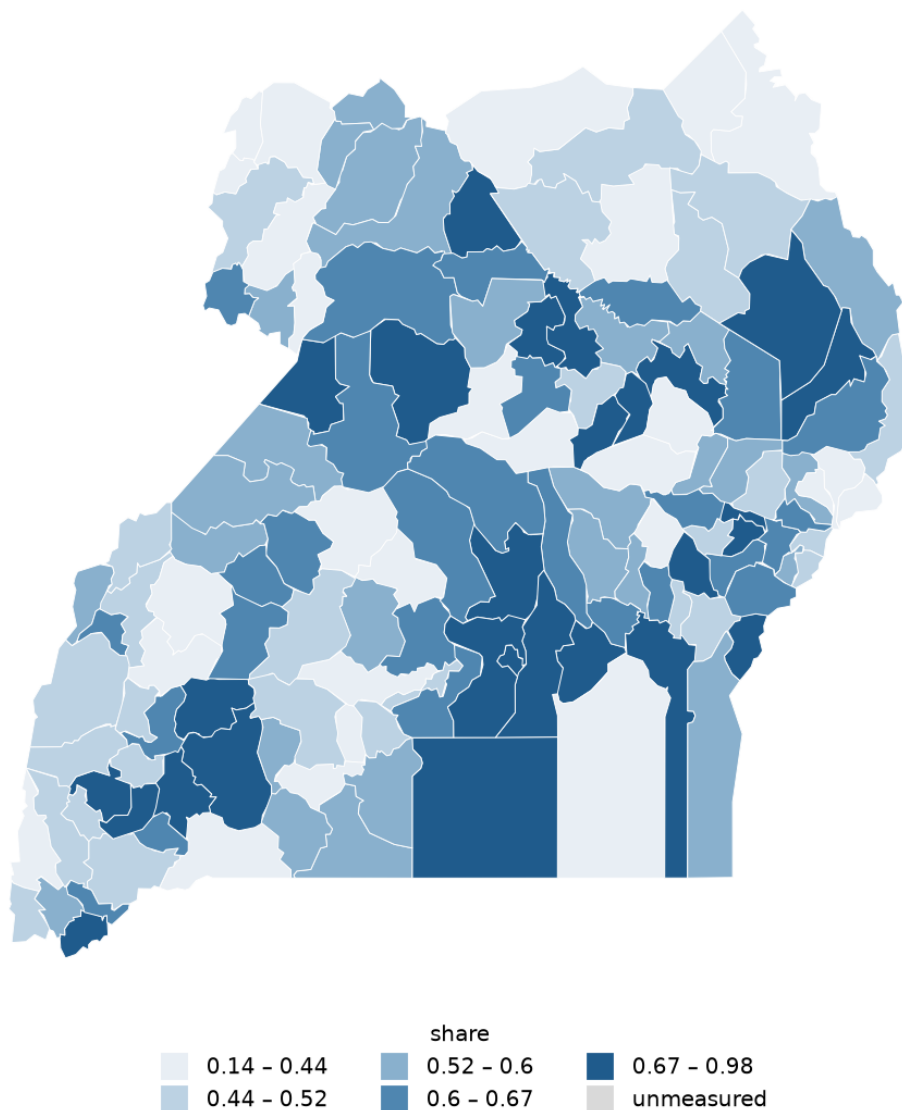


Figure 14.8: Government primary schools with water and soap for hand-washing

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Government secondary schools on an improved drinking-water source

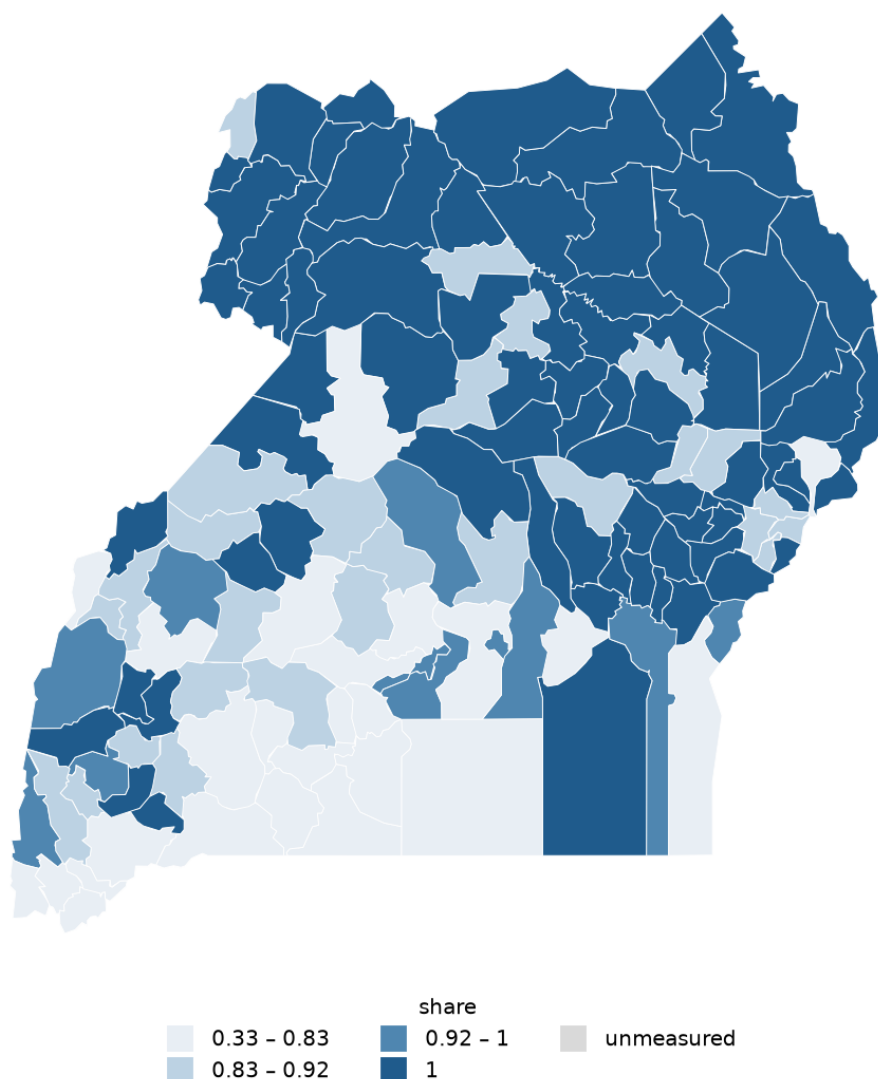


Figure 14.9: Government secondary schools on an improved drinking-water source

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The eight condition layers the census added are the clearest demonstration of this chapter's argument, because they are the layers least like the others. Figure 14.8 shows the share of government primary schools with both water and soap for hand-washing. It reaches 0.98 in Kampala and 0.94 in Kabale, and falls to 0.14 in Karenga, 0.24 in Lamwo and 0.25 in Gomba — a low set that runs from the north-east through the north to central Uganda (Kamwenge, Serere, Agago, Kween, Kaabong) and shares no obvious boundary with any other map here. Figure 14.9, improved drinking water at government secondary schools, is different again: the lowest shares are in Rakai, Kalangala, Kisoro and Buikwe, none of which appears on any other map in this atlas as badly served.

Read these two maps against Figure 14.11 and Figure 14.12 and the point is hard to avoid. A district can have enough classrooms, enough teachers, and no soap. Averaging those three into an index would make all three invisible; mapping them separately makes each one addressable by the instrument that can actually fix it — which for soap and a borehole is not the education development grant at all, and that is itself a finding worth having on a map.

These are counts of condition and not gaps. Nothing on them is a shortfall against a standard, because no standard exists; the shading is the state of the stock as enumerated.

14.4 The geography of the gaps

Crowding: public learners per available place

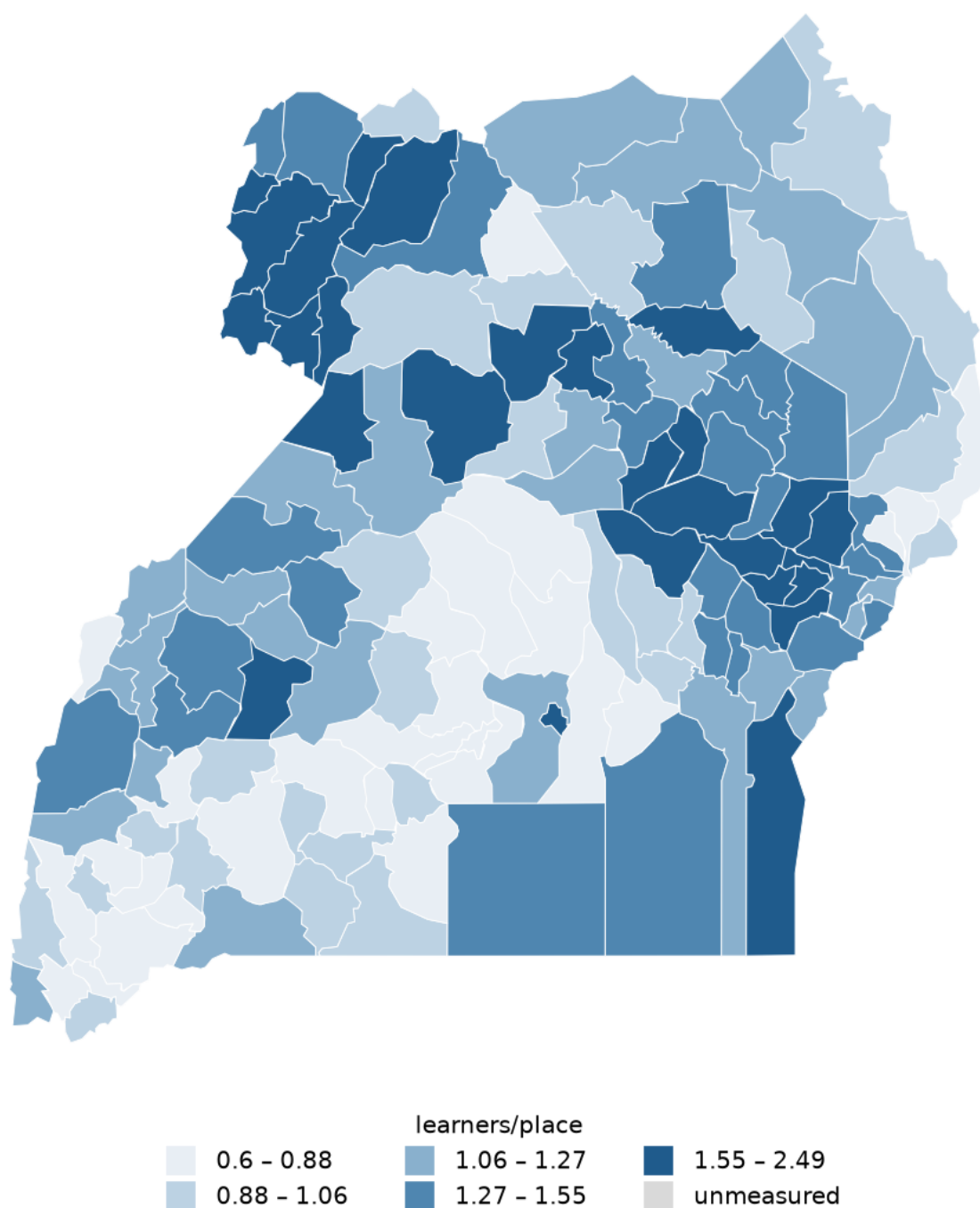


Figure 14.10: Crowding: public learners per available place

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

What binds: rooms or teachers

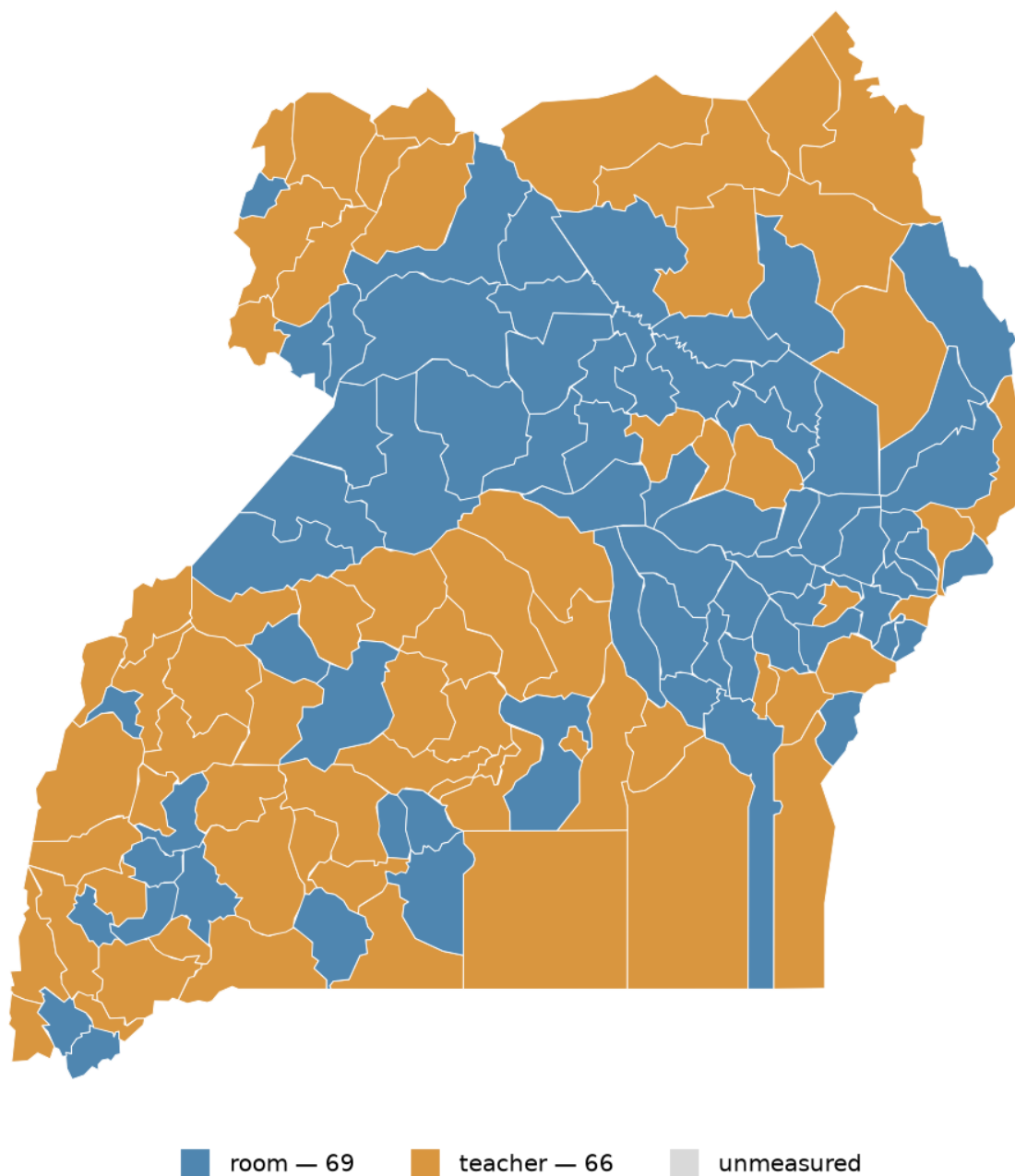


Figure 14.11: What binds capacity: rooms or teachers

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Primary teacher gap per 1,000 public learners

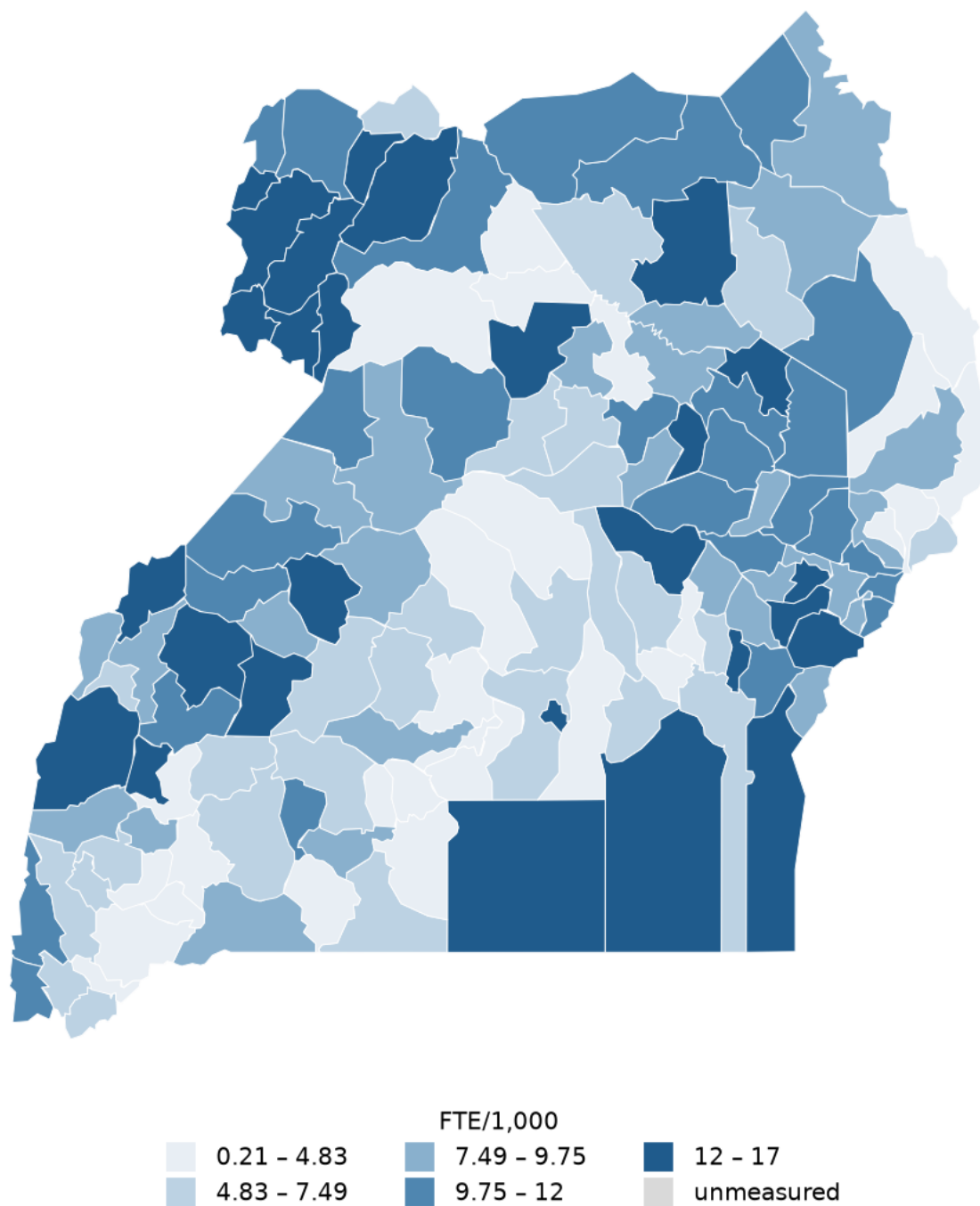


Figure 14.12: Primary teacher gap per 1,000 public learners

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Latrine stance gap per 1,000 public learners

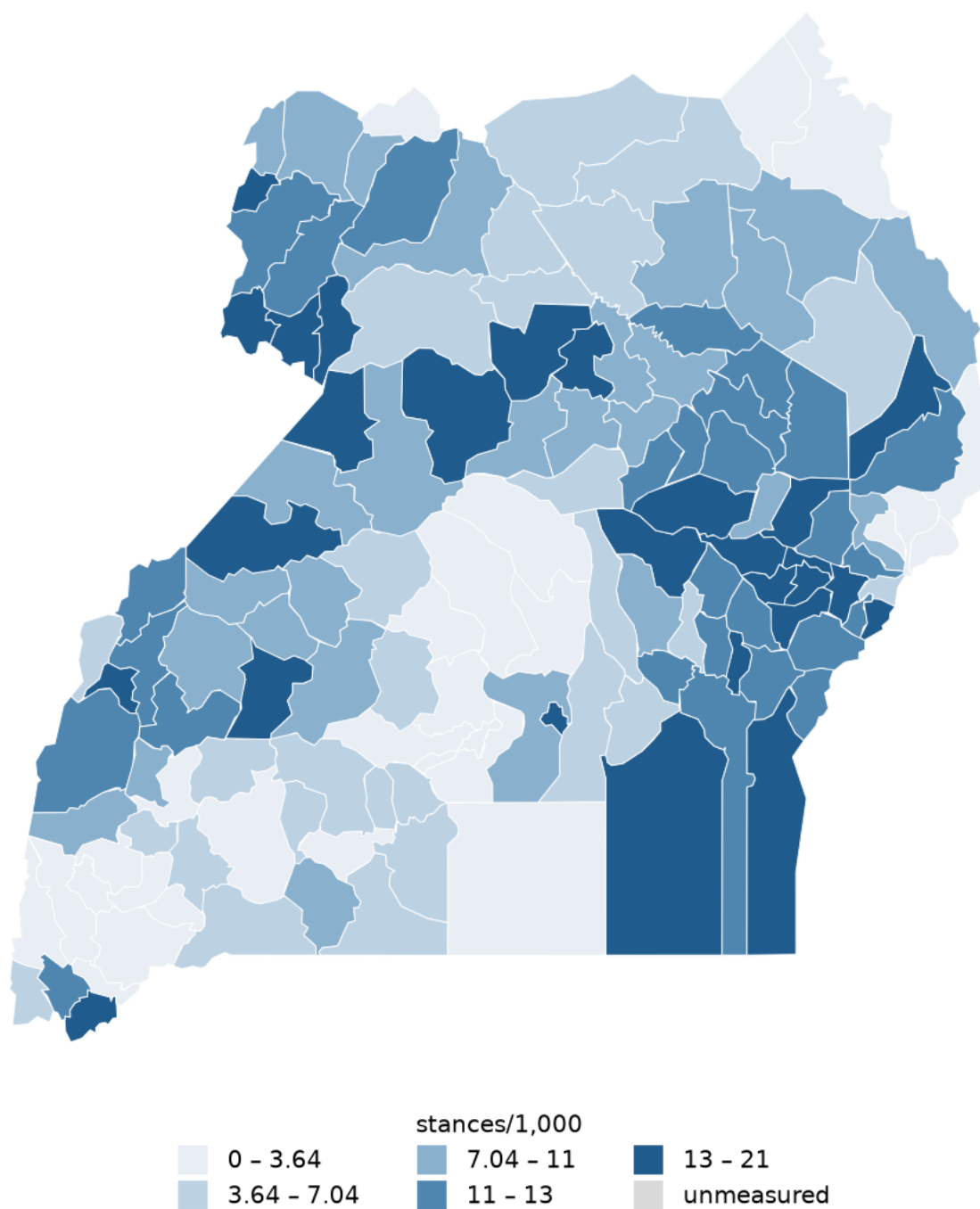


Figure 14.13: Latrine stance gap per 1,000 public learners

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Quality conditions failing (of four)

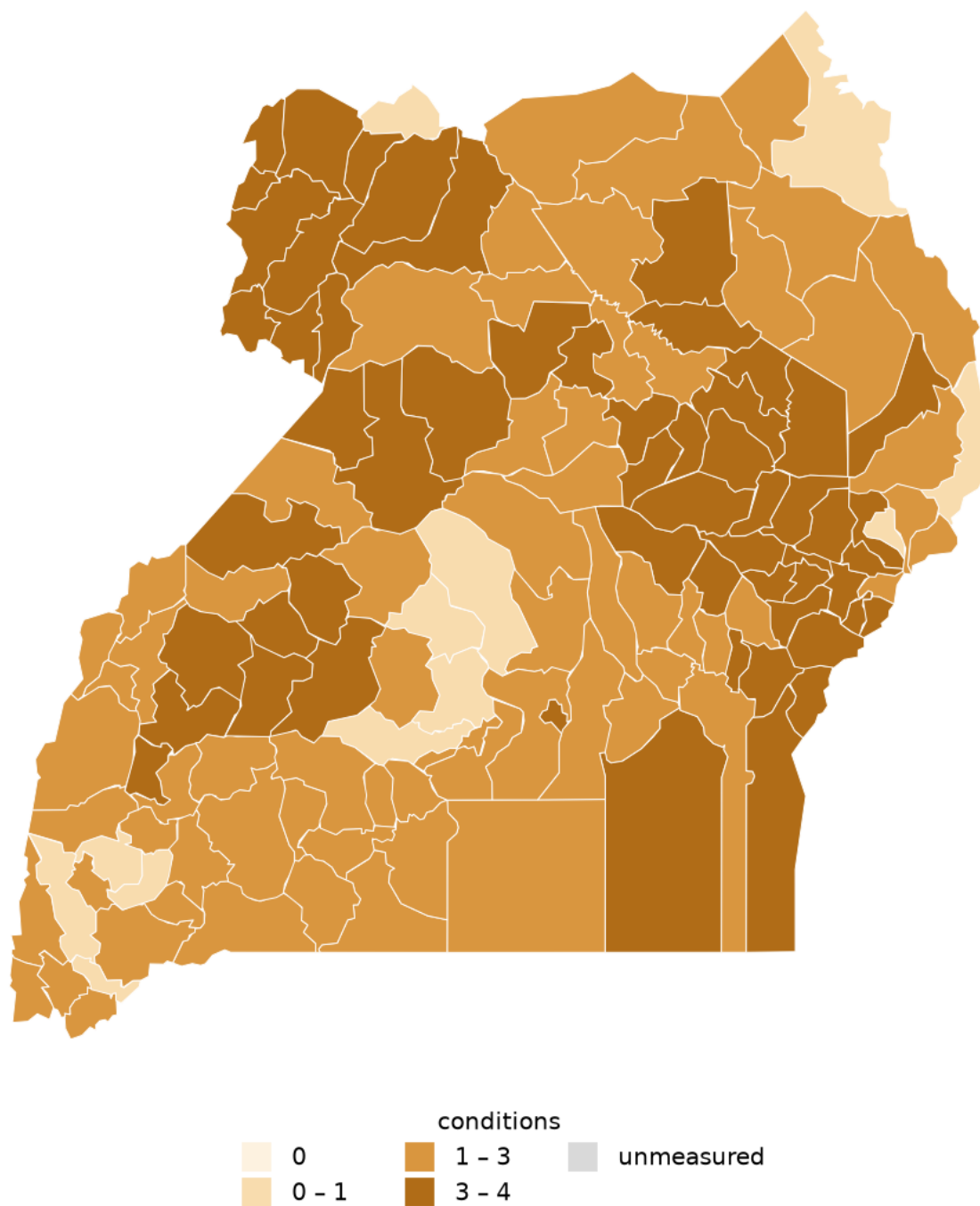


Figure 14.14: Quality conditions failing, of four

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The five gap maps are the heart of the atlas and the reason there is no sixth summarising them. Figure 14.10 draws crowding as public learners per available place. Figure 14.11 classifies each district by what limits its capacity: **104 are room-bound, 31 teacher-bound**. The distinction is operational — a teacher-bound district receiving a classroom construction grant has been mis-served by its planning system, and this map surfaces the defect before the grant is signed. Figure 14.12 normalises the teacher gap so that large and small districts are comparable:

$$g_d^{\text{teach}} = 1000 \frac{G_d^{\text{teacher}}}{E_d^{\text{pub}}} \quad (14.5)$$

where G is the district's full-time-equivalent teacher gap from the timetable calculation and E its public primary enrolment. Figure 14.13 applies the same normalisation to the latrine stance gap, and Figure 14.14 counts how many of four stated conditions fail — class size above 53, pupil–stance ratio above 40, trained-teacher share below 80%, pupil–teacher ratio above 53. The counts stay counts: twelve districts fail none, 19 fail one, 39 fail two, 54 fail three and 11 fail all four, for 303 failing conditions nationally in schools holding 7,805,262 learners.

14.4.1 The dimensions do not overlap

The case against a priority index is empirical, and the district gap matrix in Annex C settles it. Take the twenty worst districts on each of five measures — primary out-of-school children, children beyond the walking norm, the place gap, the teacher gap and the stance gap. Those five lists contain **54 distinct districts**, and **exactly one, Kyenjojo, appears on all five**. The out-of-school list shares three districts with the place-gap list and three with the teacher gap; children beyond the norm shares two with the place gap. Only the supply-side gaps overlap substantially — place and teacher share sixteen of twenty, place and stance fifteen.

The same disjunction appears inside the place dimension. **Seventeen districts have a classroom gap and no teacher gap at all; eleven have a teacher gap and no classroom gap**. Fifteen have a place surplus, three of them alongside a teacher deficit — rooms empty for want of staff, a redeployment question rather than a budget one. Twenty districts have no primary teacher gap, twenty-four no stance gap, twenty-two no child beyond the norm.

Three districts make it concrete. **Wakiso** has a teacher gap of zero and a classroom gap of 1,000; it is room-bound, and carries the country's largest untrained-teacher count at 1,004. It needs construction and in-service training, and not one recruitment. **Kampala** is the same shape — teacher gap zero, classroom gap 998, place gap 37,153. **Agago** is the reverse: teacher-bound, a teacher gap of 1,184 against a classroom gap of 966, all four quality conditions failing. A composite index would place the three on one line labelled "need" and destroy exactly the information that decides what each should be sent.

14.5 The geography of money

Requirement per public primary learner

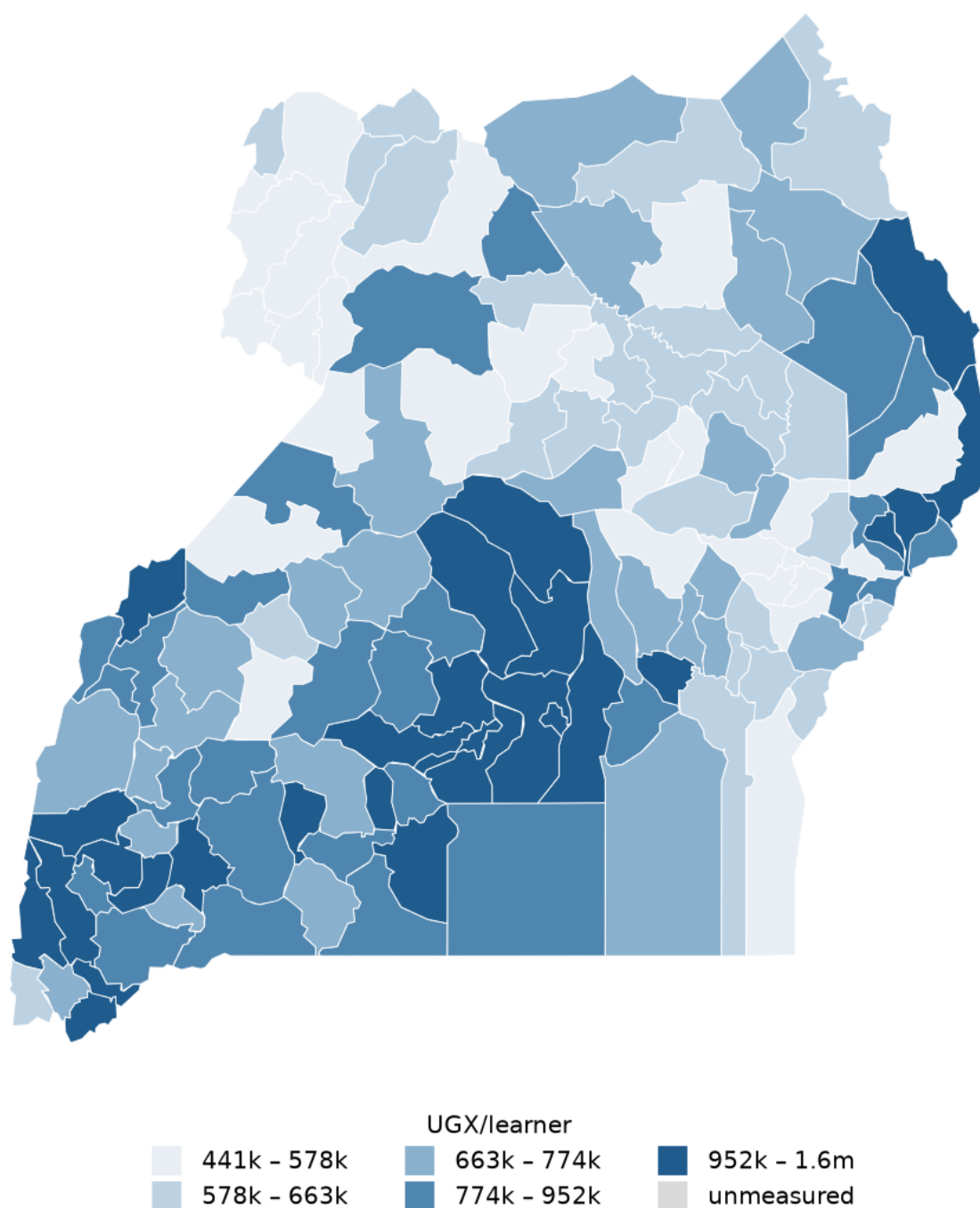


Figure 14.15: Requirement per public primary learner

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Capital programme by district

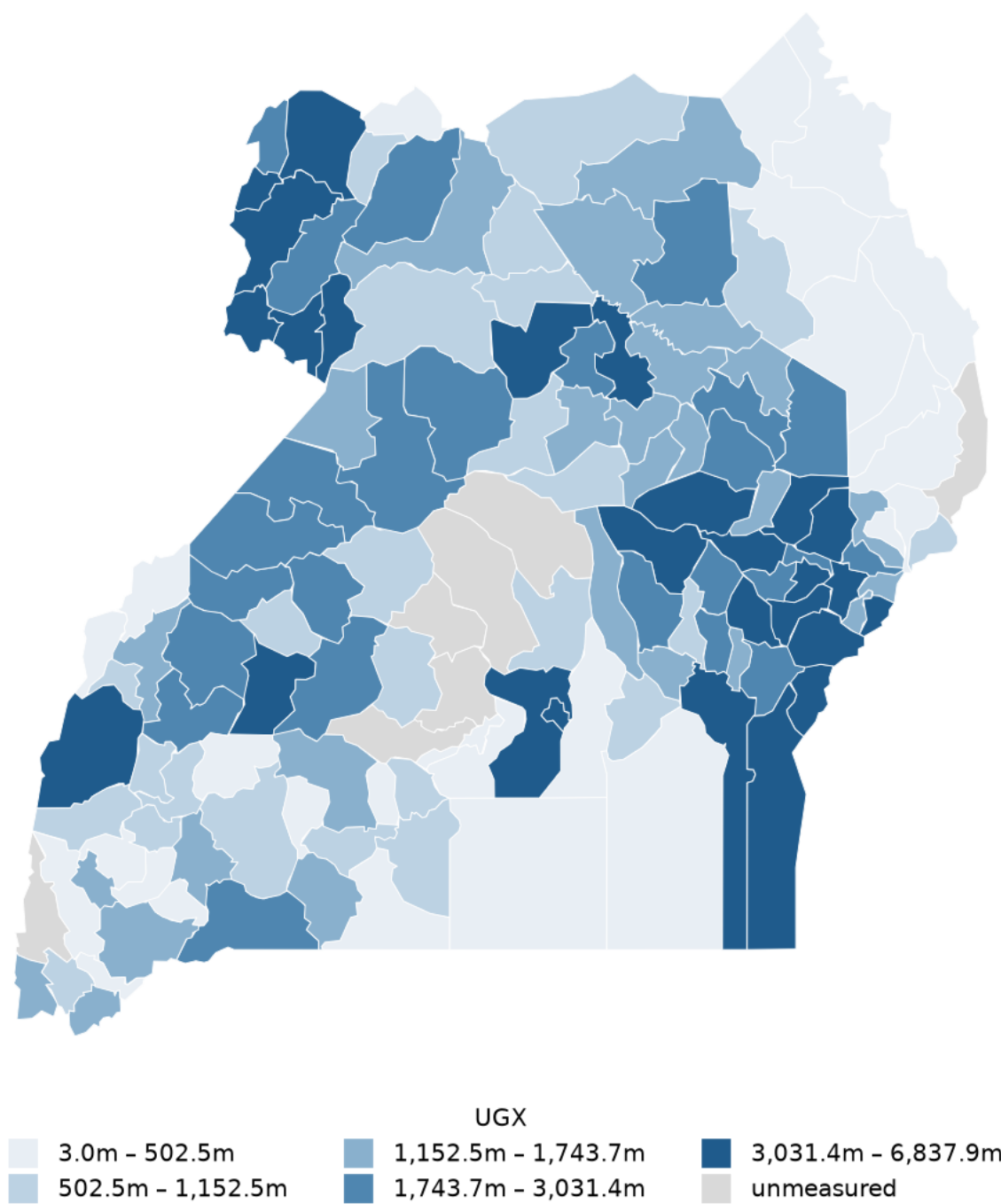


Figure 14.16: Capital programme by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Induced recurrent cost of the capital programme

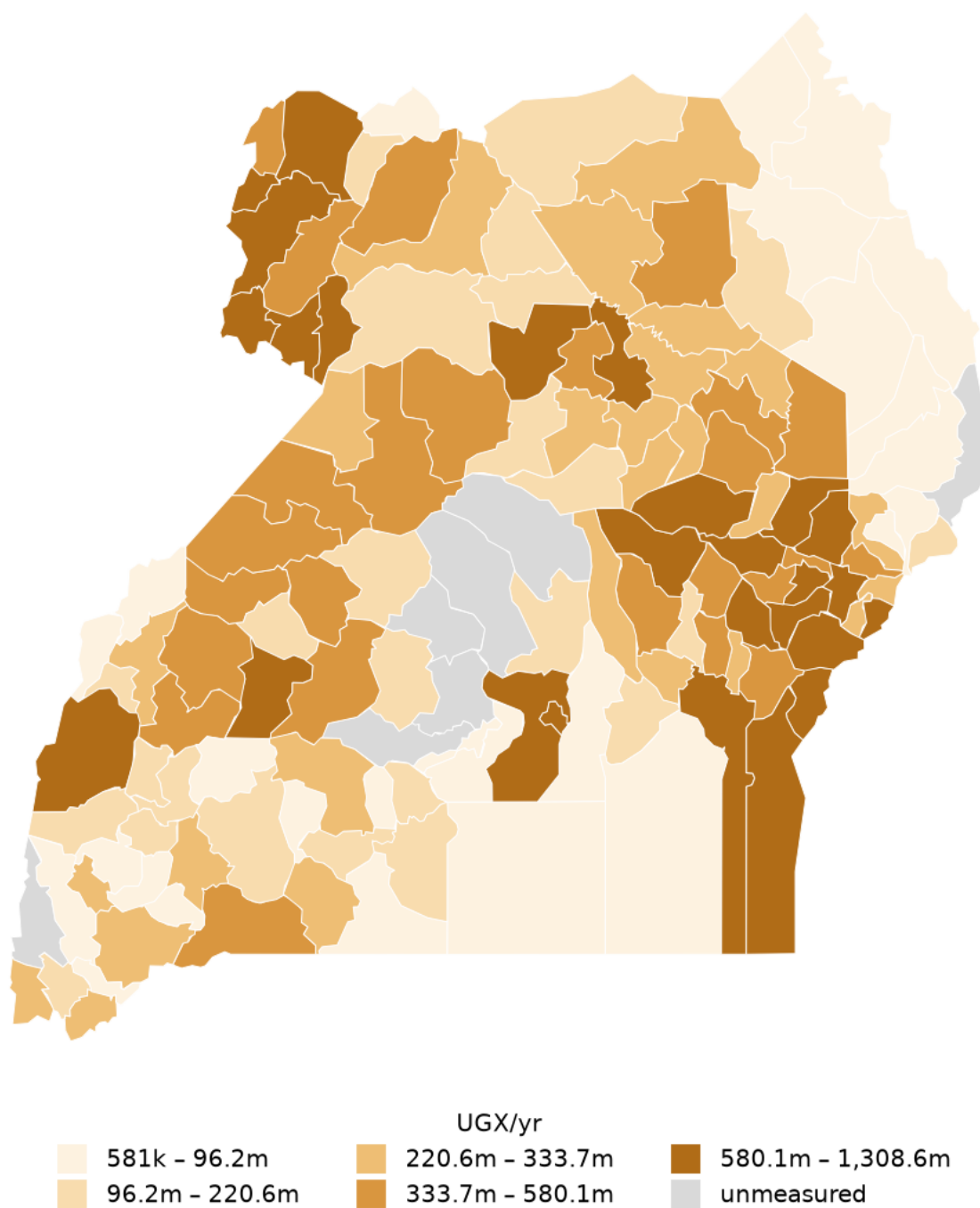


Figure 14.17: Induced recurrent cost of the capital programme

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Financing gap per year

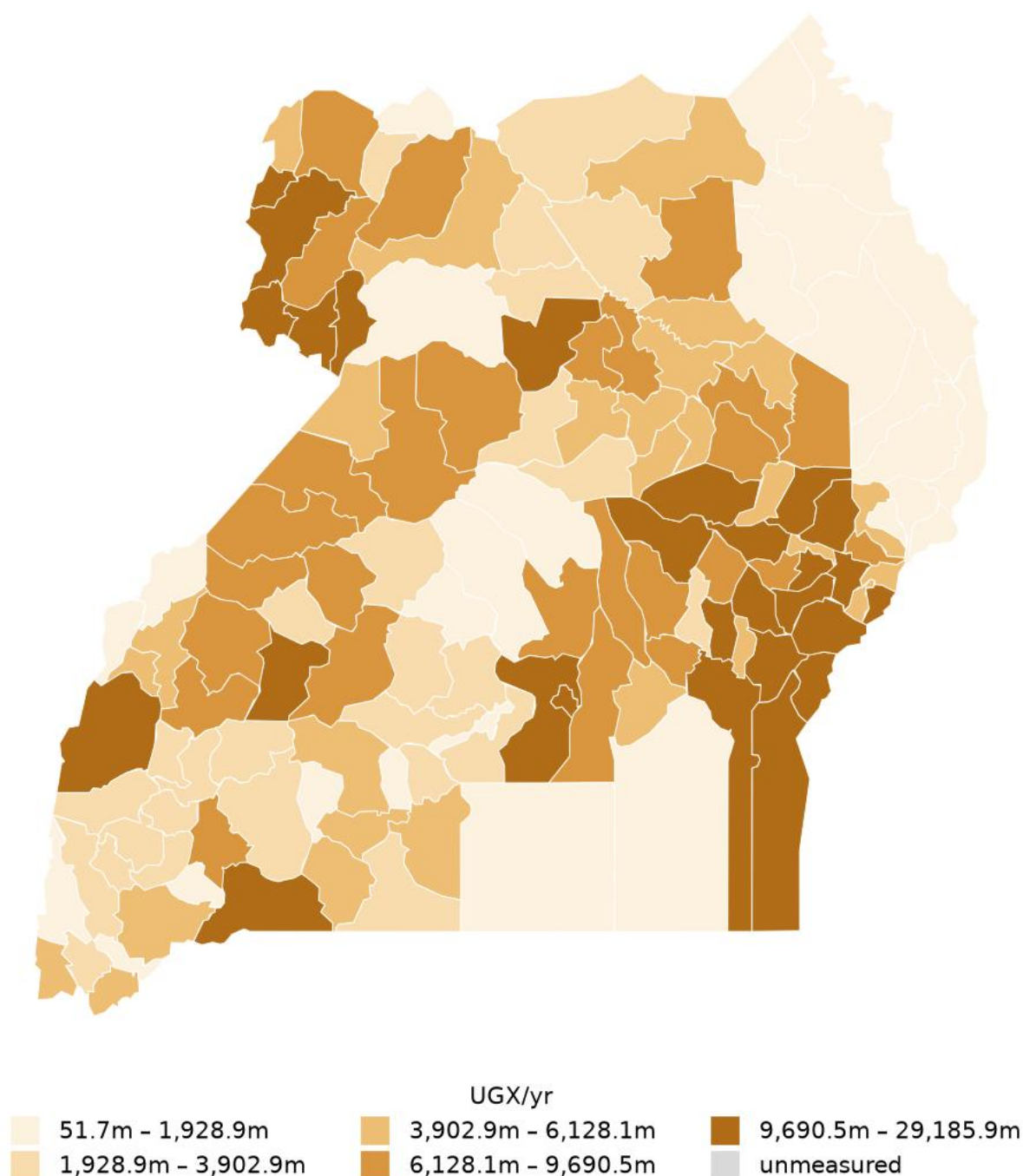


Figure 14.18: Financing gap per year

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

The cost layer, `map_cost`, draws the base-year requirement by district: **Arua at 145 bn UGX**, Tororo at 85 bn, Kampala at 83 bn, Wakiso at 82 bn and Kasese at 81 bn, against **Amudat at 5.1 bn**, Obongi at 6.4 bn and Kalangala at 6.7 bn. Read alone it says little the population map has not said. Across the 135 rows of Annex C the district requirement correlates **0.91** with enrolment and 0.67 with the school-age population, because a district's bill is mostly its learners multiplied by a unit cost that is 65.9% salary; even Arua, the largest single line, is 3.3% of the national requirement. The cost map is a map of learners with a little structure on top.

Figure 14.15 removes the population term:

$$u_d = \frac{C_d}{E_d} \quad (14.6)$$

where C is the district requirement and E its learners. Computed over the annex tables, the requirement per enrolled learner runs from **270,971 UGX in Wakiso** and 306,910 in Luuka up to **999,100 in Kotido, 1,129,411 in Nabilatuk, 1,171,282 in Nakapiripirit and 1,205,461 in Kalangala** — a factor of 4.4, against a national normative unit cost of 326,551 UGX per learner-year. (The published layer divides by public rather than all enrolled learners, so its values differ.) The per-learner map is the sparsity map in money: small schools, short class lists and fixed staffing minima mean the districts needing least in total need most per child. A per-capita rule underfunds them; a per-district rule overfunds them.

Figure 14.16 and Figure 14.17 are a pair and never shown apart. The capital programme builds 4,320 classrooms over the horizon — 864 a year at 45.5 bn UGX a year, 227.7 bn in total — and each obliges a teacher and a capitation grant thereafter. Figure 14.17 draws that obligation: 8.7 bn UGX a year induced by each year's construction, and for the rule-based scenarios a tail of 258 bn UGX a year continuing past the horizon. Principle P6 — capital always carries its induced recurrent cost — is here carried onto the map, so no district appears as a construction opportunity without appearing as a future wage and capitation obligation.

Figure 14.18 closes the sequence. Closing the measured gaps costs 5.98 tn UGX; the cumulative discretionary envelope over 2026–2030 is 1.42 tn; the financing gap is **4.55 tn UGX**. Per year and by dimension the requirement is 950 bn for places, 127 bn for materials and 118 bn for teachers, against zero funded in each.

14.6 Equity in the allocation

Table 14.1: The share of new places reaching the worst-served fifth of districts

Scenario	Share To Worst Quintile	New Places
A current trajectory		0
OPT enrolment	0.093	416,902
B universal basic completion	0.295	372,809
D post-basic expansion		0
E geographic equity	0.126	351,804
C foundational learning	0.035	356,321
F demographic pressure	0.257	384,348
OPT equity_weighted $\gamma=2.0$	0.132	416,902

Source: EPRAS run 6b2afcf6 (report/build/data/t_equity.csv).

Table 14.1 asks one question of each allocation rule: of the new places it buys, what share reaches the worst-served fifth of districts?

$$\sigma = \frac{\sum_{d \in W} p_d}{\sum_d p_d} \quad (14.7)$$

where p is the new places a rule buys in district d and W is the set of districts whose primary out-of-school rate is at or above the 80th percentile. On this run that threshold is a rate of 7.5% and W holds 27 districts, among them Amudat, Kotido, Nabilatuk, Nakapiripirit, Napak, Nwoya, Kampala and Wakiso.

Scenario C, foundational learning, sends **1.4%** of its 333,344 new places to the worst-served fifth; scenario E, geographic equity, 19.0% of 330,602; the equity-weighted optimiser run at $\gamma=2.0$, 21.2% of 464,027; the enrolment optimiser, 30.8% of the same 464,027; scenario F, demographic pressure, 57.0% of 419,177; and scenario B, universal basic completion, **81.4%** of 309,855. Scenarios A and D buy no new places, so the share is undefined and left blank rather than written as zero.

The spread is a finding about rules, not districts. The same envelope, the same construction-throughput ceiling and the same teacher pipeline produce a fifty-eight-fold difference in incidence depending only on the criterion the allocation is written against. The count of districts reached moves the same way: B funds 17 districts, 12 of them in the worst-served fifth; C funds 12, of which 2; E funds 15, of which 6; F funds 26, of which 12; both optimiser runs fund 30, of which 10.

Two cautions follow, neither a recommendation. A rule's name does not predict its incidence: "geographic equity" reaches the worst-served fifth less than "demographic pressure" and less than the unweighted enrolment optimiser, and the equity-weighted optimiser run reaches it less than the objective it was meant to improve on — because the weight inside the optimiser is defined on a different criterion from the one Equation (14.7) scores. And the metric is only as good as its denominator, the imputed out-of-school rate discussed above: membership of W rests on an inverse-GER allocation of a national survey total, not a district measurement. No rule in Table 14.1 is recommended, best, preferred or optimal; the table exists so the choice between them is made in the open.

14.7 Equity beyond geography

District maps answer "where", not "who". The survey series held alongside the run are the only place that question is answered at all.

Table 14.2: Attendance, completion and out-of-school rates from the household survey, by sex and residence

Indicator Code	Indicator Name	Sex	Disaggregation	Year	Value
ED_15-24_LR		F	_T	2018	89.95
ED_15-24_LR		M	_T	2018	88.83
ED_15-24_LR		_T	_T	2018	89.4
ED_ANAR_L02		F	_T	2016	73.46
ED_ANAR_L02		M	_T	2016	71.23
ED_ANAR_L02		_T	Q1	2016	46.51
ED_ANAR_L02		_T	Q2	2016	65.38
ED_ANAR_L02		_T	Q3	2016	76.22
ED_ANAR_L02		_T	Q4	2016	86.61
ED_ANAR_L02		_T	Q5	2016	94.39
ED_ANAR_L02		_T	_T	2016	72.32
ED_ANAR_L1		F	_T	2016	85.4
ED_ANAR_L1		M	_T	2016	84.2
ED_ANAR_L1		_T	Q1	2016	76.8
ED_ANAR_L1		_T	Q2	2016	84.5
ED_ANAR_L1		_T	Q3	2016	86.4
ED_ANAR_L1		_T	Q4	2016	86.8
ED_ANAR_L1		_T	Q5	2016	91.5
ED_ANAR_L1		_T	_T	2016	84.8
ED_ANAR_L2		F	_T	2016	20.5
ED_ANAR_L2		M	_T	2016	18.2
ED_ANAR_L2		_T	Q1	2016	5.5
ED_ANAR_L2		_T	Q2	2016	9.1
ED_ANAR_L2		_T	Q3	2016	16.6
ED_ANAR_L2		_T	Q4	2016	26.6
ED_ANAR_L2		_T	Q5	2016	42.5

Indicator Code	Indicator Name	Sex	Disaggregation	Year	Value
ED_ANAR_L2		_T	_T	2016	19.4
ED_ANAR_L3		F	_T	2016	7.1
ED_ANAR_L3		M	_T	2016	8.6
ED_ANAR_L3		_T	Q1	2016	0.7
ED_ANAR_L3		_T	Q2	2016	2.6
ED_ANAR_L3		_T	Q3	2016	2.1
ED_ANAR_L3		_T	Q4	2016	8.7
ED_ANAR_L3		_T	Q5	2016	21
ED_ANAR_L3		_T	_T	2016	17.3
ED_CR_L1		F	_T	2016	43.37
ED_CR_L1		M	_T	2016	39.02
ED_CR_L1		_T	Q1	2016	17.24
ED_CR_L1		_T	Q2	2016	25.28
ED_CR_L1		_T	Q3	2016	39.85

UNICEF SDMX, 2016 reference year — the survey counterpart to the administrative participation rates the engine computes. Restricted-source rule: aggregates only. Source: EPRAS run 6b2afcf6 (report/build/data/t_unicef_attendance.csv).

Table 14.3: Education indicators from the Demographic and Health Surveys

Indicator Code	Indicator Name	Year	Sex	Value
ED_EDUC_M_NED	Men with no education	1995	Total 15-49	11.3
ED_EDUC_M_NED	Men with no education	2000	Total 15-49	5.9
ED_EDUC_M_NED	Men with no education	2004	Total 15-49	8.3
ED_EDUC_M_NED	Men with no education	2006	Total 15-49	4.9
ED_EDUC_M_NED	Men with no education	2011	Total 15-49	5.6
ED_EDUC_M_NED	Men with no education	2016	Total 15-49	3.8
ED_EDUC_M_PRI	Men with primary education	1995	Total 15-49	62.7
ED_EDUC_M_PRI	Men with primary education	2000	Total 15-49	65.1
ED_EDUC_M_PRI	Men with primary education	2004	Total 15-49	60.6
ED_EDUC_M_PRI	Men with primary education	2006	Total 15-49	65
ED_EDUC_M_PRI	Men with primary education	2011	Total 15-49	56.8
ED_EDUC_M_PRI	Men with primary education	2016	Total 15-49	54.9
ED_EDUC_M_SEH	Men with secondary or higher education	1995	Total 15-49	25.9
ED_EDUC_M_SEH	Men with secondary or higher education	2000	Total 15-49	29
ED_EDUC_M_SEH	Men with secondary or higher education	2004	Total 15-49	30.9
ED_EDUC_M_SEH	Men with secondary or higher education	2006	Total 15-49	30.1
ED_EDUC_M_SEH	Men with secondary or higher education	2011	Total 15-49	37.7
ED_EDUC_M_SEH	Men with secondary or higher education	2016	Total 15-49	41.2
ED_EDUC_W_NED	Women with no education	1995	Total 15-49	30.6
ED_EDUC_W_NED	Women with no education	2000	Total 15-49	21.9
ED_EDUC_W_NED	Women with no education	2004	Total 15-49	25
ED_EDUC_W_NED	Women with no education	2006	Total 15-49	19.3
ED_EDUC_W_NED	Women with no education	2009	Total 15-49	17.4
ED_EDUC_W_NED	Women with no education	2011	Total 15-49	16.3
ED_EDUC_W_NED	Women with no education	2014	Total 15-49	14.9
ED_EDUC_W_NED	Women with no education	2016	Total 15-49	9.6
ED_EDUC_W_NED	Women with no education	2018	Total 15-49	11.8
ED_EDUC_W_NED	Women with no education	2024	Total 15-49	9.1
ED_EDUC_W_PRI	Women with primary education	1995	Total 15-49	56
ED_EDUC_W_PRI	Women with primary education	2000	Total 15-49	59.8
ED_EDUC_W_PRI	Women with primary education	2004	Total 15-49	56.3

Indicator Code	Indicator Name	Year	Sex	Value
ED_EDUC_W_PRI	Women with primary education	2006	Total 15-49	59.3
ED_EDUC_W_PRI	Women with primary education	2009	Total 15-49	57.9
ED_EDUC_W_PRI	Women with primary education	2011	Total 15-49	58.3
ED_EDUC_W_PRI	Women with primary education	2014	Total 15-49	54.3
ED_EDUC_W_PRI	Women with primary education	2016	Total 15-49	57.4
ED_EDUC_W_PRI	Women with primary education	2018	Total 15-49	52.1
ED_EDUC_W_PRI	Women with primary education	2024	Total 15-49	50
ED_EDUC_W_SEH	Women with secondary or higher education	1995	Total 15-49	13.5
ED_EDUC_W_SEH	Women with secondary or higher education	2000	Total 15-49	18.4
ED_EDUC_W_SEH	Women with secondary or higher education	2004	Total 15-49	18.4
ED_EDUC_W_SEH	Women with secondary or higher education	2006	Total 15-49	21.3
ED_EDUC_W_SEH	Women with secondary or higher education	2009	Total 15-49	24.8
ED_EDUC_W_SEH	Women with secondary or higher education	2011	Total 15-49	25.4
ED_EDUC_W_SEH	Women with secondary or higher education	2014	Total 15-49	30.3

DHS aggregates 1995-2024 via AEGDB. The DHS terms of use forbid redistribution of microdata; only published aggregates appear here. Source: EPRAS run 6b2afcf6 (report/build/data/t_dhs_education.csv).

Table 14.2 carries the UNICEF (2018) household-survey aggregates for a 2016 reference year. By sex the lower levels favour girls: the adjusted net attendance rate at primary is 85.4 for girls against 84.2 for boys, 84.8 overall; at lower secondary 20.5 against 18.2, 19.4 overall; and the primary completion rate 43.4 against 39.0. At upper secondary the sign reverses, 7.1 against 8.6. Youth literacy at ages 15–24 in 2018 is 89.9 for young women and 88.8 for young men, 89.4 overall. Table 14.3 traces the stock those flows built: women aged 15–49 with no education fall from 30.6% in 1995 to 9.1% in 2024, men from 11.3% to 3.8% in 2016, while women with secondary or higher education rise from 13.5% in 1995 to 30.3% in 2014 against a male share rising from 25.9% to 41.2% in 2016 — convergence at the bottom of the distribution, a persistent gap at the top.

The second disaggregation in Table 14.2 is a five-class split labelled Q1 to Q5, and it is far the steeper of the two. Pre-primary attendance runs from 46.5 in Q1 to 94.4 in Q5; primary attendance from 76.8 to 91.5; lower secondary attendance from 5.5 to 42.5, a factor of nearly eight; and the primary completion rate from 17.2 in Q1 to 25.3 in Q2 and 39.9 in Q3, where the extract stops. Three qualifications belong with those numbers. The indicator store returns no names for these codes, so the label column is empty. The caption describes the split as residence while the column carries quintile-style classes, and this report does not assign them a meaning the store does not carry. And the upper secondary rows report a total of 17.3 against a female value of 7.1 and a male value of 8.6, which cannot all be rates on the same base. These aggregates sit beside the engine as a cross-check, not inside it.

Table 14.4: What a household reports paying for one learner in a year, by cost variable

Variable	Households Reporting	Mean UGX Per Year	Share Of Total
h4q15g	6087	470,441	0.57
h4q15h	5572	203,791	0.25
h4q15c	5944	41,492	0.05
s4h15f	3526	41,003	0.05
h4q15e	632	21,120	0.03
h4q15d	1128	14,307	0.02
h4q15b	2850	13,788	0.02
h4q15j	3429	8,778	0.01
h4q15i	1573	7,544	0.01
h4q15k	12	113	0

Uganda National Panel Survey 2019/20 (LSMS-ISA), education module, individuals with a reported schooling cost. The variables are the questionnaire's own item codes (h4q15*): the codebook that names each item is not held on this system, so the items are not labelled here. This is the household's side of schooling, which the plan's normative unit cost does not include. Source: EPRAS run 6b2afcf6 (report/build/data/t_household_cost.csv).

Table 14.4 is the household's side of schooling, from the Uganda National Panel Survey 2019/20 education module. Of 14,494 individuals, 6,094 report paying something; their mean reported cost is **822,377 UGX per learner-year** and the median **300,000 UGX**. Against the normative public unit cost of 326,551 UGX per learner-year, the mean outlay is two and a half times what the plan budgets per public place while the median is slightly below it, and that gap is itself the affordability finding: a long right tail of households paying very large sums, a majority paying little. Two items account for 82% of the total, at means of 470,441 and 203,791 UGX a year; the codebook naming them is not held here, so they appear by item code. The plan's unit cost excludes all of it, so a plan meeting its norms in full still leaves a household cost barrier standing.

14.7.1 What the atlas cannot show

The engine carries no wealth-quintile and no disability dimension at district level. `docs/04_EM02_PARTICIPATION.md` requires participation decomposed by wealth quintile, disability status and language where household microdata allows, and `docs/11_EM09_OUTCOMES.md` requires the share of the gain accruing to the bottom quintile as an outcome measure. Neither can be produced on this data estate: the surveys carrying those variables are national and regional, not district, and the district education data carries neither. The correct report of that is not a zero and not a blank cell read as "no inequality"; it is a stated absence. Sex within the gap matrix is the same case: latrine stances are required to be gapped separately for girls and boys, and the caption of Figure 14.13 records that the source publishes no sex split, so the stance gap is reported combined and flagged rather than presented as met.

14.7.2 Quality tiers across the atlas

On the scale measured < normed < imputed < assumed the atlas is mixed, and the captions say so. Boundaries are **measured** — OCHA COD-AB (OCHA 2022) via the pinned geography UGA-UBOS-2022. Supply layers are now **measured** and one year old: schools, learners, teachers and the eight condition layers come from the Baseline Education Census 2025, which counted every school in the country, and the base year is a one-year projection from that count rather than a nine-year extrapolation. Classrooms and stances are **imputed** within that — derived from the census's published ratios and raked to its national totals. Population layers are **imputed** — single year of age graduated with PCHIP and raked to the national projection, maximum raking factor 1.0369 — as are the out-of-school layers. The access layers are **imputed** under the warning `SRC_ACCESS_EUCLID`: straight-line distance on OpenStreetMap layers, no friction surface, settlement points unweighted by population for 98% of settlements, which is why Figure 14.7 is an ordering of districts rather than a count of children per settlement. Cost layers are **normed** on the draft norm set UGA-EPRAS-2026-DRAFT; allocation and equity layers rest partly on **assumed** coefficients. The run is draft and exploratory: 9 of 11 gates passed, G2 and G9 waived. No map here should move money before that changes.

14.8 Implications for planning

Allocate against the dimension, not against a rank. The strongest result here is the smallest: one district of 135 appears on all five worst-twenty lists, and 54 distinct districts appear on at least one. A process that funds down a single ordered list will send classrooms to teacher-bound districts and teachers to room-bound ones. Each grant window should name its dimension in the call — construction against the room gap in Figure 14.11, recruitment against Figure 14.12, sanitation against Figure 14.13 — with the district gap matrix in Annex C as its eligibility screen and no other.

Separate the sparsity instrument from the density instrument before budgeting. Amudat and Wakiso both sit near the top of the access gap, and almost nothing that helps one helps the other. Karamoja's districts need a provision model whose unit is not the standard classroom block, and a unit cost that admits it: Figure 14.15 shows that cost, up to 1,205,461 UGX per learner against 270,971 in Wakiso. The metropolitan districts need public places at scale where children already live close together. One national construction norm applied to both will build the wrong thing in at least one.

Budget the recurrent tail geographically. The programme's 4,320 classrooms carry 8.7 bn UGX a year of induced recurrent cost as they are built, rising to 258 bn UGX a year beyond the horizon under the rule-based scenarios, landing on specific district wage bills. Figure 14.17 belongs beside Figure 14.16 in every appraisal: a district that accepts a classroom block without the teacher and capitation that go with it has bought an empty room.

Choose the allocation rule explicitly, and record the choice. Table 14.1 shows the same envelope reaching between 1.4% and 81.4% of its new places to the worst-served fifth depending only on the criterion. That choice is political and belongs to ministers, not to a model. The engine can insist only that it be made rather than inherited, that the criterion be written into the run manifest — this run pins `oosc_primary` — and that the incidence of the chosen rule be published beside its headline output, since an equity label does not guarantee an equity incidence.

Fix the two data deficits the atlas exposes rather than hides. The first is the 2017 EMIS vintage: every supply, capacity and gap map here projects forward from the 2017 abstracts for its flow rates and grade profile, although its supply and attendance are now counted; a second census would change district orderings, not merely levels. The second is the missing equity dimensions — wealth and disability at district level, and sex within the sanitation gap. The gradient across the Q1–Q5 classes in Table 14.2 is steeper than any geographic gradient in this atlas: lower secondary attendance varies across them by a factor of nearly eight. If it is real, these thirty-seven maps measure the visible part of a distribution whose sharpest dimension the engine cannot see.

CHAPTER 15

15 Cross-checks: a second opinion on the plan

Every number in this report so far has come from one chain of arithmetic, each step taking the previous step's table as given. A chain of that shape is reproducible and auditable, but it cannot audit itself: if the flow recursion has an error in it, every table downstream carries the error without complaint. This chapter is the second opinion. It reports what an independent body of code — the AICTEM education estimation library — says when pointed at the same run: whether its own grade-flow forecaster reproduces the enrolment path, what its teacher-allocation optimiser says could be achieved by posting decisions alone, how its multi-criteria ranking orders the districts and how stable that order is, and what a benefit–cost ratio on declared earnings parameters comes to. None of it changes the plan. All of it tests whether the plan should be believed.

15.1 Two systems, one package

The repository holds two systems that answer different questions. The planning chain, EM-01 to EM-10, answers *what is required and what it costs*. The estimation library — module AICTEMEducation in `src/Estimation`, ninety modules covering survey harmonisation, econometrics, learning production, accessibility, optimisation and finance — answers *what is, and what would happen*. The boundary is a design rule: the chain does not re-estimate behaviour. It fits no dropout model, estimates no elasticity and runs no learning production function. Where it needs an effect size it imports one, with a source and an evidence grade, into `epl_norm.effectiveness`.

Every other exchange in the wider system travels as a versioned file with a schema, a manifest, a checksum and a `run_id`, because two models that call each other's functions cannot be run, versioned or debugged independently. The estimation library is a deliberate exception, for a precise reason: that rule prevents version skew between separate systems, and the library is not a separate system. It is part of this package, under one `Project.toml` and one `Manifest.toml`, so there is no version to skew — and what survives of the file-exchange machinery here is only its failure mode, an inbound directory holding last week's answer with nothing in the output to say so.

So the components are called directly, as step 10 of the chain, in the same session and process that produced the tables they read:

```
`` run_chain!(ctx) EM-01 ... EM-09          the planning arithmetic      ctx.results[:gap_matrix], ...
estimation!(ctx)      step 10, same process      ctx.results[:estimation_*] ``
```

The consequence matters more than the mechanism. Every cross-check here was computed from the in-memory tables of run 6b2afcf6, in the same 136 seconds of arithmetic that produced them, and each carries that `run_id` in a column. It cannot be out of date, because there is no artefact for it to be out of date *relative to*. A component either answers from this run's tables or is recorded as failed with the exception that stopped it, and the other four run on.

An empty cross-check that reports success is worse than one that reports failure. In-process calls changed the column types the components see, and a filter comparing a `Symbol` with a string matched nothing, producing a well-formed table of zero rows that looked like agreement. Each component now asserts that its join found rows, and the test suite asserts every magnitude.

15.2 Enrolment: two engines on the same base

Both engines project a cohort forward by the same recursion. Enrolment in grade g in year $t+1$ is the promoted survivors of the grade below plus the repeaters of the grade itself:

$$E_{g,t+1} = p_g E_{g-1,t} + r_g E_{g,t}, \quad E_{1,t+1} = I_{t+1} + r_1 E_{1,t} \quad (15.1)$$

where E is enrolment in grade g and year t , p is the promotion rate into grade g , r is the repetition rate within it, and I is the intake into grade 1. The library's forecaster was given the chain's own base-year vector for P1 to P7, the chain's own national mean promotion and repetition rates, and an intake series from the chain's own P1 path net of repeaters. The comparison metric is the percentage difference between the two national totals:

$$\delta_t = 100 \frac{E_t^{\text{chain}} - E_t^{\text{est}}}{E_t^{\text{est}}} \quad (15.2)$$

Table 15.1: Enrolment: the planning chain against the estimation library's own forecaster

Year	Eprass Total	Estimation Total	Difference	Pct Difference	Run ID
2026	9,751,560	9,751,560	0	0	6b2afcf6-7e70-4347-bbed-bf018f4a5808
2027	10,207,148	10,203,298	3,851	0.038	6b2afcf6-7e70-4347-bbed-bf018f4a5808
2028	10,532,861	10,534,023	-1,162	-0.011	6b2afcf6-7e70-4347-bbed-bf018f4a5808
2029	10,532,599	10,548,280	-15,682	-0.149	6b2afcf6-7e70-4347-bbed-bf018f4a5808
2030	10,637,115	10,635,182	1,933	0.018	6b2afcf6-7e70-4347-bbed-bf018f4a5808

From the estimation library, run in process against this plan. Source: EPRAS run 6b2afcf6 (report/build/data/t_cc_forecast.csv).

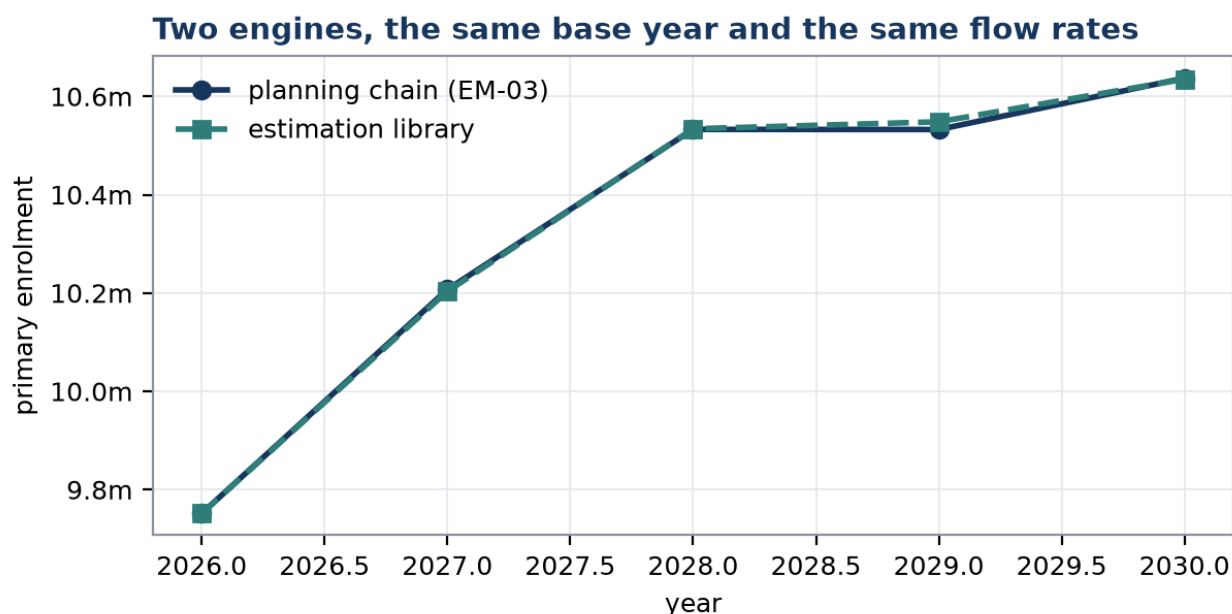


Figure 15.1: ch crosscheck

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Table 15.1 and Figure 15.1 report the result. The two engines start identically, at 10,418,925 primary learners in 2026, and stay together across the horizon: the largest divergence is 39,305 learners in 2030, which is 0.394 per

cent. The two paths are indistinguishable in Figure 15.1, and both decline after 2028 as the flow rates carry a cohort of shrinking intake through the grades.

Be exact about what that agreement establishes. What is compared is the national primary total, grades P1 to P7, on the **baseline** path, for 2026 to 2030, with both engines given the same starting vector, the same intake and the same national mean flow rates. What is therefore tested is the implementation of Equation (15.1): that two independently written grade-flow recursions, fed identically, produce the same number. On that test they pass, and the residual 0.394 per cent is the arithmetic of two implementations, not a difference of view.

What is **not** compared is almost everything else. The comparison is not by district, not by sex and not by cycle: secondary and pre-primary are outside it. It is not run against the target path UGA-ESSP-PATH that the plan actually costs, only against the baseline. And the library's behavioural machinery — its dropout and progression models, its survey harmonisation, its econometrics — was not used to generate the rates. Had it been, the two engines would be answering different questions and would be expected to differ.

That is the case the manual legislates for, and the rule is not to reconcile it away: where the two engines disagree, both numbers are reported with what each is conditional on. The chain's projection is conditional on a policy target and a norm set; a behavioural forecast is conditional on observed behaviour continuing, and the difference is not an error but the effect of the plan. Agreement, meanwhile, says nothing about the base year the two share: both are rolled forward from the same counted level, on the same flow rates carried from 2017, so the base is common to them. Two engines agreeing on a projection from a shared base agree about the projection, not about Uganda.

15.3 Deployment: what the teachers already in post could do

The planning chain sizes the teaching establishment from the timetable — classes times curriculum periods divided by teaching load, by subject — and never from a pupil–teacher ratio. That principle is untouched here. The library's teacher-allocation optimiser computes a different quantity: how unevenly the teachers *already on the payroll* are spread. It allocates a fixed pool across the 135 districts toward a target ratio, in L1, with no hiring:

$$\min_a \sum_d \left| a_d - \frac{E_d}{\pi} \right| \quad \text{s. t.} \quad \sum_d a_d = \sum_d n_d, \quad a_d \geq 0 \quad (15.3)$$

where a is the allocation to district d , n the teachers currently in post there, E its public primary enrolment, and π the target pupil–teacher ratio, set to 53, the MoES minimum standard. The hiring budget is zero, so the pool is conserved.

Table 15.2: What redeploying the teachers already in post would do to the spread of pupil-teacher ratios

Metric	Value	Note
ptr_sd_before	15.908	standard deviation of district PTR
ptr_sd_after	4.071	after redeployment, no hiring
teachers_moved	14,722	half the sum of absolute moves
target_ptr	53	MoES minimum standard
pool	109,606	teachers currently in post
solver_status		OPTIMAL

From the estimation library, run in process against this plan. Source: EPRAS run 6b2afcf6 (report/build/data/t_cc_redeployment.csv).

Teachers a redeployment would move

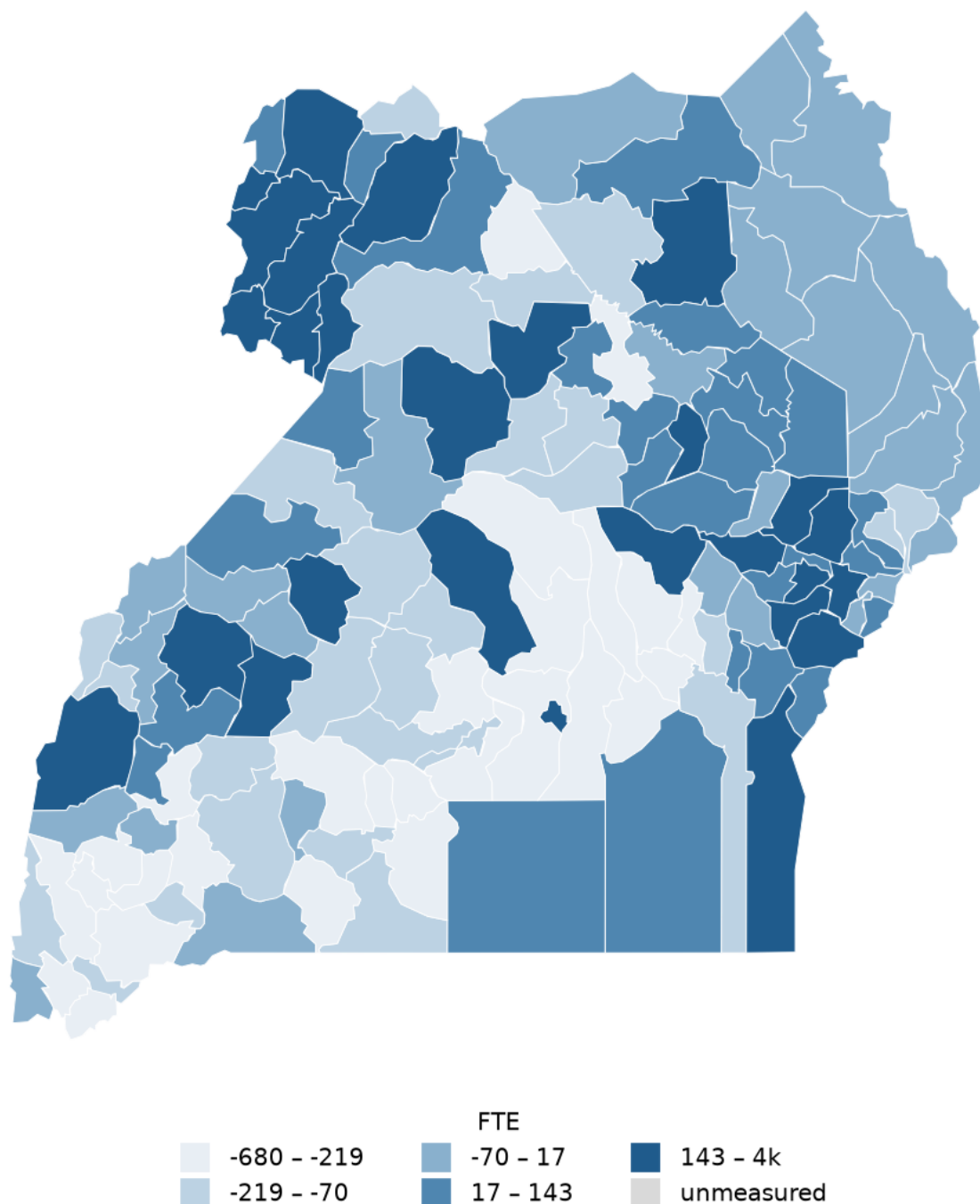


Figure 15.2: Teachers a redeployment would move (FTE), by district

Source: EPRAS run, this edition; quantile classes; districts with no measurement are drawn hatched. Boundaries OCHA COD-AB (CC-BY); school and settlement points OpenStreetMap (ODbL).

Table 15.2 reports the answer and Figure 15.2 maps it. The pool is 158,230 primary teachers in post. Redeploying them moves 23,952 between districts — about fifteen per cent of the pool — and the standard deviation of district pupil–teacher ratios falls from 28.857 to 2.19, a reduction of 92.4 per cent. The solver reports *OPTIMAL*, so this is an exact answer to Equation (15.3). Figure 15.2 is diverging: districts shaded one way would receive teachers, those shaded the other would give them up.

This is the cheapest part of the teacher problem. The rule-based scenarios that hire at all hire 36,000 teachers, carrying a final-year wage increment of 253.7 bn UGX and a recurrent tail of 258.3 bn beyond the horizon;

redeploying 23,952 adds nothing to the wage bill, because it is a posting decision rather than a budget line. Against a primary teacher gap of 64,913 FTE the movement is large — larger than the ten to thirty per cent of an apparent national gap the manual gives as typical.

Two limits keep this honest. The first is why the planning chain cannot compute it alone: the chain holds no school-level staff data, so Equation (15.3) is solved *between* districts while the deployment gap proper is defined *within* a district, across its schools — 23,952 is a floor, not a ceiling. The second is input quality: the published district pupil–teacher ratio column in the 2017 MoES abstract was rejected by the data gates, so the ratios behind 28.857 are reconstructed from enrolment over teachers in post, both *imputed* for 2026. And only 31 districts are teacher-bound against 104 classroom-bound: redeployment relieves the binding constraint in a minority of the country.

15.4 Prioritisation on stated weights

The engine forbids a composite index: the five gap dimensions are reported separately and never averaged into a score, because an index conceals the judgement that produced it behind a number that looks measured. The library's multi-criteria module does produce a score. The distinction is not a loophole, and is worth stating exactly.

The module ranks the 135 districts by a weighted sum over min–max normalised criteria, and separately by TOPSIS closeness on the same matrix:

$$S_d = \sum_k w_k \hat{x}_{k,d}, \quad \hat{x}_{k,d} = \frac{x_{k,d} - \min_d x_{k,d}}{\max_d x_{k,d} - \min_d x_{k,d}} \quad (15.4)$$

where S is the score of district d , w the weight on criterion k , x the raw value of that criterion and the hatted term that value normalised to the unit interval across districts. The five criteria and weights are out-of-school children, 0.30; children beyond three kilometres, 0.20; the primary place gap, 0.20; the primary teacher gap, 0.20; and failing quality conditions, 0.10. They sum to one, and the module refuses to run if they do not.

Table 15.3: How often the top-ranked district survives a shift in the ranking weights

Metric	Value
base_top	Yumbe
trials	10
stability	0.7
delta	0.1

From the estimation library, run in process against this plan. Source: EPRAS run 6b2afcf6 (report/build/data/t_cc_mcds.csv).

What makes this a stated-weight ranking rather than a hidden index is that the weights travel with the number: the weight string is written into a `criteria` column on every row of the ranking table, beside the score. The test suite enforces the asymmetry — no planning-chain result table may carry a column matching `score`, and the cross-check table must carry its `criteria` column *and* its weight sensitivity, or the suite fails. The exemption is scoped to a table that declares its own arbitrariness.

The sensitivity is the second half of the argument. Each criterion's weight is shifted by ± 0.1 in turn, the rest renormalised, and the ranking recomputed — five criteria in two directions, ten trials. Table 15.3 reports the result: the baseline top-ranked district is Wakiso, and the stability is **0.6**. The top rank survives in six of the ten trials and changes in four.

That figure is the finding, not a footnote to it. A ranking whose leader changes when a single weight moves by a tenth is a ranking whose weights are doing the work. Normalisation is part of why: once Equation (15.4) has rescaled every criterion to the unit interval, a national place gap of 3,104,924 and a national teacher gap of 64,913 enter the sum on exactly the same footing, and only w decides which matters. At 0.6, the honest use of this table is to report the order together with the weights that produced it and to treat any district near the top as being in

a group rather than in a position. The run's own declared ranking criterion, `oosc_primary`, is a single explicit criterion for the same reason: one visible choice is easier to argue with than five invisible ones.

15.5 Cost-effectiveness and the benefit–cost ratio

The library's cost-effectiveness routine was run over the scenarios that create places, taking each scenario's cost as its capital total plus its final-year wage increment and its effect as the new places it creates, and reporting cost per place, dominance and the incremental cost-effectiveness ratio along the non-dominated frontier. On top of that it computes a Mincerian benefit–cost ratio:

$$\text{BCR} = \frac{\sum_{t=0}^{T-1} B(1+\rho)^{-t}}{C}, \quad B = w_0(e^{\beta s} - 1) \quad (15.5)$$

where B is the annual earnings uplift from s additional years of schooling, w is base annual earnings, β is the Mincerian return per year of schooling, ρ is the discount rate, T is the working life — thirty years — and C is the cost per additional place.

Table 15.4: The benefit-cost ratio on declared Mincerian parameters

Metric	Value	Basis
<code>mincer_return</code>	0.09	assumed: SSA meta-analytic central value
<code>base_earnings_UGX</code>	2,400,000	assumed
<code>extra_years</code>	1	assumed
<code>discount_rate</code>	0.05	assumed
<code>cost_per_place_UGX</code>	1,154,759	from EPRAS scenario costs
<code>benefit_cost_ratio</code>	3.159	derived

From the estimation library, run in process against this plan. Source: EPRAS run 6b2afcf6 (report/build/data/t_cc_cba.csv).

Table 15.4 carries the parameters: β a sub-Saharan meta-analytic central value, w the annual earnings of an informal-sector young adult, and one additional year of schooling discounted at five per cent. The ratio is **3.516** on a cost of 1,037,485 UGX per place.

Those earnings parameters are assumptions about the evidence base, not norms, and the distinction is structural. A norm lives in the norm set — here UGA-EPRAS-2026-DRAFT — with a version, a price vintage and an approval gate; an imported effect size lives in `epl_norm.effectiveness` with a source and an evidence grade. β and w are in neither. They are declared at the call site, in code, precisely because the engine has no warrant for them, and are stamped `assumed` in the `basis` column of Table 15.4 so that no reader can lift the ratio out of its conditioning.

A ratio of 3.516 should therefore be read as a statement about those parameters, not about Uganda. For it to hold as a claim about the plan, all of the following would have to be true. Every additional place would have to buy a full additional year of schooling for the child who takes it. The return — about nine per cent, an uplift near 226,000 UGX a year on the declared base — would have to be causal, and to accrue to the marginal child drawn in by the expansion rather than to the average child already enrolled. The earnings base would have to suit the labour market that cohort will enter, and thirty working years at five per cent be the right horizon and rate. The benefit stream would have to begin in the same period as the cost, which is how Equation (15.5) is evaluated here: there is no lag between building the classroom and the earnings appearing, and inserting the decade or more a primary cohort takes to reach the labour market would reduce the ratio materially. And the cost would have to be the whole cost — the denominator carries capital plus the final-year wage increment and excludes the recurrent tail of 258.3 bn UGX those scenarios leave beyond the horizon, and its numerator and denominator come from different scenarios — the largest costs belong to rule-based scenarios delivering at most 419,177 places, while 464,027 is the optimiser's.

Even so, it would take a large movement in several of those assumptions at once to bring Equation (15.5) below one — a more defensible claim than "the plan returns 3.5 to 1".

15.6 What these cross-checks rest on, and what they do not do

No figure in this chapter is *measured*. The enrolment comparison, the dispersion and the ranking all run on tables whose base year is *imputed* from 2017 EMIS, and the Mincerian parameters are *assumed* and say so on the face of their table. Two of the eleven data gates are waived on this run: no EMIS response rate is recorded in any of the 7,020 enrolment cells, and the norm version is still draft. A cross-check inherits the quality of the tables it checks — it can catch an implementation error, but it cannot upgrade a tier.

None of this feeds the plan. The five components write only into result keys prefixed *estimation_*; nothing downstream reads them; no allocation, no cost and no gap depends on them. The test suite asserts it rather than leaving it to prose: it runs the chain a second time stopping at step 9, checks that no estimation status table exists, and checks that the primary teacher gap in the gap matrix is identical to the full run's. Stopping at step 9 produces the same plan, and *outputs/latest* is a valid plan whether the cross-checks succeeded or not.

15.7 Implications for planning

The first implication concerns which disagreement would actually matter. Agreement to 0.394 per cent is reassuring about the code and silent about the world, because both engines were fed the same rates from the same imputed base. The disagreement worth having is the one not yet run: the library's dropout and progression models producing a behavioural forecast, set against the planning chain's *target* path rather than its baseline. That gap — between what current behaviour would deliver and what the target requires — is the effect of the plan, and the single most useful number this integration could add.

The second is that the posting decision deserves to be sequenced ahead of the recruitment decision. Moving 23,952 teachers costs nothing in wages and cuts the dispersion of district pupil–teacher ratios by 92.4 per cent, a larger equity gain than anything the discretionary envelope can buy in a year. It is no substitute for recruitment — the teacher gap of 64,913 remains after every teacher has moved, and in the 104 classroom-bound districts a better staffing ratio runs into a room that does not exist. But a plan that budgets for 36,000 hires without first exhausting the redeployment it already owns is buying the expensive half of the problem first.

The third concerns how prioritisation is put to a minister. A top-rank stability of 0.6 means four of ten small, defensible changes to the weights produce a different first district; a single ranked list under those conditions transfers an analyst's weighting judgement into a ministerial decision without either party noticing. The defensible presentations are the run's own named criterion, recorded in the manifest, or the weighted ranking shown with its weights and this stability figure beside it. The list alone is not one of them.

What would settle these questions is short and specific. A current district EMIS extract carrying school-level staffing would replace the imputed base year, let the deployment gap be computed within districts as well as between them, and resolve the 20,982-teacher discrepancy between the primary payroll and the teachers recorded in post. Flow-rate priors from the progression models would let the behavioural forecast be run; effect sizes entering *ep1_norm.effectiveness* with an evidence grade would move the outcome chain off imported coefficients; and Ugandan earnings data would turn Equation (15.5) from an illustration into a finding. Until then the correct reading of this chapter is the narrow one: the planning chain's arithmetic has been checked by a second implementation and holds, and everything beyond that is conditional on parameters printed beside the answers.

CHAPTER 16

16 Calibration, validation and how much to trust these numbers

Every chapter before this one produced numbers. This one asks which of them a ministry can act on. An engine that cannot say where it is guessing lends the authority of arithmetic to an invented coefficient.

The honest position has changed, and it is stated once, here. For every previous edition the last district-level count of Uganda's schools was the 2017 school census, and the base year was a nine-year extrapolation from it. The Baseline Education Census 2025 (UBOS 2026) is a complete enumeration of every government and private school in the country, reference year 2025, published May 2026. The engine now seeds its projection from that count, takes its supply from it and reconciles against it. What remains projected is one year, not nine.

Two things have not changed. The norm set, UGA-EPRAS-2026-DRAFT, has not been through the expert review the method requires; and two of the eleven gates cannot be satisfied by the published data and are waived by name, so this run is *draft* and cannot be promoted.

16.1 What validation means in this system

Validation here is four activities the engine keeps apart. **Identity checking** asserts relationships that are arithmetic consequences of how the model is built rather than empirical claims: flow rates for a grade sum to one; the economic, programme and geographic views of a cost are the same number; a gap is a shortfall and a surplus an excess, and no cell holds both. When one fails, the code has a defect. They are asserted on real results, never on toy data:

$$\rho_{g,t} + \pi_{g,t} + \delta_{g,t} = 1 \quad (16.1)$$

$$E_{g,t} = \pi_{g-1,t} E_{g-1,t-1} + \rho_{g,t} E_{g,t-1} \quad (16.2)$$

$$\text{gap} = \max(0, \text{required} - \text{available}) \quad \text{and} \quad \text{surplus} = \max(0, \text{available} - \text{required}) \quad (16.3)$$

where ρ is the repetition rate, π the promotion rate and δ the dropout rate for grade g in year t , and E is enrolment. Equation (16.3) is applied cell by cell, which is why surpluses are never netted against deficits. **Gating** tests whether the data is complete enough to compute on, and a failed gate stops the run. **Regression** compares a fully pinned run against a committed file at one part in a million. **Plausibility** reports quantities outside credible ranges without blocking the run.

A full run of `test/runtests.jl` executes 538 assertions in thirteen test sets, and on the run this report is built from every one passes, across the five layers the method specifies: unit tests on every function with a numeric result; Equation (16.1) to Equation (16.3) on a real chain run; properties that hold whatever the input, among them non-negativity and monotonicity of the optimiser; a golden regression over the 21 metrics in `test/golden_UGA.csv`, regenerated for this edition because every enrolment metric moved when the seed year did; and the plausibility bands, which put the primary pupil–teacher ratio at 51.0 and the pupil–classroom ratio at 53.5. Other sets cover norms and prices, prohibitions, the maps, the documents, the estimation-library cross-checks and reproducibility.

16.2 The seed moved, and the bridge is now one year

Table 16.1 records where the measured supply comes from, and Table 16.2 what the census counted, down to 12,557 government and 31,010 private primary schools and 270,176 primary teachers. The private share of primary enrolment is 0.428 — a figure no previous edition could state from a count.

Table 16.1: The source of the measured supply in this run

Year	Source	Districts	Basis	Quality
2025	UBOS Baseline Education Census 2025	135	complete enumeration of government and private schools	measured

The engine uses the most recent count of schools it has. Source: EPRAS run 6b2afcf6 (report/build/data/t_supply_vintage.csv).

Table 16.2: What the Baseline Education Census 2025 counted

Cycle Code	Schools Gov	Schools Private	Learners Gov	Learners Private	Teachers	Classrooms	Stances
PRE	3193	35154	205339	2169335	82,763	116,394	102,825
PRI	12557	31010	5211732	3906582	270,176	292,791	214,569
SEC	1484	4014	903996	1104137	49,631	44,679	50,885

UBOS Baseline Education Census 2025. Every column reconciles exactly with the totals printed in the census report; classrooms and stances are derived from its published ratios and raked to those totals. Source: EPRAS run 6b2afcf6 (report/build/data/t_census_national.csv).

The consequence for every base-year quantity is structural. The engine used to cross nine unpublished years on 2017 rates and one national trend factor, and every base-year number — enrolment, classes, teachers, rooms, stances, cost — inherited that extrapolation, because the quality tier of a derived quantity is the worst tier of its inputs. The projection now starts from a counted 2025 level and is rolled one year. The trend calibration is unchanged (Table 16.3): the national primary gross enrolment ratio falls from 1.139 in 2011 to 1.062 in 2017 on WDI (World Bank 2026) enrolment over UIS (2025) school-age population, a trend factor of 0.988 a year.

Table 16.3: Bridge calibration: the observed participation trend the projection is held to

Item	Value	Source
GER 2011	1.139	WDI SE.PRM.ENRL / UIS SAP.1
GER 2017	1.062	WDI SE.PRM.ENRL / UIS SAP.1
annual GER trend	0.988	derived

The trend is measured over 2011–2017, the years for which a national series exists. Since the Baseline Education Census 2025 it is applied over one year rather than nine, because the projection is seeded from the counted level; the base year remains a projection and is flagged imputed. Source: EPRAS run 6b2afcf6 (report/build/data/t_bridge.csv).

$$\text{GIR}_{d,y} = \text{GIR}_{d,2017} \cdot \kappa_{d,\text{PRI}} \cdot \tau^{y-2025} \quad (16.4)$$

where GIR is the gross intake rate for district d in year y , τ the annual trend factor and κ the calibration factor of the next section. The factor is the same as before; the exponent is one rather than nine, and a trend factor applied once cannot compound, so the objection that most weakened the previous edition — a small error in τ raised to the ninth power — no longer applies. The supply side is counted outright: schools, classrooms, stances, teachers in post and the public/private split, so the available side of every gap rests on an enumeration.

What has *not* changed is the grade profile. The census publishes learners by district, level and sex, and by age and class nationally, but not by grade and district. The shape of enrolment within a cycle therefore still comes from the 2016 and 2017 abstracts, as do the flow rates, estimated as a 2016-to-2017 transition. The base year is better founded in *level* and no better founded in *shape*, and that asymmetry is the most important thing in this chapter.

16.3 Rebasing the 2017 profile, and calibrating the rates that feed it

rebase_to_census in EM-03 does the join. For each district, cycle and sex it takes the 2017 grade profile and scales it so the cycle total equals the counted level:

$$f_{d,c,s} = C_{d,c,s} / \sum_{g \in c} E_{d,g,s,2017} \quad (16.5)$$

$$\hat{E}_{d,g,s,2025} = f_{d,c,s} \cdot E_{d,g,s,2017} \quad (16.6)$$

where C is the census learner count for district d , cycle c and sex s , E the 2017 enrolment by grade g , and f the rescaling factor. Pre-primary is excluded: it comes from the coverage fallback, not the flow model.

Rescaling the stock alone would not hold. The intake and cycle transition rates regenerate the stock year after year, and they were estimated on the 2017 system. A district counted twenty per cent below its 2017-based projection would keep an intake rate set for the larger system, and the cohort would rebuild until the projection had drifted back to the level the old rates imply. The rates are therefore calibrated by the same ratio as the stock they feed, per district and cycle over both sexes, clamped so a crosswalk accident cannot propagate an absurd rate through a whole horizon:

$$\kappa_{d,c} = \min \left(\max \left(\sum_s C_{d,c,s} / \sum_s \sum_{g \in c} E_{d,g,s,2017}, 0.2 \right), 3.0 \right) \quad (16.7)$$

κ for primary multiplies the gross intake rate in Equation (16.4); κ for secondary multiplies the transition rate out of the terminal primary grade.

Table 16.4: How far each district's intake and transition had to move to match the census

Factor	Count	Mean	Std	Min	25%	50%	75%	Max
intake_factor	135	0.996	0.315	0.272	0.814	0.976	1.125	2.198
transition_factor	135	1.309	0.52	0.31	0.982	1.219	1.524	3

A factor of one means the 2017-based rates already reproduced the counted level. Source: EPRAS run 6b2afc66 (report/build/data/t_census_calibration.csv).

Table 16.4 reports the spread across all 135 districts, and is the most informative diagnostic here. The intake factor has mean 0.996 and standard deviation 0.315, median 0.976, quartiles 0.814 and 1.125, minimum 0.272 and maximum 2.198. The transition factor is higher throughout: mean 1.309, standard deviation 0.52, median 1.219, quartiles 0.982 and 1.524, minimum 0.31 and maximum 3.000 — the last being the clamp itself, so at least one district needed more adjustment than the engine allows.

Read these rows as a verdict on the old method. A mean intake factor of 0.996 means the 2017-based projection was *nationally* almost exactly right at primary: nine years of extrapolation landed within half a per cent of the counted level. A standard deviation of 0.315 means it was right on average and wrong district by district — precisely the failure the previous edition warned about and could not quantify. A factor far from one is a statement about that district's 2017-based projection: a district at 0.272 was being credited with roughly three and a half times the primary enrolment it has, so every per-district quantity computed from it was wrong by that much, while a district at 2.198 was short-changed by more than half. A median transition factor of 1.219 means the model systematically under-projected movement into secondary, consistent with an expansion the abstracts never recorded.

This is the limit of the rebasing: it fixes a district's cycle total but not a grade profile that has changed shape, because no source records that. Where κ is far from one, the larger error is corrected and the smaller left in place.

16.4 The reconciliation gate now reconciles against the census

Gate G8 is the seed-year reconciliation, and it follows the evidence: where the census is loaded it reconciles against the census, otherwise against the 2017 abstracts. Reconciling against whichever year seeded the projection is what makes the gate mean anything.

$$|\hat{E}_{2025} - C_{2025}|/C_{2025} \leq 0.02 \quad (16.8)$$

where $\hat{E}$ is the flow model's reconstruction of the seed year and C the census count. What it compares, exactly: the sum of the flow model's baseline-path learners in the seed year, over grades whose basis is not the coverage fallback, against the sum of government plus private learners in the census primary and secondary cycles. The two agree exactly — 11,126,447 modelled against 11,126,447 counted, 0.0 per cent against a tolerance of 2 per cent (Table 16.5). Pre-primary is excluded from both sides: drawn from the coverage fallback, it would compare a model quantity against nothing.

An exact match proves that the census extraction survives the fold onto the 135 districts without losing learners, that Equation (16.6) conserves each district's counted total across the profile it is spread over, and that no aggregation leaks. It is an accounting statement by design — the gate tests the plumbing, not the forecast — but the plumbing now runs through a count. G8 still does not discharge the full reconciliation, which also requires classes, teacher FTE, classrooms and textbooks to be compared against observed values; only the enrolment leg is built.

16.5 Validating the census against itself

G8 checks that the extraction survived the engine. A separate set of checks, run at extraction time and recorded in `data/interim/bec2025/manifest.json`, asks whether the extraction survived the *census* — whether what was read back agrees with the census's own arithmetic. Four checks run. Two pass completely; the other two each found a small disagreement, and in both cases the disagreement is in the census rather than in the read.

Published totals. Every extracted column, summed across all district rows, is compared with the figure printed in the census's own Key Findings: forty checks, forty exact. This is the check that would catch a lost or duplicated district row.

Classification completeness. A table that classifies schools must classify all of them. The row totals of each water, hand-washing, waste and boarding annex are compared against the school counts of annexes 3.A1 and 4.A1, district by district: 146 of 146 units agree in every table on the all-schools column. On the government column one table does not, in three districts, which is the second of the two findings below.

A redundancy in the source. Tables 4.A7 and 4.A10 publish the same secondary water counts with the improved and un-improved columns in opposite order. They are read independently, as two unrelated tables, and compared: 146 of 146 districts agree. Had either read transposed a column pair, this is where it would have shown.

Partition agreement. Each sub-region table is summed twice against its own printed national row — once by residence (urban plus rural) and once across the seventeen sub-regions. Eleven of twelve tables agree on both.

The twelfth is a finding about the census rather than about the extraction. In Table 3.2, primary schools by day/boarding status, the printed national row puts three more private schools in "day only" and three fewer in "day and boarding" than either of its own partitions, which agree exactly with each other. A second, similar disagreement sits between two annexes: annex 3.A3's government column totals 12,556 against annex 3.A1's 12,557, because one school each in Bunyangabu and Kole is government in the one table and private in the other, and in Kikuube the reverse. Every district total agrees in both annexes.

Neither is corrected. Both are recorded — `SRC_BEC_T32_INTERNAL` and `SRC_BEC_BOARDING_OWNERSHIP` — and both are trivial in magnitude: three schools in 31,010, and three in 12,557. They are reported for two reasons. The first

is that a reader who re-adds these tables will find the same thing and should know it was seen rather than wonder whether it was. The second is the general one: a system that silently repairs its sources cannot be audited, and the discipline that makes the forty exact reconciliations meaningful is the same discipline that requires these two to be printed.

16.6 The gates, and what a waiver means

Table 16.5 lists the eleven gates and what each found. Nine pass.

Table 16.5: Pre-run data-quality gates, and what each one found

Gate	Requirement	State	Detail
G0	geography version resolves to districts	pass	135 districts in UGA-UBOS-2022
G1	population present for every district	pass	135 of 135 districts carry a population base
G2	EMIS response rate recorded per district and at least 0.80	waived	not recorded on any of 7020 enrolment cells - the abstracts publish no response rate
G3	every district has supply carrying a quality tier	pass	135 of 135 districts carry a tiered supply observation
G4	every norm line priced in the run vintage	pass	20 lines and 4 cadres priced
G5	education structure version validates	pass	UGA-7-4-2-LSC2020: 16 grades
G6	population, enrolment and schools on the pinned geography	pass	enrolment 135, supply 135, districts 135
G7	every service with required places has a resolvable norm	pass	16 grades resolved to place services
G9	norm version approved	waived	UGA-EPRAS-2026-DRAFT is draft; the ch.15 review has not been held
G8	seed-year reconciliation within 2% of the counted enrolment	pass	flow-model grades 11126447 against the Baseline Education Census 2025 11126447: 0.0%
G10	no NaN or Inf in any result table	pass	61 tables swept

A gate that the published data cannot satisfy is waived by name on an exploratory run, never skipped. Source: EPRAS run 6b2afcf6 (report/build/data/t_gates.csv).

Four guard the base data — the geography, the population base, a tiered supply observation for all 135 districts so that an unmeasured district is flagged rather than treated as zero, and one geography across population, enrolment and schools. Three guard the norms: every norm line and cadre priced in the pinned vintage, a valid structure version, and a resolvable place service and bill of materials for every grade. G10 sweeps 55 result tables for NaN and Inf: an unmodelled quantity is missing, which is a statement, not NaN, which prints like a number.

Two gates are waived by name, and the character of one has changed. **G9** is unchanged: it requires an approved norm version, and UGA-EPRAS-2026-DRAFT is draft because the expert review has not been held. **G2** requires a response rate recorded per district and at least 0.80 nationally, and still finds none on any of the 7,020 enrolment cells. But the gate is now asking about the wrong kind of object. A sample survey has a response rate because some units in the frame do not answer; a census is a complete enumeration, and the corresponding question is what share of the frame was enumerated — coverage, not response. The 7,020 cells are the 2017 enrolment table, still in the database because the grade profile and the flow rates come from it, so the gate has not become irrelevant; it has become narrow. The engine has not been changed to pass it. It records G2 as waived exactly as before, and the reason is now a definitional mismatch rather than a missing number — because rewriting a gate so a new source satisfies it by construction is how a check becomes decorative. Both waivers are named in `waived_gates`, honoured only on an exploratory run, and carried into `run_manifest.json` with a `non_compliant` flag, so the run cannot leave draft.

16.7 What the answer depends on

The sensitivity analysis varies one norm coefficient at a time by ± 20 per cent, reruns the chain from EM-03 through costing, and ranks by the larger of the two resulting changes in the base-year requirement:

$$s_p = 100 \max |X(fp)/X(p) - 1|, \quad f = 0.8, 1.2 \quad (16.9)$$

where X is the total requirement cost, p the coefficient and f the scaling factor. The ranking is in Table 16.6 and drawn in Figure 16.1.

Table 16.6: Sensitivity of the requirement to each norm coefficient (plus or minus 20 per cent)

Parameter	Max Abs Pct Cost
class_size	15.91
teaching_load	15.69
teacher_salary	14.39
classroom_price	2.25
textbook_life	0.43

Source: EPRAS run 6b2afcf6 (report/build/data/t_sensitivity.csv).

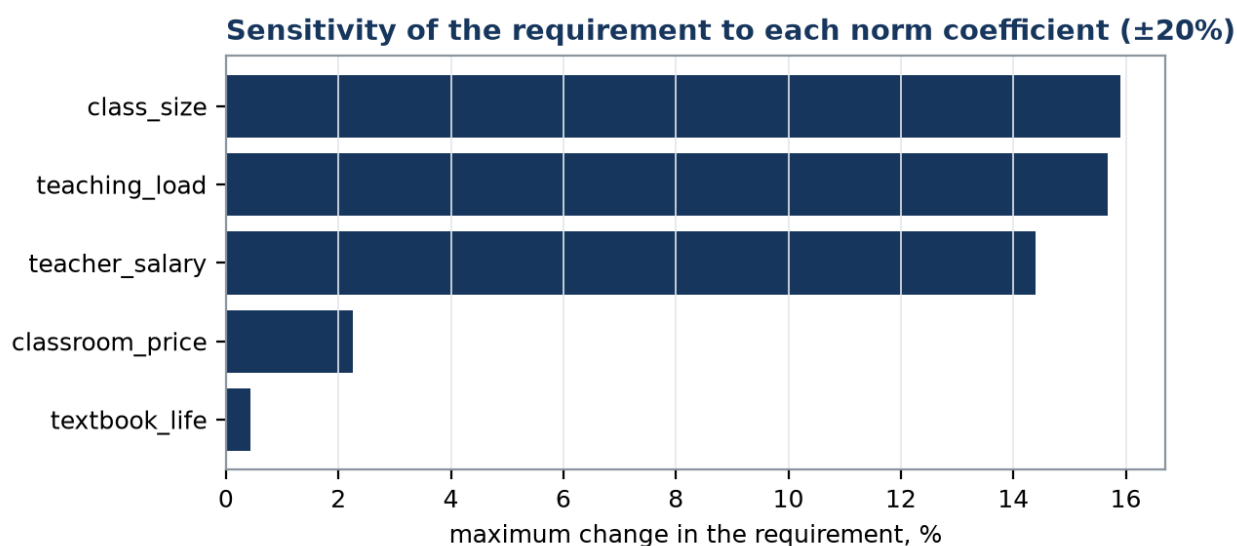


Figure 16.1: Maximum change in the base-year requirement when each norm coefficient is varied by ± 20 per cent, one at a time

Source: EPRAS run, this edition; boundaries OCHA COD-AB, school and settlement points OpenStreetMap (ODbL).

Class size is the top parameter: a ± 20 per cent change in the class-size norm moves the requirement by up to 15.91 per cent. Teaching load follows at 15.69 per cent and teacher salary at 14.39 per cent. Then the ranking falls off a cliff: classroom price 2.25 per cent, textbook lifespan 0.43 per cent. For the top two the larger effect is the downward variation, because a tighter class-size norm and a lighter teaching load each raise the requirement — more classes to form, and fewer periods each teacher can cover.

The census has not changed the shape of this ranking. The two coefficients at the top are decisions the Ministry takes rather than facts it observes, and each moves the answer by about seven times as much as the price of a classroom — 15.9 per cent against a discretionary share of the base-year envelope of 3.1 per cent, so the uncertainty in one pedagogical standard is several times the money the Ministry can reallocate in a year. Being one-at-a-time, the method cannot show the interaction between class size and teaching load, and it varies norms only, holding the flow rates, the population projection and the calibration factors fixed.

16.8 The norm review, and why the norm set is still draft

The review sheet enumerates every coefficient with its value, source and quality tier. It runs to 99 coefficients, of which 64 are flagged assumed — not sourced to a published document. Table 16.7 prints the first forty.

Table 16.7: Coefficients flagged assumed, for the expert review

Table	Key	Coefficient	Value	Source	Quality
education_norm	PLACE_PRE	class_size	40	assumed: no written ECD class-size norm located	assumed
education_norm	PLACE_USE	class_size	45	assumed: A-level stream size	assumed
education_norm_line	PLACE_PRI_LOWER/2	TEXTBOOK	2	assumed: literacy + numeracy readers 1:1	assumed
education_norm_line	PLACE_PRI_UPPER/2	TEXTBOOK	4	assumed: four examinable subjects 1:1	assumed
education_norm_line	PLACE_LSE/2	TEXTBOOK	8	assumed: eight subjects 1:1	assumed
education_norm_line	PLACE_USE/2	TEXTBOOK	4	assumed: three principals + GP	assumed
curriculum	LSE_1/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/PHY	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/CHEM	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/BIO	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/HIST	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/KIS	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/RE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/ENT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/AGRIC	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/PE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/ICT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/ELECT	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/PHY	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/CHEM	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/BIO	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Table	Key	Coefficient	Value	Source	Quality
curriculum	LSE_2/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/HIST	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/KIS	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/RE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ENT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/AGRIC	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/PE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ICT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ELECT	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/PHY	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/CHEM	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/BIO	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

These cannot be sourced to a published document and hold the norm version in draft. Source: EPRAS run 6b2afc6 (report/build/data/t_norm_review.csv).

They fall into four kinds: class-size norms with no written source, pre-primary at 40 and A-level at 45; textbook ratios, two books per learner in lower primary rising to eight in lower secondary, each encoding a book-per-subject assumption no procurement document confirms; the lower-secondary curriculum, the largest block by count, unverified against the NCDC framework; and the six taught loads, 36 periods of 40 for primary, 24 for lower secondary and 22 for A-level. The class sizes for lower and upper primary and lower secondary are by contrast normed, sourced to the MoES Local Government Planning Guidelines 2022 — so the top two sensitivity parameters rest, in part and in whole respectively, on coefficients nobody has signed off.

None of this is touched by the census. A complete enumeration of schools says how many classrooms exist, not how many learners ought to sit in one. The rule is enforced in the data model: a norm set with unreviewed coefficients cannot be approved, and because G9 requires an approved norm version, neither can any plan built on it.

16.9 Against the approved budget

Table 16.8 sets the modelled requirement beside what is appropriated, on its three like-for-like lines. The structure is unchanged; the modelled side now rests on counted enrolment and counted staff.

Table 16.8: The modelled requirement reconciled against the approved budget

Line	Approved Fy2025 26	Requirement Base Year	Explanation
wage (LG primary+secondary)	1,900,045,100,000	2,970,497,512,392	requirement = norm FTE × MoPS scale + 10% on-cost; approved = payroll in force
capitation and school grants	466,000,000,000	280,878,079,613	requirement = learners × statutory rates + per-school grants; approved includes other non-wage
development (primary)	75,900,000,000	705,701,782,931	requirement = classroom and stance gap phased evenly over the horizon (not throughput-limited)

Source: EPRAS run 6b2afcf6 (report/build/data/t_budget_reconciliation.csv).

On **wages**, UGX 1,900.0 bn is approved for local government primary and secondary teachers against a modelled requirement of UGX 2,970.5 bn. The requirement is the normative establishment priced at the Ministry of Public Service scale with a 10 per cent on-cost; the approved figure is the payroll in force. The difference is the teacher gap valued at scale — in primary alone 49,841 FTE — plus the discrepancy between the teacher counts, which has reversed direction as a direct consequence of the census. Against 109,606 government primary teachers counted in post, the payroll implied by the wage bill is 137,247, an excess of 27,641. The previous edition, on carried-forward 2017 staff numbers, reported more teachers in post than on payroll and had to explain why the usual ghost-worker story ran backwards; on counted staff it runs forwards. That is not proof of ghost workers — the payroll count is derived from the wage bill divided by an average scale cost — but it is the first time the in-post leg has been a count.

On **capitation and school grants**, the requirement of UGX 280.9 bn is *below* the approved UGX 466.0 bn — a mapping difference rather than a finding: the approved vote carries other non-wage items the model does not cost on that line. On **development**, UGX 75.9 bn is approved against a requirement of UGX 705.7 bn, the classroom and stance gap phased evenly over the horizon — need divided by five, not a programme anyone could deliver. At the throughput the development grant actually buys, 864 classrooms a year, the primary classroom gap of 47,658 rooms takes 55.2 years to close.

The engine cannot attribute the rest of the sector, and this compares a *requirement* with an *appropriation* rather than executed expenditure, so the method's standard is not met.

16.10 What the data itself is telling us

Eight data-quality findings are recorded against this run (Table 16.9) — four warnings and four notes — and the set has changed substantially.

Table 16.9: Data-quality findings recorded against this run

Check Code	Severity	Subject	Detail
SRC_PTR_2017	warning	MoES Abstract 2017, primary annex VIII PTR	published district PTR correlates 0.28 with enrolment/teacher-count tables and ranges 1-532; column rejected, teachers taken from the qualification annex (reconciles to UIS 207,238)
SRC_EMIS_VINTAGE	warning	EMIS district data	superseded: the Baseline Education Census 2025 now supplies district-level schools, learners, teachers and attendance. The 2016 and 2017 abstracts remain the only source for the grade profile within a cycle and for the flow rates, so those are still carried from 2017
SRC_ACCESS_EUCLID	warning	accessibility	straight-line settlement-to-school distance on OSM layers; no friction surface; settlement points unweighted by population for 98% of settlements
SRC_SEC_TEACHERS	note	secondary teachers 2017	grand total per district from the qualification annex; gov/private split by enrolment share
SRC_BEC_2025	note	UBOS Baseline Education Census 2025	first nationwide census of government and private schools, reference year 2025, published May 2026; supplies measured schools, learners, teachers, classrooms, stances and net attendance by district and supersedes the 2017 abstracts as the engine's supply and seed
SRC_BEC_RATIO_DERIVED	note	census classrooms and stances	published by district as pupil-classroom and pupil-stance ratios rather than counts; derived per census unit before aggregation and raked to the published national totals, so the counts are imputed from measured ratios
SRC_BEC_CITY_FOLD	note	census geography	the census reports 146 units; ten cities and Terego are folded into their parent districts to match UGA-UBOS-2022, and every unit's rule is recorded in bec_district_crosswalk
SRC_BEC_WASH	note	school water, hygiene and waste	the census counts schools by drinking-water source, by functional hand-washing facility and by waste disposal, at pre-primary, primary and secondary; these are loaded as counted into bec_facilities and reported, but no capital standard exists for them in this engine, so they are not costed and not part of any gap dimension

Check Code	Severity	Subject	Detail
SRC_BEC_ORIGIN_INTERNAL	note	census table 3.5A, learners by country of origin	its split of primary learners by sex differs from annex 3.A4's by 4,612 while the grand total agrees exactly, so the origin detail is used only for the distribution across countries and never for a sex split. In table 4.7A one row (Dubai) reached the extractor a field short and was restored from the table's own total row, the residual placing the missing cell uniquely; after that repair the country rows sum to the printed total
SRC_BEC_BOARDING_OWNERSHIP	note	census annex 3.A3, primary schools by day/boarding status	its government column totals 12,556 against the 12,557 of annex 3.A1: in Bunyangabu and Kileleshwa one school is government in 3.A1 and private in 3.A3, and in Kileleshwa the reverse. Every district total agrees in both annexes, so three schools are classified differently between two tables of the same census; the boarding shares are reported on 3.A3's own denominator and the difference is recorded rather than reconciled
SRC_BEC_T32_INTERNAL	note	census Table 3.2, primary schools by day/boarding status	the national row of that table allocates three private schools to 'day only' that both of its own partitions - urban plus rural, and the seventeen sub-regions - allocate to 'day and boarding'. The two partitions agree with each other and every total agrees, so the printed national row is the outlier; it is reported as published and not corrected
SRC_BEC_SUBREGION_ONLY	note	disability, nationality and support staff	learners with a disability, learners by nationality, non-teaching staff and secondary day/boarding status are published by sub-region and not by district; they are stored at that geography in bec_subregion and never apportioned to districts
SRC_OOSC_DIVERGENCE	warning	out-of-school children	the census attendance rates and the UIS survey series disagree materially at primary and lower secondary; both are reported, neither is averaged into the other, and each is labelled with what it is conditional on

Source: EPRAS run 6b2afcf6 (report/build/data/t_data_quality.csv).

SRC_EMIS_VINTAGE is superseded. It used to be the governing finding of this report: there was no district EMIS after 2017, and everything inherited it. It is retained, because an answered finding should be recorded as answered rather than deleted, and it now states what survives — the 2016 and 2017 abstracts remain the only source for the grade profile within a cycle and for the flow rates.

Four findings are new and all concern the census. **SRC_BEC_2025** records the load itself and the measured schools, learners, teachers, classrooms, stances and net attendance by district that come with it. **SRC_BEC_RATIO_DERIVED** is the most consequential caveat on it: the census publishes classrooms and stances by district as pupil–classroom and pupil–stance *ratios* rather than counts, so the engine derives counts per census unit and rakes them to the published national totals. Those counts are imputed from measured ratios — which matters because the classroom gap and the stance gap are computed from them. **SRC_BEC_CITY_FOLD** records the geography: the census reports 146 units, and ten cities together with Terego are folded into their parent districts to match UGA-UBOS-2022, every rule recorded in `bec_district_crosswalk` — 13 units reconciled, including two spelling variants. The fold is right for a plan pinned to this boundary set and wrong for anyone who wants a city figure. **SRC_OOSC_DIVERGENCE** is the sharpest new warning: the census attendance rates and the UIS survey series disagree materially. On the census, primary net attendance is 68.4 per cent and gross attendance 96.0 per cent, and out-of-school children of primary age number 2,467,716; on the survey series the same quantity is 753,482. Both are reported and neither is averaged into the other. A gap of that size is a finding about Uganda's statistical system, not a number to split.

Three findings carry over. **SRC_PTR_2017** still rejects a published column: the district pupil–teacher ratio in the 2017 abstract correlates 0.28 with the enrolment and teacher-count tables in the same document and ranges from 1 to 532. Its downstream reach has shrunk, because teachers in post now come from the census. **SRC_ACCESS_EUCLID** is untouched by the census: straight-line distances on OSM layers, no friction surface, settlement points unweighted by population for 98 per cent of settlements. So the share of children within 3 km — 94.6 per cent, leaving 726,951 children beyond it — is optimistic where the terrain is hardest, and the siting proposals inherit that. **SRC_SEC_TEACHERS** remains a note on the 2017 secondary teacher total, split by enrolment share; but its consequence has gone, because the census counts secondary classrooms. Secondary capacity is no longer teacher-bound by construction: of the 135 districts, 66 are teacher-bound and 69 room-bound, and which binds is now a finding.

16.11 How much to trust these numbers

The trust statement. *Robust:* the structure, the arithmetic and — new in this edition — the supply. The identities hold on real results, not test fixtures; the three cost views reconcile to one part in a billion; no result table contains a non-finite number; two runs with identical pins are bit-identical; and an independently written forecaster in the estimation library reproduces the chain's enrolment path to within 0.15 per cent. **Counted, not modelled:** 12,557 government and 31,010 private primary schools; 9,118,314 primary and 2,008,133 secondary learners; 270,176 primary teachers; the public/private split, 0.428 private at primary; and net attendance of 68.4 per cent at primary and 18.7 per cent at secondary. The gaps computed from these — a primary place gap of 1,194,733 against a surplus of 297,053 elsewhere, a classroom gap of 47,658 rooms, a teacher gap of 49,841 FTE, a stance gap of 55,605 — are much better founded than in any previous edition, because their available side is an enumeration rather than a nine-year extrapolation. The requirement of UGX 4,128.3 bn against a base-year envelope of UGX 2,441.9 bn of which only UGX 75.9 bn is uncommitted remains a conclusion no plausible data correction overturns. *Soft:* the grade profile within each cycle and all flow rates, still from the 2016–2017 abstracts and now rescaled rather than replaced; classrooms and latrine stances, derived from published ratios rather than counted; the 64 assumed norm coefficients, above all the taught loads and curriculum periods from which the whole teacher requirement is built; straight-line access; and learning outcomes, modelled nationally. District figures remain softer than national ones, and districts with a calibration factor far from one softer again. *Not computed:* the non-enrolment legs of the base-year reconciliation, the two-way sensitivity, the reconciliation against executed expenditure, district-level learning, the completion effect, and the expert review itself. **Use the national aggregates and the counted supply for argument; use a district's level with the confidence its calibration factor earns; do not use any single district's grade-by-grade figure as an entitlement, and do not use any of it as a budget.**

Three of the previous edition's caveats are retired. The nine-year bridge is gone: it is one year now, and Table 16.4 shows how far wrong it had gone district by district. "No district EMIS after 2017" is retired as a statement about supply, the public/private split and the seed year — but not about the grade profile or the flow rates. And "secondary classrooms are not measured at all, so secondary capacity is teacher-bound only" is retired outright.

Four are not retired, and two are new. The norm set is still draft and the 64 assumed coefficients untouched by any census. The grade profile and the flow rates are still

1. Access is still Euclidean. The base-year reconciliation is still enrolment-only.

New: classrooms and stances are ratio-derived rather than counted, and the two measures of out-of-school children disagree by more than a factor of three.

"Robust" and "soft" differ in kind, not in precision: the arithmetic is checked to one part in a billion, which says nothing about whether 36 taught periods of 40 is what a Ugandan primary teacher does. And what is uncomputed stays explicit: completion change is *missing* with the note "no evidence available: not modelled", never zero; established posts are not inferred; secondary teachers in post by subject are *unmeasured*.

16.12 Implications for planning

Commission the norm review before anything else. It is the cheapest action in this report with the largest effect on the credibility of every number in it, and the census has made it *more* important: with the supply side counted, the assumed coefficients are a larger share of what remains uncertain. It would retire G9 and shrink the dominant uncertainty in the requirement. Start with the taught loads and the two unsourced class sizes.

Ask UBOS and MoES for learners by grade and district. This is the one request that would close what the census left open. A grade-by-district table would retire the 2017 grade profile, allow the flow rates to be re-estimated on a current pair of years, and remove the last structural dependence on a nine-year-old source. It is a tabulation of data already collected. The chain runs end to end in 64.6 seconds, so the rebuild is a morning's work.

Treat the calibration factors as a district diagnostic, not as plumbing. A district whose intake factor is 0.272 or 2.198 is one whose education system moved between 2017 and 2025 in a way no published series recorded — boundary change, refugee settlement, urban growth or closures outrunning the statistics. Read Table 16.4 against a map to find the districts needing local correction.

Argue with the reconciliation table, not with the headline. The three lines in Table 16.8 are the ones MoFPED will recognise, and the wage line matters more than it did: with 109,606 government primary teachers counted in post against 137,247 implied by the wage bill, the engine's account of the teacher gap can be tested against a document the Ministry of Finance already holds. But **keep the draft label until it is earned**: the census has removed the larger of the two reasons this report was cautious, not the remaining one, which is a norm set nobody has signed.

CHAPTER 17

17 Conclusions, limitations and what to do next

This report set out to answer six questions for Uganda's education sector: what the school-age population needs, what the system has, where the gaps are, what closing them costs, where additional resources could go, and what they would achieve. This edition answers them for the first time against a count of the system rather than a projection of it, because the Baseline Education Census 2025 arrived between editions (UBOS 2026). This chapter says what the answers add up to, what they still rest on, and what should happen next.

17.1 What the analysis establishes

Delivery capacity binds before money does. At the rate the local-government development grant actually finances construction, the primary classroom gap takes fifty-five years to close; at the assumed college output and absorption, the teacher gap takes fifteen. Both halved when the gaps were recomputed on counted supply, and both remain an indictment of the delivery rate rather than a forecast. Every scenario that spends anything reaches the construction-throughput or teacher-pipeline ceiling before the budget ceiling, and the medium-term framework shows the plan spending less than its envelope in the outer years. A sector plan that asks only for more money, without asking what would raise the number of classrooms and teachers the country can deliver in a year, is answering the second question first.

The discretionary space is a few per cent of the envelope. Of the local-government education envelope, the existing wage bill and capitation account for almost all of it before any planning decision is taken. The census did not change this and could not: it is a fact about the budget, not about the schools. Allocation debates conducted over the whole envelope are about money that is already committed.

The public system is smaller than the sector. The census counts 42.8 per cent of primary learners in private schools and nearly three private primary schools for every government one. The requirement the government is being asked to finance is correspondingly smaller than previous editions modelled — and the children in those private schools are still Uganda's children, which makes the regulation and quality of private provision a planning question this engine does not currently answer.

Far more children are out of school than the international series says. Adjusted for children attending a level other than the one for their age, the census puts 2.47 million primary-age children out of school against the survey series' 753,000. The report publishes both. If the census is right, the scale of the exclusion problem in Uganda has been understated for years; if the survey is right, the census's attendance denominators need examination. Either way the discrepancy is now the most consequential open question in Uganda's education statistics, and it cannot be settled by modelling.

The gaps do not overlap, and must not be averaged. Across the five gap dimensions, the districts at the extremes are largely different districts. A composite priority index would produce a defensible-looking ranking that hides precisely the information a planner needs: whether a district needs rooms or teachers, whether its children are absent because there is no school within reach or because there is no place in the school they can reach.

Surpluses are real and are not available. Empty places exist in the same system as a million-place shortage, and they are in the wrong districts. Netting them would understate the task and imply, falsely, that redistribution alone could close a meaningful share of the gap.

The cheapest large improvement available still requires no money. Moving teachers already in post between districts would sharply cut the dispersion of pupil–teacher ratios with no new hiring. That it has not happened tells us the constraint is not fiscal.

17.2 17.2 What the analysis does not establish

The census is a baseline, not a series. It counts 2025. It cannot produce a repetition, promotion or dropout rate, because those need two observations of the same system; this report still takes its flow rates, and the grade profile within each cycle, from the 2016 and 2017 abstracts. That is now the oldest load-bearing component of the chain.

Some counted quantities are recovered rather than counted. Classrooms and latrine stances are published by district as ratios, not as counts, so they are derived from the published ratios and raked to the census's own national totals. They are measured quantities read through a rounded ratio, and they are tiered accordingly.

It does not know what a child is learning. The only district-level learning evidence in the estate is a decade old. Outcomes here are projected from effect sizes with evidence grades and transfer discounts, carry intervals, and are reported as "no detectable effect at this evidence base" where the interval spans zero. Completion is not modelled at all, and says so.

It does not see the whole sector. Technical and vocational education, teacher training and tertiary education are outside this phase. The census counts non-tertiary institutions and pre-primary, and this report reports them, but does not cost them. Household spending on schooling, which the survey evidence suggests is substantial, sits outside the plan's unit cost entirely.

Two thirds of its norm coefficients are assumed. Sixty-four of ninety-nine could not be sourced to a published document. They are listed in Annex B, they hold the norm set in draft, and the sensitivity analysis says which of them the answer actually depends on: class size, teaching load and the teacher salary, in that order.

Physical access is still a straight line. Every other part of the supply picture improved this edition; this one did not, and it is now the weakest link in the spatial analysis.

Four measured deficiencies have no price in this report. The census counted the schools with no hand-washing facility, those on un-improved drinking water, those with no proper means of waste disposal, and those taking boarders. The first three have no published standard to be differenced against and the fourth has no unit cost, so none of them enters the requirement, the gaps or the envelope. This is a boundary of the engine and not of the evidence: the counts exist, by district, and the moment the Ministry publishes a norm and a rate they become computable. Until then, every cost figure in this report is a cost of places, teachers, materials and stances — and of nothing else.

The cost of a boarding place is missing where it matters most. Because the unit costs are for day provision, the districts where most government primary schools take boarders — Kotido, Amudat, Napak, Moroto — are the districts whose true cost this report most understates. The bias has a known sign and a known location, which is the most that can be said about it here.

The workforce is larger than the establishment costed. The census found 27,835 non-teaching staff in government schools. The teacher requirement is built from the timetable and covers teaching posts, correctly; the people outside it are paid from the same budgets and appear in no figure in this report.

17.3 17.3 What should happen next

For the Uganda Bureau of Statistics and the Ministry of Education and Sports.

1. **Make the census a series.** A baseline that is never repeated decays into a historical document in exactly the way the 2017 abstracts did. An annual or biennial return built on the census frame would let flow rates be measured instead of carried, which is the single largest remaining weakness here.
2. **Publish learners by grade and district,** not only by class nationally. It is the one disaggregation that would retire the last use of the 2017 profile.
3. **Publish classrooms and stances as counts,** not only as ratios, so they need not be recovered through rounding.
4. **Resolve the out-of-school discrepancy.** The census and the international series disagree by a factor of three at primary. A reconciliation note from the two producing agencies would be worth more to planning than another year of modelling.
5. **Add teacher qualification to the census return.** It was in the 2017 abstracts and is not in the census, so the qualification gap is now carried forward as a share.
6. **Publish a service standard for school water, hand-washing and waste, and a boarding unit cost.** These are the four things the census now counts that this analysis cannot price. A norm per school or per learner, with a unit rate, would move all four from reported evidence into the requirement — and for roughly 2,800 schools with nowhere to wash hands, that is the difference between a number in an annex and a line in a budget.
7. **Publish learners with a difficulty, and non-Ugandan learners, by district.** Both are counted and both are released by sub-region only, which is one step too coarse to site anything against.

For the Ministry of Finance, Planning and Economic Development.

1. Read the requirement and the envelope as two different quantities, both correct. The gap between them is the financing gap, reported by district, dimension and year, and it is not closed by moving money between districts.
2. Note that the plan cannot absorb a large increase in the development grant in its current form, because throughput binds first. Money and delivery capacity have to be raised together or the money will not convert.
3. Carry the recurrent tail. Every classroom in the investment programme obliges a teacher, capitation and maintenance in perpetuity.

For the National Planning Authority and development partners.

1. Use the district tables in Annex C as the unit of discussion. The national totals are sums of them, and every disagreement about a national figure resolves into a disagreement about particular districts.
2. Fund the next observation before funding the next model. The census has just demonstrated what one year of real data is worth: it halved two headline gaps, tripled a third, and reversed the balance between the two binding constraints.

For the engine itself. The conformance register in the technical manual (chapter 21) lists what the build owes its own specification. The items that would most change a planning conclusion are the depth of the service catalogue and its system services, the price and progression gaps in costing, the benefit curve and constraint set in allocation, and the coverage of the factor trace.

17.4 17.4 A closing note on how to read a number in this report

Every figure here carries a quality tier, and the tiers are not decoration. A number marked *measured* came from a published source in a named year. One marked *normed* came from a standard. One marked *imputed* was derived by a stated method from other numbers. One marked *assumed* is a judgement with no source, and the report says whose judgement and why.

More of this edition is measured than of any before it, and the difference was made by a census rather than by a model. That is the lesson worth carrying: the largest single improvement in the quality of this analysis came from counting the schools, and the largest remaining improvement available is to count them again.

ANNEX A

A Formula compendium

Every quantity in this report is produced by one of the formulas below. They are collected here so that a reader can check an arithmetic claim without reading the chapter that made it, and so that an analyst reproducing the work has the identities in one place. Symbols carry the same meaning throughout: g indexes a grade, d a district, t a year, j a subject, q a cadre, r an input and c a cycle.

A.1 A.1 The planning identity

The whole engine is one identity, applied per grade, district and year.

$$A_{g,d,t} = P_{a(g),d,t} \quad (\text{A.1})$$

$$E_{g,d,t}^* = \text{flow}(E_{.,d,t-1}, \rho, \pi, \delta, \tau, I^*) \quad (\text{A.2})$$

$$C_{g,d,t} = \left\lceil \frac{E_{g,d,t}^*}{\kappa_{g,d}} \right\rceil \times m_{g,d} \quad (\text{A.3})$$

$$T_{q,d,t} = \sum_{j,g} C_{g,d,t} \cdot h_{j,g} \cdot s_{j,g} \cdot \frac{1+\alpha}{1-\beta} \cdot \frac{1}{L_q} \quad (\text{A.4})$$

$$R_{r,g,d,t} = E_{g,d,t}^* \cdot q_r \cdot \sigma_r \cdot \frac{1+\omega_r}{\ell_r} \quad (\text{A.5})$$

$$X_{g,d,t} = \sum_r R_{r,g,d,t} \cdot p_{r,d,t} + \sum_q T_{q,d,t} \cdot w_{q,d,t} \quad (\text{A.6})$$

where A is the official-age cohort; P the population at the official age $a(g)$; E^* the required places; ρ, π, δ the repetition, promotion and dropout rates; τ the transition rate at a cycle boundary; I^* the intake path; C the classes formed; κ the class-size norm; m the multigrade factor; T teacher full-time equivalents; h curriculum periods per week; s the practical-subject split factor; α the absence allowance; β the administrative release; L the teaching load in periods per week; R the quantity of input r ; q its quantity per learner; σ the share of learners it reaches; ω wastage; ℓ lifespan in years; X the cost; p an input price; and w the total employment cost of a cadre.

A.2 A.2 Population (EM-01)

Graduation of a banded count to single years of age preserves the band total:

$$\sum_{a \in b} \hat{P}_a = P_b \quad \text{for every band } b \quad (\text{A.7})$$

The cohort-component step ages each single-year cohort forward with survival and adds births at age zero:

$$P_{a+1,d,t+1} = P_{a,d,t} \cdot S_a \quad (\text{A.8})$$

Raking reconciles the district sum to the national projection:

$$f_t = \frac{N_t}{\sum_{d,a} P_{a,d,t}}, \quad P_{a,d,t}^{\text{raked}} = f_t \cdot P_{a,d,t} \quad (\text{A.9})$$

Age heaping is measured by the Whipple index on ages ending in 0 and 5:

$$W = 100 \times \frac{\sum_{a \in \{25, 30, \dots, 60\}} P_a}{\sum_{a=23}^{62} P_a} \quad (\text{A.10})$$

A.3 A.3 Participation (EM-02)

Reconstructed flow rates from two consecutive years:

$$\rho_{g,t} = \frac{R_{g,t+1}}{E_{g,t}}, \quad \pi_{g,t} = \frac{E_{g+1,t+1} - R_{g+1,t+1}}{E_{g,t}}, \quad \delta_{g,t} = 1 - \rho_{g,t} - \pi_{g,t} \quad (\text{A.11})$$

A negative δ is recorded as re-entry or error and never discarded:

$$\epsilon_{g,t} = \max(0, -\delta_{g,t}) \quad (\text{A.12})$$

District rates are shrunk towards the national rate with a weight that rises with the district's own enrolment:

$$\hat{\theta}_d = w_d \theta_d + (1 - w_d) \theta_{\text{nat}}, \quad w_d = \frac{E_d}{E_d + k} \quad (\text{A.13})$$

Participation ratios, both from primitives:

$$\text{GER}_{c,d,t} = \frac{\sum_{g \in c} E_{g,d,t}}{P_{\text{school age}(c),d,t}}, \quad \text{GIR}_{d,t} = \frac{E_{1,d,t} - R_{1,d,t}}{P_{\text{entry age},d,t}} \quad (\text{A.14})$$

Out-of-school children, anchored to a survey rate and distributed by the inverse of administrative participation:

$$\text{OOSC}_{c,d,t} = r_{c,d} \cdot P_{\text{school age}(c),d,t}, \quad r_{c,d} = \text{clamp}\left(r_c^{\text{nat}} \cdot \frac{\text{GER}_c^{\text{nat}}}{\text{GER}_{c,d}}, 0, 0.9\right) \quad (\text{A.15})$$

A.4 A.4 Demand (EM-03)

The grade-flow recursion, with the cycle-boundary transition:

$$E_{g,d,t} = \pi_{g-1} E_{g-1,d,t-1} + \rho_g E_{g,d,t-1}, \quad E_{1,d,t} = I_{d,t} \cdot P_{\text{entry age},d,t} + \rho_1 E_{1,d,t-1} \quad (\text{A.16})$$

Integer class formation, with the small-school correction used where only district totals exist:

$$C_{d,t} \approx \left\lceil \frac{E_{d,t}^*}{\kappa} + n_d^{\text{schools}} \cdot \varepsilon \right\rceil \quad (\text{A.17})$$

Rooms from classes, at a utilisation target below one and net of shifts:

$$\text{Rooms}_{d,t} = \frac{C_{d,t}}{\text{shifts} \times u} \quad (\text{A.18})$$

Specialist rooms from the specialist timetable, never one per school:

$$\text{Labs}_{d,t} = \max \left(n_d^{\text{schools}}, \left\lceil \frac{\sum_{j \in \mathcal{F}} \text{periods}_{j,d,t}}{H \cdot u} \right\rceil \right) \quad (\text{A.19})$$

where $\mathcal{F}$ is the set of subjects requiring a facility and H the periods in the school week.

Effective annual quantity of an input, and its acquisition quantity:

$$q_r^{\text{eff}} = \frac{q_r \cdot \sigma_r \cdot (1 + \omega_r)}{\ell_r}, \quad q_r^{\text{stock}} = q_r \cdot \sigma_r \cdot (1 + \omega_r) \quad (\text{A.20})$$

A.5 A.5 Supply and capacity (EM-04)

Usable classrooms, weighted by condition:

$$\text{Rooms}_d^{\text{usable}} = \sum_{\text{condition}} n_{d,\text{condition}} \cdot u_{\text{condition}} \quad (\text{A.21})$$

Places from rooms and from teachers, and capacity as their minimum:

$$K_d^{\text{room}} = \text{Rooms}_d^{\text{usable}} \cdot \kappa \cdot \text{shifts} \cdot u, \quad K_d^{\text{teacher}} = \frac{T_d^{\text{in post}} \cdot L}{H \cdot (1 + \alpha)} \cdot \kappa \quad (\text{A.22})$$

$$K_d = \min (K_d^{\text{room}}, K_d^{\text{teacher}}) \quad (\text{A.23})$$

A.6 A.6 Gaps (EM-05)

$$G_{k,d,t} = \max (0, R_{k,d,t} - A_{k,d,t}), \quad S_{k,d,t} = \max (0, A_{k,d,t} - R_{k,d,t}) \quad (\text{A.24})$$

$$G_{k,t} = \sum_d G_{k,d,t} \geq \max \left(0, \sum_d R_{k,d,t} - \sum_d A_{k,d,t} \right) \quad (\text{A.25})$$

A.7 A.7 Cost (EM-06)

Annualised durable, acquisition and maintenance:

$$X_r^{\text{rec}} = \frac{p_r}{\ell_r} \cdot R_r, \quad X_r^{\text{cap}} = p_r \cdot \Delta R_r, \quad X_r^{\text{maint}} = \mu \cdot p_r \cdot R_r \quad (\text{A.26})$$

Unit cost per learner-year, with its mandatory components:

$$\text{UC}_c = \frac{X_c^{\text{salary}} + X_c^{\text{nonsalary}} + X_c^{\text{annualised capital}}}{E_c^{\text{public}}} \quad (\text{A.27})$$

A.8 A.8 Investment (EM-07)

Throughput-constrained phasing and the induced recurrent obligation:

$$\sum_d \Delta \text{Rooms}_{d,t} \leq \Theta_t, \quad X_t^{\text{induced}} = \sum_{\tau \leq t} \Delta \text{Rooms}_{\tau} \cdot (w_{\text{teacher}} + \gamma_{\text{capitation}} \cdot \kappa + \mu p_{\text{room}}) \quad (\text{A.28})$$

The teacher pipeline as a state variable:

$$T_{t+1} = T_t - \lambda T_t + \min(\Gamma_t \cdot \phi, \text{demand}_t) \quad (\text{A.29})$$

where λ is attrition, Γ college output and ϕ the public deployment share.

Maximal covering, over candidate sites j and settlements i :

$$\max \sum_i y_i \quad \text{s. t.} \quad y_i \leq \sum_{j \in N_i} x_j, \quad \sum_j x_j \leq n, \quad x_j \in \{0, 1\} \quad (\text{A.30})$$

where N_i is the set of candidates within the walking norm of settlement i .

A.9 A.9 Allocation (EM-08)

The envelope decomposition, computed before any allocation:

$$B_t = B_t^{\text{committed}} + B_t^{\text{discretionary}} \quad (\text{A.31})$$

The programme solved for each stated objective:

$$\max \sum_d v_d \cdot z_d \quad \text{s. t.} \quad \sum_d (w \cdot h_d + p \cdot c_d) \leq B^{\text{discretionary}}, \quad \sum_d h_d \leq \Pi, \quad \sum_d c_d \leq \Theta \quad (\text{A.32})$$

$$z_d \leq \min(K_d^{\text{room}} + \kappa c_d, K_d^{\text{teacher}} + \kappa_T h_d, E_d^*) - K_d \quad (\text{A.33})$$

where h is teachers hired, c classrooms built, z places delivered, Π the pipeline ceiling, Θ the throughput ceiling and v the objective weight — unity for the enrolment objective and the deficit share raised to the exponent γ for the equity-weighted objective.

The financing gap, by district, dimension and year:

$$F_{k,d,t} = X_{k,d,t}^{\text{gap}} - X_{k,d,t}^{\text{funded}} \quad (\text{A.34})$$

A.10 A.10 Outcomes (EM-09)

Places filled at the fill rate, capped by the out-of-school population:

$$\Delta E_d = \min(\phi \cdot z_d, \text{OOSC}_d) \quad (\text{A.35})$$

The composition effect, reported separately from the within-group effect:

$$\Delta \bar{y} = \frac{E_0}{E_1} \Delta y_0 + \frac{\Delta E}{E_1} (y_{\text{new}} - \bar{y}_0) \quad (\text{A.36})$$

ight) \$\$ {#eq:a-composition}

where the first term is the within-group effect on those already enrolled and the second is the composition effect of the newly enrolled, who start further behind. Proficiency is read off the observed distribution:

$$\Delta \text{Prof} = \Phi(z_0 + \Delta y) - \Phi(z_0), \quad z_0 = \Phi^{-1}(\text{Prof}_0) \quad (\text{A.37})$$

A.11 A.11 Budget and MTEF (EM-10)

Nominal from constant through the deflator path, both labelled:

$$X_t^{\text{nom}} = X_t^{\text{const}} \cdot \prod_{\tau \leq t} (1 + \iota_\tau) \quad (\text{A.38})$$

The wage share memo line, and the recurrent tail beyond the horizon:

$$\text{WageShare}_t = \frac{X_t^{\text{wage}}}{X_t^{\text{total}}}, \quad X_{T+k}^{\text{tail}} = \sum_{t \leq T} \Delta \text{Rooms}_t \cdot x^{\text{induced}} \quad (\text{A.39})$$

ANNEX B

B Reference catalogues, norms and prices

This annex prints the parameter tier in full. Everything the engine computes is driven by these tables: change a coefficient here and every number in the report moves, which is why each row carries a source, a source year and a quality tier, and why a coefficient that cannot be sourced is flagged assumed and holds the norm version in draft.

B.1 B.1 The education structure

The structure is data. Grades, entry ages, cycle lengths and terminal examinations are read from the pinned structure version and are never written into the code, so the same engine runs a 7–4–2 system and a 6–3–3 one without a source change.

Table B.1: The education structure this run is pinned to

Cycle Code	Cycle Name	Isced Level	Entry Age	N Grades	Compulsory	Fee Free Policy	Terminal Exam
PRE	Pre-primary	0	3	3	0	0	
PRI	Primary	1	6	7	1	1	PLE
LSE	Lower secondary	2	13	4	0	1	UCE
USE	Upper secondary	3	17	2	0	0	UACE

Structure version UGA-7-4-2-LSC2020. Grades, entry ages and durations are data, never code. Source: EPRAS run 6b2afcf6 (report/build/data/t_structure.csv).

B.2 B.2 Education services

A service is the unit that carries a norm: a place in a grade, a support service such as a meal or a bursary, or a system service such as inspection or examinations. System services are costed on their own drivers precisely because omitting them is what makes bottom-up education costings come in below actual expenditure.

Table B.2: Education services: the units that carry a norm

Service Code	Service Name	Service Kind
PLACE_LSE	Lower secondary place S1-S4	place
PLACE_PRE	Pre-primary place	place
PLACE_PRI_LOWER	Primary place P1-P3	place
PLACE_PRI_UPPER	Primary place P4-P7	place
PLACE_USE	Upper secondary place S5-S6	place
SYS_SCHOOL	School-level system services	system

Source: EPRAS run 6b2afcf6 (report/build/data/t_services.csv).

B.3 B.3 Norm headers

One row per service: the class it forms, the shifts it runs, the multigrade factor, the school year and the timetable.

Table B.3: Norm headers: the class the place belongs to

Service Code	Class Size	Shifts	Multigrade Factor	Weeks Per Year	Periods Per Week	Period Minutes	Source	Source Year	Quality
PLACE_LSE	60	1	1	36	40	40	MoES LG Planning Guidelines 2022 p.23: classroom:student 1:60	2022	normed
PLACE_PRE	40	1	1	36	40	30	assumed: no written ECD class-size norm located	2022	assumed

Service Code	Class Size	Shifts	Multigrade Factor	Weeks Per Year	Periods Per Week	Period Minutes	Source	Source Year	Quality
PLACE_PRI_LOWER	53	1	1	36	40	30	MoES LG Planning Guidelines 2022 p.23: classroom:pupil 1:53	2022	normed
PLACE_PRI_UPPER	53	1	1	36	40	40	MoES LG Planning Guidelines 2022 p.23: classroom:pupil 1:53	2022	normed
PLACE_USE	45	1	1	36	40	40	assumed: A-level stream size	2022	assumed

One row per service and norm version. Every coefficient carries its source, its year and its quality tier. Source: EPRAS run 6b2afcf6 (report/build/data/t_norms.csv).

B.4 B.4 The bill of materials

One row per input or cadre that a learner-year consumes. The effective annual quantity is quantity × share of learners × (1 + wastage) ÷ lifespan years, so a textbook lasting three years costs a third of its price per learner-year, and a meal reaching two-fifths of learners costs two-fifths of a meal.

Table B.4: The bill of materials: every line of every service

Service Code	Input Code	Cadre Code	Quantity	Unit	Share Of Learners	Wastage	Lifespan Years	Source	Source Year	Quality
PLACE_LSE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26 60 sets per classroom	2022	normed
PLACE_LSE	TEXTBOOK		8	copy	1	0.05	3	assumed: eight subjects 1:1	2022	assumed
PLACE_LSE	CAPITATION_USE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 USE per learner	2022	normed
PLACE_LSE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_PRE	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_LOWER	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_LOWER	TEXTBOOK		2	copy	1	0.05	3	assumed: literacy + numeracy readers 1:1	2022	assumed
PLACE_PRI_LOWER	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	normed
PLACE_PRI_LOWER	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_PRI_UPPER	DESK_3SEAT		0.333	desk	1	0.02	10	MoES LG Planning Guidelines 2022 p.23 desk 1:3	2022	normed
PLACE_PRI_UPPER	TEXTBOOK		4	copy	1	0.05	3	assumed: four examinable subjects 1:1	2022	assumed
PLACE_PRI_UPPER	CAPITATION_UPE		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE per learner	2022	normed
PLACE_PRI_UPPER	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
PLACE_USE	FURN_SEC		1	place	1	0.02	10	MoES LG Planning Guidelines 2022 p.26	2022	normed
PLACE_USE	TEXTBOOK		4	copy	1	0.05	3	assumed: three principals + GP	2022	assumed
PLACE_USE	CAPITATION_UPOLET		1	learner_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPOLET per learner	2022	normed
PLACE_USE	LATRINE_STANCE		0.025	stance	1	0	15	MoES LG Planning Guidelines 2022 p.23 stance 1:40	2022	normed
SYS_SCHOOL	INSPECT_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 inspection per school	2022	normed
SYS_SCHOOL	MONITOR_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.19 monitoring per school	2022	normed
SYS_SCHOOL	CAPITATION_UPE_SCHOOL		1	school_year	1	0	1	MoES LG Planning Guidelines 2022 p.18 UPE fixed per school	2022	normed

Effective annual quantity is quantity × share of learners × (1 + wastage) / lifespan years. Source: EPRAS run 6b2afcf6 (report/build/data/t_norm_lines.csv).

B.5 B.5 Curriculum

Periods per week by grade and subject, with the maximum teaching-group size that splits a class for practical subjects.

Table B.5: Curriculum periods by grade and subject

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_1	AGRIC	2		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	BIO	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	CHEM	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ELECT	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	ICT	2	40	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	KIS	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	PHY	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_1	RE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	AGRIC	2		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	BIO	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_2	CHEM	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ELECT	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	ICT	2	40	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	KIS	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	PHY	3	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_2	RE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	BIO	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	CHEM	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ELECT	8		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
LSE_3	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_3	PHY	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	BIO	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	CHEM	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ELECT	8		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ENG	5		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	ENT	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	GEOG	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	HIST	3		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	MATH	5		TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	PE	2		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
LSE_4	PHY	4	30	TEACH_SEC_SCI	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
PRE_1	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRE_2	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRE_3	PRE_ECD	40		TEACH_PRE	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_1	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_2	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_3	THEMATIC	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_4	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_5	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_6	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
PRI_7	PRI_CLASS	40		TEACH_PRI	NCDC curricula (P1-P3 thematic; LSC 2020)	normed
USE_1	A_PRINC	30	25	TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Grade Code	Subject Code	Periods Per Week	Max Group Size	Cadre Code	Source	Quality
USE_1	A_SUBS	10		TEACH_SEC_ARTS	assumed: periods not yet verified against the NCDC framework; ch.15 \$15.4 review	assumed

Source: EPRAS run 6b2afc6 (report/build/data/t_curriculum.csv).

B.6 B.6 Teaching load and staffing standards

Teachers scale with classes and periods; head teachers, deputies and technicians scale with schools, streams and facilities. The two are separate tables because they are separate quantities, and applying one basis to both is the error the separation prevents.

Table B.6: Teaching load: the periods one full-time teacher teaches

Cadre Code	Cycle Code	Periods Per Week Taught	Absence Allowance	Admin Release	Source	Quality
TEACH_SEC_ARTS	LSE	24	0.05	0	assumed: 24 taught periods; ch.15 §15.4 review	assumed
TEACH_SEC_SCI	LSE	24	0.05	0	assumed: 24 taught periods; ch.15 §15.4 review	assumed
TEACH_PRE	PRE	36	0.05	0	assumed: 36 of 40 periods taught; ch.15 §15.4 review	assumed
TEACH_PRI	PRI	36	0.05	0	assumed: 36 of 40 periods taught (class-teacher model); ch.15 §15.4 review	assumed
TEACH_SEC_ARTS	USE	22	0.05	0	assumed	assumed
TEACH_SEC_SCI	USE	22	0.05	0	assumed	assumed

Source: EPRAS run 6b2afcf6 (report/build/data/t_teaching_load.csv).

Table B.7: Non-teaching staffing standards, each on its own basis

School Type Code	Cadre Code	Basis	Quantity	Threshold	Source	Quality
PRI_GOV	DEPUTY_PRI	per_school	1	7	assumed: deputy above 7 classes	assumed
PRI_GOV	HEAD_PRI	per_school	1		MoES establishment practice	normed
SEC_GOV	DEPUTY_SEC	per_school	1		MoES establishment practice	normed
SEC_GOV	HEAD_SEC	per_school	1		MoES establishment practice	normed
SEC_GOV	LAB_TECH	per_school	1		MoES LG Planning Guidelines 2022 p.23 one science laboratory per school	normed

Source: EPRAS run 6b2afcf6 (report/build/data/t_staffing.csv).

B.7 B.7 Capacity standards

Table B.8: Capacity standards: rooms, utilisation and area

School Type Code	Facility Input	Basis	Quantity	Utilisation Target	Area M2	Source	Quality
PRI_GOV	CLASSROOM	per_class	1	0.9	56	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.90	normed
PRI_GOV	LATRINE_STANCE	per_40_learners	1	1		MoES LG Planning Guidelines 2022 p.23	normed
SEC_GOV	CLASSROOM_SEC	per_class	1	0.85	63	MoES LG Planning Guidelines 2022 p.23; utilisation assumed 0.85	normed
SEC_GOV	SCIENCE_BLOCK	per_school	1	1		MoES LG Planning Guidelines 2022 p.23	normed

Source: EPRAS run 6b2afcf6 (report/build/data/t_capacity_standards.csv).

B.8 B.8 Prices

Prices are pinned to a vintage and held in constant base-year currency. A policy rate — a capitation grant, a salary on the public scale — is carried at its declared value; a market price is rebased. A missing price stops the run and names the input rather than costing it at zero.

Table B.9: Prices in the pinned vintage

Input Code	Cadre Code	Unit	Price	Currency	Price Basis	Price Kind	Source
CAPITATION_UPE		learner_year	17,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_LEARNER)
CAPITATION_UPE_SCHOOL		school_year	1,350,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPE_SCHOOL)
CAPITATION_UPOLET		learner_year	270,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_UPOLET_GOV)
CAPITATION_USE		learner_year	175,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.18 (CAP_USE_GOV)
CLASSROOM		room	52,711,605	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_CLASSROOM_2BLOCK)
CLASSROOM_SEC		room	82,021,551	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_CLASSROOM_2BLOCK_SEC)
DEO_FIXED		district_year	48,500,000	UGX	constant_2026	policy_rate	MoES LG Planning Guidelines 2022 p.19 (monitoring+inspection+top-up)
	DEPUTY_PRI	FTE_year	9,478,372	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	DEPUTY_SEC	FTE_year	22,253,682	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
DESK_3SEAT		desk	373,523	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_DESK_3SEAT)
FURN_SEC		place	390,124	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (FUR_CLASS_SET_SEC)
	HEAD_PRI	FTE_year	11,600,972	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.13 midpoint x12 x(1+0.10 employer on-cost)
	HEAD_SEC	FTE_year	30,498,494	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.15 midpoint x12 x(1+0.10 employer on-cost)
INSPECT_SCHOOL		school_year	112,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_INSPECT_SCHOOL)
	LAB_TECH	FTE_year	29,040,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.17 midpoint x12 x(1+0.10 employer on-cost)
LATRINE_STANCE		stance	8,056,217	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25-26 (CAP_LATRINE_5)
MONITOR_SCHOOL		school_year	100,000	UGX	constant_2026	policy_rate	MOES_PBI_GUIDELINES_2022 p.19 (SYS_MONITOR_SCHOOL)
NEW_PRI_SCHOOL		school	842,625,718	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_PRIMARY_SCHOOL_NEW)
NEW_SEED_SCHOOL		school	1,065,207,900	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SEED_SCHOOL_PH1)

Input Code	Cadre Code	Unit	Price	Currency	Price Basis	Price Kind	Source
SCIENCE_BLOCK		unit	308,785,625	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.25 (CAP_SCIENCE_BLOCK)
TEACHER_HOUSE		unit	134,564,072	UGX	constant_2026	market_price	MOES_PBI_GUIDELINES_2022 p.26 (CAP_HOUSE_2UNIT_PRI)
	TEACH_PRE	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_PRI	FTE_year	7,047,810	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.14 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_ARTS	FTE_year	13,453,770	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
	TEACH_SEC_SCI	FTE_year	52,800,000	UGX	constant_2026	policy_rate	MOPS_CSI1_2025 (Salary Structure FY2025/26) p.16 midpoint x12 x(1+0.10 employer on-cost)
TEXTBOOK		copy	8,789	UGX	constant_2026	market_price	WB_P133780_PAD_2014 p.133 (MAT_TEXTBOOK_PRI)

Price vintage UGA-2026; all amounts constant. Source: EPRAS run 6b2afcf6 (report/build/data/t_prices.csv).

B.9 B.9 Coefficients flagged assumed

These could not be sourced to a published document. They are the review list of chapter 15 of the technical manual, and until they are reviewed the norm version cannot be approved and every run that uses it stays draft.

Table B.10: Coefficients flagged assumed, with the reason

Table	Key	Coefficient	Value	Source	Quality
education_norm	PLACE_PRE	class_size	40	assumed: no written ECD class-size norm located	assumed
education_norm	PLACE_USE	class_size	45	assumed: A-level stream size	assumed
education_norm_line	PLACE_PRI_LOWER/2	TEXTBOOK	2	assumed: literacy + numeracy readers 1:1	assumed
education_norm_line	PLACE_PRI_UPPER/2	TEXTBOOK	4	assumed: four examinable subjects 1:1	assumed
education_norm_line	PLACE_LSE/2	TEXTBOOK	8	assumed: eight subjects 1:1	assumed
education_norm_line	PLACE_USE/2	TEXTBOOK	4	assumed: three principals + GP	assumed
curriculum	LSE_1/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/PHY	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/CHEM	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/BIO	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/HIST	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/KIS	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/RE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/ENT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/AGRIC	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/PE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Table	Key	Coefficient	Value	Source	Quality
curriculum	LSE_1/ICT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_1/ELECT	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/PHY	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/CHEM	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/BIO	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/HIST	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/KIS	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/RE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ENT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/AGRIC	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/PE	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ICT	periods_per_week	2	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_2/ELECT	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/ENG	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/MATH	periods_per_week	5	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/PHY	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

Table	Key	Coefficient	Value	Source	Quality
curriculum	LSE_3/CHEM	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/BIO	periods_per_week	4	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed
curriculum	LSE_3/GEOG	periods_per_week	3	assumed: periods not yet verified against the NCDC framework; ch.15 §15.4 review	assumed

These cannot be sourced to a published document and hold the norm version in draft. Source: EPRAS run 6b2afcf6 (report/build/data/t_norm_review.csv).

ANNEX C

C District statistical tables

One row per district, for every stage of the chain. These are the tables a district education officer should read first: they are the same numbers the national chapters aggregate, and a district that disagrees with its own row is the most useful data-quality report this system can receive.

All 135 districts of the pinned geography appear in every table. A blank cell is a quantity that is not measured, not a zero: the distinction is the whole of the engine's position on data.

C.1 C.1 Population, enrolment and participation

School-age population aged 6 to 12, enrolment carried from the last observed administrative year, and the gross enrolment ratio formed from the two.

Table C.1: Primary school-age population, enrolment and gross enrolment ratio, by district

District ID	School Age 6 12	Enrolled	GER
Abim	36,247	29,679	0.819
Adjumani	48,513	66,362	1.368
Agago	51,475	83,857	1.629
Alebtong	58,920	77,807	1.321
Amolatar	39,129	43,211	1.104
Amudat	30,964	6,797	0.22
Amuria	50,299	57,308	1.139
Amuru	46,392	52,474	1.131
Apac	50,609	64,223	1.269
Arua	157,570	247,603	1.571
Budaka	55,990	66,601	1.19
Bududa	61,126	58,047	0.95
Bugiri	97,247	87,581	0.901
Bugweri	42,492	42,596	1.002
Buhweju	28,854	28,772	0.997
Buikwe	98,161	78,196	0.797
Bukedea	56,029	70,055	1.25
Bukomansimbi	33,460	44,720	1.337
Bukwo	25,733	46,055	1.79
Bulambuli	51,795	41,961	0.81
Buliisa	28,521	24,238	0.85
Bundibugyo	52,004	60,138	1.156
Bunyangabu	39,088	39,626	1.014
Bushenyi	51,715	64,124	1.24
Busia	83,389	99,021	1.187
Butaleja	63,743	98,762	1.549
Butambala	23,993	27,036	1.127

District ID	School Age 6 12	Enrolled	GER
Butebo	29,910	34,740	1.161
Buvuma	18,645	15,610	0.837
Buyende	86,790	88,357	1.018
Dokolo	49,534	57,119	1.153
Gomba	35,928	36,110	1.005
Gulu	69,182	71,748	1.037
Hoima	71,930	48,446	0.674
Ibanda	55,237	67,407	1.22
Iganga	88,711	87,960	0.992
Isingiro	120,127	94,818	0.789
Jinja	105,452	91,437	0.867
Kaabong	26,066	33,967	1.303
Kabale	46,858	64,976	1.387
Kabarole	63,733	58,334	0.915
Kaberamaido	30,926	35,844	1.159
Kagadi	86,560	97,725	1.129
Kakumiro	97,536	73,163	0.75
Kalaki	31,148	36,879	1.184
Kalangala	6,285	5,569	0.886
Kaliro	62,924	56,746	0.902
Kalungu	41,779	66,169	1.584
Kampala	258,959	223,283	0.862
Kamuli	125,325	118,201	0.943
Kamwenge	66,879	62,733	0.938
Kanungu	56,249	70,853	1.26
Kapchorwa	27,013	34,244	1.268
Kapelebyong	22,598	25,777	1.141
Karenga	12,742	17,597	1.381
Kasese	157,154	180,711	1.15
Kassanda	61,554	52,634	0.855
Katakwi	41,219	52,161	1.265
Kayunga	89,142	99,860	1.12

District ID	School Age 6 12	Enrolled	GER
Kazo	44,941	38,926	0.866
Kibaale	39,766	32,957	0.829
Kiboga	34,260	32,193	0.94
Kibuku	55,110	61,386	1.114
Kikuube	70,097	49,220	0.702
Kiruhura	34,119	29,329	0.86
Kiryandongo	65,470	70,974	1.084
Kisoro	64,240	71,641	1.115
Kitagwenda	31,924	29,058	0.91
Kitgum	45,842	61,363	1.339
Koboko	55,362	72,727	1.314
Kole	63,340	75,628	1.194
Kotido	38,784	21,902	0.565
Kumi	62,157	78,172	1.258
Kwania	48,460	61,620	1.272
Kween	23,207	32,872	1.416
Kyankwanzi	55,349	42,961	0.776
Kyegegwa	92,167	65,129	0.707
Kyenjojo	103,036	94,618	0.918
Kyotera	53,780	76,028	1.414
Lamwo	28,838	43,797	1.519
Lira	103,209	106,132	1.028
Luuka	60,216	63,511	1.055
Luwero	111,538	127,805	1.146
Lwengo	59,814	66,958	1.119
Lyantonde	21,246	26,320	1.239
Madi Okollo	34,838	55,282	1.587
Manafwa	37,271	39,336	1.055
Maracha	42,425	80,290	1.893
Masaka	65,897	57,601	0.874
Masindi	63,997	66,905	1.045
Mayuge	118,721	104,514	0.88

District ID	School Age 6 12	Enrolled	GER
Mbale	122,407	123,565	1.009
Mbarara	71,143	78,080	1.098
Mitooma	40,227	55,989	1.392
Mityana	74,084	65,671	0.886
Moroto	21,412	13,139	0.614
Moyo	18,230	39,300	2.156
Mpigi	58,853	44,447	0.755
Mubende	112,607	97,880	0.869
Mukono	138,919	101,945	0.734
Nabilatuk	20,861	8,443	0.405
Nakapiripirit	22,679	9,426	0.416
Nakaseke	46,866	52,806	1.127
Nakasongola	45,389	43,836	0.966
Namayingo	52,681	54,211	1.029
Namisindwa	51,246	60,448	1.18
Namutumba	66,409	70,645	1.064
Napak	30,070	22,019	0.732
Nebbi	60,433	94,548	1.565
Ngora	36,130	48,932	1.354
Ntoroko	14,632	15,200	1.039
Ntungamo	109,134	116,064	1.063
Nwoya	55,736	28,626	0.514
Obongi	5,434	12,186	2.243
Omoro	44,268	52,104	1.177
Otuke	29,173	35,640	1.222
Oyam	99,053	119,888	1.21
Pader	42,386	80,315	1.895
Pakwach	40,826	34,257	0.839
Pallisa	75,585	83,720	1.108
Rakai	65,338	68,283	1.045
Rubanda	42,901	58,689	1.368
Rubirizi	29,874	29,421	0.985

District ID	School Age 6 12	Enrolled	GER
Rukiga	20,264	26,165	1.291
Rukungiri	68,394	80,650	1.179
Rwampara	28,559	31,392	1.099
Serere	79,058	98,281	1.243
Sheema	46,113	49,064	1.064
Sironko	58,821	78,594	1.336
Soroti	78,702	84,546	1.074
Ssembabule	60,673	79,223	1.306
Tororo	129,166	169,877	1.315
Wakiso	532,695	304,222	0.571
Yumbe	170,874	142,676	0.835
Zombo	58,396	70,993	1.216

One row per district; 135 districts on the pinned geography. Source: EPRAS run 6b2afcf6 (report/build/data/a_pop.csv).

C.2 Out-of-school children

The out-of-school count is the survey rate applied to the district's own school-age population after distribution by inverse administrative participation. D2 is never attended; D3 is dropped out.

Table C.2: Out-of-school children by district and dimension

District ID	School Age	Oos Rate	Oosc	D2 Never	D3 Dropped
Abim	45,282	0.51	23,114	9,245	13,868
Adjumani	64,331	0.174	11,168	4,467	6,701
Agago	71,401	0.338	24,150	9,660	14,490
Alebtong	70,975	0.389	27,619	11,047	16,571
Amolatar	48,355	0.392	18,973	7,589	11,384
Amudat	40,919	0.942	38,526	15,410	23,116
Amuria	65,225	0.325	21,213	8,485	12,728
Amuru	61,238	0.34	20,845	8,338	12,507
Apac	58,748	0.299	17,580	7,032	10,548
Arua	190,508	0.22	41,874	16,749	25,124
Budaka	72,783	0.021	1,519	608	912
Bududa	69,629	0.449	31,243	12,497	18,746
Bugiri	132,334	0.235	31,142	12,457	18,685
Bugweri	52,313	0.204	10,668	4,267	6,401
Buhweju	39,632	0.351	13,920	5,568	8,352
Buikwe	117,227	0.126	14,763	5,905	8,858
Bukedea	75,558	0.112	8,452	3,381	5,071
Bukomansimbi	39,704	0.14	5,559	2,224	3,336
Bukwo	35,080	0.173	6,052	2,421	3,631
Bulambuli	63,306	0.209	13,252	5,301	7,951
Buliisa	41,098	0.449	18,441	7,376	11,064
Bundibugyo	72,610	0.413	29,985	11,994	17,991
Bunyangabu	51,723	0.352	18,222	7,289	10,933
Bushenyi	53,659	0	0	0	0
Busia	103,831	0.158	16,450	6,580	9,870
Butaleja	90,093	0.099	8,907	3,563	5,344
Butambala	28,219	0.212	5,968	2,387	3,581

District ID	School Age	Oos Rate	Oosc	D2 Never	D3 Dropped
Butebo	39,010	0.244	9,518	3,807	5,711
Buvuma	34,974	0.569	19,898	7,959	11,939
Buyende	131,738	0.287	37,851	15,140	22,711
Dokolo	56,346	0.307	17,288	6,915	10,373
Gomba	44,717	0.164	7,327	2,931	4,396
Gulu	76,686	0.2	15,308	6,123	9,185
Hoima	94,360	0.11	10,423	4,169	6,254
Ibanda	66,328	0.196	13,023	5,209	7,814
Iganga	105,039	0.041	4,354	1,742	2,613
Isingiro	163,205	0.306	49,897	19,959	29,938
Jinja	119,789	0.079	9,419	3,767	5,651
Kaabong	31,336	0.883	27,671	11,068	16,602
Kabale	52,135	0.07	3,629	1,452	2,178
Kabarole	79,745	0.11	8,785	3,514	5,271
Kaberamaido	37,494	0.11	4,113	1,645	2,468
Kagadi	124,230	0.321	39,865	15,946	23,919
Kakumiro	148,642	0.335	49,792	19,917	29,875
Kalaki	39,575	0.219	8,670	3,468	5,202
Kalangala	12,447	0.495	6,165	2,466	3,699
Kaliro	84,287	0.189	15,910	6,364	9,546
Kalungu	48,982	0	0	0	0
Kampala	312,799	0.155	48,541	19,416	29,124
Kamuli	153,110	0.136	20,775	8,310	12,465
Kamwenge	102,978	0.297	30,591	12,237	18,355
Kanungu	67,947	0.15	10,176	4,070	6,106
Kapchorwa	29,959	0.18	5,395	2,158	3,237
Kapelebyong	29,824	0.383	11,412	4,565	6,847
Karenga	19,298	0.838	16,163	6,465	9,698
Kasese	211,338	0.318	67,131	26,852	40,279
Kassanda	79,764	0.122	9,700	3,880	5,820
Katakwi	51,580	0.276	14,261	5,704	8,557
Kayunga	109,351	0.156	17,088	6,835	10,253
Kazo	57,303	0.309	17,706	7,082	10,623
Kibaale	60,930	0.314	19,156	7,662	11,494

District ID	School Age	Oos Rate	Oosc	D2 Never	D3 Dropped
Kiboga	43,484	0.197	8,585	3,434	5,151
Kibuku	74,593	0.314	23,452	9,381	14,071
Kikuube	104,709	0.337	35,302	14,121	21,181
Kiruhura	43,410	0.136	5,890	2,356	3,534
Kiryandongo	86,350	0.237	20,508	8,203	12,305
Kisoro	83,835	0.33	27,629	11,051	16,577
Kitagwenda	43,700	0.345	15,064	6,026	9,039
Kitgum	58,562	0.173	10,103	4,041	6,062
Koboko	73,327	0.393	28,851	11,541	17,311
Kole	75,326	0.276	20,827	8,331	12,496
Kotido	52,015	0.867	45,085	18,034	27,051
Kumi	77,616	0	0	0	0
Kwania	56,689	0.286	16,226	6,491	9,736
Kween	28,896	0.324	9,367	3,747	5,620
Kyankwanzi	77,469	0.187	14,455	5,782	8,673
Kyegegwa	135,208	0.406	54,957	21,983	32,974
Kyenjojo	147,772	0.327	48,380	19,352	29,028
Kyotera	64,312	0.013	855	342	513
Lamwo	39,323	0.4	15,728	6,291	9,437
Lira	115,283	0.094	10,811	4,324	6,487
Luuka	73,207	0.397	29,042	11,617	17,425
Luwero	132,059	0	0	0	0
Lwengo	77,324	0.063	4,881	1,952	2,928
Lyantonde	28,841	0.197	5,694	2,278	3,416
Madi Okollo	43,985	0.236	10,399	4,159	6,239
Manafwa	46,136	0.243	11,207	4,483	6,724
Maracha	56,072	0.247	13,863	5,545	8,318
Masaka	81,151	0	0	0	0
Masindi	85,159	0.155	13,215	5,286	7,929
Mayuge	161,364	0.247	39,896	15,959	23,938
Mbale	143,660	0.065	9,346	3,738	5,607
Mbarara	85,160	0	0	0	0
Mitooma	48,335	0.1	4,831	1,932	2,898
Mityana	89,190	0.021	1,862	745	1,117

District ID	School Age	Oos Rate	Oosc	D2 Never	D3 Dropped
Moroto	33,248	0.702	23,345	9,338	14,007
Moyo	20,262	0.162	3,276	1,310	1,966
Mpigi	72,790	0	0	0	0
Mubende	157,108	0.219	34,420	13,768	20,652
Mukono	170,160	0.136	23,088	9,235	13,853
Nabilatuk	26,508	0.896	23,752	9,501	14,251
Nakapiripirit	31,587	0.747	23,581	9,433	14,149
Nakaseke	56,142	0.088	4,942	1,977	2,965
Nakasongola	56,375	0.192	10,824	4,330	6,495
Namayingo	75,186	0.245	18,426	7,371	11,056
Namisindwa	69,751	0.129	9,011	3,604	5,407
Namutumba	90,345	0.116	10,497	4,199	6,298
Napak	44,719	0.804	35,952	14,381	21,571
Nebbi	74,950	0.117	8,790	3,516	5,274
Ngora	44,812	0.313	14,040	5,616	8,424
Ntoroko	19,615	0.447	8,759	3,504	5,255
Ntungamo	136,420	0.15	20,431	8,172	12,259
Nwoya	75,510	0.518	39,116	15,646	23,470
Obongi	7,007	0.385	2,696	1,079	1,618
Omoro	52,695	0.415	21,875	8,750	13,125
Otuke	37,276	0.297	11,074	4,429	6,644
Oyam	121,642	0.225	27,309	10,923	16,385
Pader	52,724	0.353	18,632	7,453	11,179
Pakwach	54,524	0.215	11,709	4,684	7,026
Pallisa	96,183	0.144	13,884	5,554	8,330
Rakai	88,869	0.291	25,823	10,329	15,494
Rubanda	53,194	0.313	16,666	6,667	10,000
Rubirizi	37,023	0.153	5,665	2,266	3,399
Rukiga	23,644	0.158	3,746	1,498	2,248
Rukungiri	77,811	0.141	10,979	4,392	6,588
Rwampara	34,836	0.23	8,009	3,204	4,806
Serere	105,201	0.26	27,378	10,951	16,427
Sheema	47,726	0	0	0	0
Sironko	66,490	0.109	7,221	2,889	4,333

District ID	School Age	Oos Rate	Oosc	D2 Never	D3 Dropped
Soroti	96,384	0.202	19,426	7,770	11,655
Ssembabule	79,890	0.091	7,292	2,917	4,375
Tororo	155,914	0.139	21,662	8,665	12,997
Wakiso	716,074	0.036	25,808	10,323	15,485
Yumbe	213,525	0.741	158,252	63,301	94,951
Zombo	79,368	0.346	27,446	10,978	16,468

One row per district; 135 districts on the pinned geography. Source: EPRAS run 6b2afcf6 (report/build/data/a_oosc.csv).

C.3 C.3 Supply and capacity

Government schools, classrooms weighted by condition, teachers in post, the capacity those two imply, which of them binds, and the share of settlements within the walking norm.

Table C.3: Government supply, capacity and access, by district

District ID	Schools Gov	Classrooms Usable	Teachers In Post	Places	Binding	Access Share 3Km
Abim	37	302	329	14,414	room	0.855
Adjumani	78	765	623	28,302	teacher	0.938
Agago	114	911	866	39,341	teacher	0.883
Alebtong	77	630	727	30,072	room	0.925
Amolatar	53	414	489	19,740	room	0.886
Amudat	18	133	109	4,952	teacher	0.42
Amuria	68	565	621	26,946	room	0.939
Amuru	52	450	499	21,451	room	0.84
Apac	64	625	686	29,796	room	0.912
Arua	195	1,914	1,888	85,769	teacher	0.994
Budaka	60	615	465	21,124	teacher	1
Bududa	87	638	607	27,575	teacher	0.997
Bugiri	145	1,198	1,213	55,105	teacher	0.996
Bugweri	54	474	496	22,533	teacher	1
Buhweju	54	423	448	20,155	room	0.992
Buikwe	163	1,334	1,275	57,921	teacher	0.996
Bukedea	99	734	1,013	34,997	room	0.973
Bukomansimbi	73	590	639	28,161	room	1
Bukwo	49	409	433	19,488	room	0.981
Bulambuli	56	461	539	21,995	room	0.982
Buliisa	31	261	344	12,438	room	0.85
Bundibugyo	100	704	576	26,167	teacher	0.989
Bunyangabu	61	490	590	23,368	room	1
Bushenyi	150	1,305	1,164	52,879	teacher	0.997
Busia	123	1,150	1,216	54,837	room	1
Butaleja	103	911	1,002	43,452	room	0.998
Butambala	67	511	501	22,760	teacher	0.996
Butebo	31	300	451	14,311	room	1

District ID	Schools Gov	Classrooms Usable	Teachers In Post	Places	Binding	Access Share 3Km
Buvuma	20	163	140	6,360	teacher	0.767
Buyende	92	740	870	35,293	room	0.912
Dokolo	60	525	525	23,850	teacher	0.953
Gomba	91	667	502	22,805	teacher	0.938
Gulu	88	917	1,045	43,732	room	0.857
Hoima	97	782	878	37,319	room	0.904
Ibanda	125	1,057	1,111	50,415	room	0.998
Iganga	107	940	1,264	44,819	room	1
Isingiro	191	1,592	1,527	69,369	teacher	0.887
Jinja	107	1,094	1,228	52,205	room	0.995
Kaabong	32	235	207	9,404	teacher	0.713
Kabale	134	1,003	1,114	47,865	room	1
Kabarole	78	730	715	32,481	teacher	0.995
Kaberamaido	47	385	505	18,378	room	0.92
Kagadi	137	1,012	999	45,383	teacher	0.987
Kakumiro	83	652	596	27,075	teacher	0.975
Kalaki	49	400	396	17,990	teacher	0.988
Kalangala	23	165	116	5,270	teacher	0.673
Kaliro	90	682	847	32,524	room	0.986
Kalungu	88	728	903	34,737	room	0.994
Kampala	82	802	828	37,615	teacher	1
Kamuli	184	1,582	1,802	75,451	room	0.999
Kamwenge	85	725	722	32,799	teacher	0.982
Kanungu	137	1,121	752	34,162	teacher	0.987
Kapchorwa	40	355	381	16,927	room	0.997
Kapelebyong	41	319	348	15,221	room	0.868
Karenga	21	155	145	6,587	teacher	0.633
Kasese	256	2,100	1,726	78,410	teacher	0.969
Kassanda	100	757	768	34,889	teacher	0.976
Katakwi	78	628	721	29,940	room	0.808
Kayunga	167	1,334	1,450	63,655	room	0.92
Kazo	64	532	541	24,577	teacher	0.979
Kibaale	51	367	392	17,503	room	0.981
Kiboga	87	642	551	25,031	teacher	0.95
Kibuku	51	523	761	24,959	room	0.989
Kikuube	75	647	746	30,841	room	0.96

District ID	Schools Gov	Classrooms Usable	Teachers In Post	Places	Binding	Access Share 3Km
Kiruhura	76	596	615	27,939	teacher	0.861
Kiryandongo	76	711	836	33,933	room	0.939
Kisoro	140	1,305	1,090	49,517	teacher	1
Kitagwenda	67	556	452	20,534	teacher	1
Kitgum	99	819	747	33,935	teacher	0.846
Koboko	69	621	621	28,211	teacher	0.934
Kole	61	565	759	26,941	room	0.986
Kotido	20	185	173	7,859	teacher	0.619
Kumi	92	748	1,051	35,659	room	0.918
Kwania	59	538	660	25,651	room	0.892
Kween	40	314	328	14,901	teacher	0.867
Kyankwanzi	115	837	819	37,206	teacher	0.931
Kyegegwa	72	630	597	27,121	teacher	0.972
Kyenjojo	129	969	803	36,479	teacher	0.898
Kyotera	111	961	869	39,477	teacher	0.927
Lamwo	74	632	567	25,758	teacher	0.673
Lira	113	993	1,430	47,369	room	0.977
Luuka	89	774	941	36,923	room	1
Luwero	230	1,861	1,856	84,315	teacher	0.934
Lwengo	133	1,052	968	43,975	teacher	1
Lyantonde	50	389	342	15,537	teacher	0.956
Madi Okollo	70	561	506	22,987	teacher	0.923
Manafwa	61	543	570	25,878	room	1
Maracha	61	520	646	24,800	room	1
Masaka	97	810	903	38,625	room	0.961
Masindi	101	862	915	41,133	room	0.897
Mayuge	143	1,269	1,519	60,524	room	0.939
Mbale	130	1,198	1,503	57,135	room	1
Mbarara	148	1,313	1,650	62,611	room	0.99
Mitooma	110	891	968	42,491	room	1
Mityana	158	1,192	1,096	49,790	teacher	1
Moroto	21	157	186	7,502	room	0.702
Moyo	49	412	406	18,444	teacher	0.915
Mpigi	110	901	889	40,386	teacher	0.962
Mubende	116	910	1,076	43,390	room	0.847
Mukono	220	1,749	1,714	77,865	teacher	0.99

District ID	Schools Gov	Classrooms Usable	Teachers In Post	Places	Binding	Access Share 3Km
Nabitaluk	16	103	154	4,898	room	0.562
Nakapiripirit	28	196	219	9,340	room	0.725
Nakaseke	116	932	808	36,706	teacher	0.696
Nakasongola	145	1,034	1,033	46,928	teacher	0.888
Namayingo	83	645	552	25,077	teacher	0.993
Namisindwa	97	767	913	36,578	room	0.998
Namutumba	110	847	1,181	40,403	room	0.995
Napak	30	264	196	8,904	teacher	0.498
Nebbi	102	739	802	35,268	room	0.993
Ngora	59	505	573	24,068	room	0.945
Ntoroko	35	238	184	8,359	teacher	0.728
Ntungamo	249	2,048	2,059	93,537	teacher	0.996
Nwoya	44	355	434	16,931	room	0.713
Obongi	24	246	176	7,995	teacher	0.832
Omoro	67	575	666	27,428	room	0.893
Otuke	45	370	482	17,635	room	0.792
Oyam	110	988	1,084	47,139	room	0.947
Pader	107	874	918	41,695	room	0.772
Pakwach	64	472	648	22,524	room	0.93
Pallisa	76	679	943	32,368	room	0.982
Rakai	124	1,037	1,171	49,443	room	0.981
Rubanda	113	882	951	42,055	room	0.954
Rubirizi	54	423	428	19,443	teacher	0.987
Rukiga	71	563	574	26,076	teacher	1
Rukungiri	177	1,387	1,214	55,150	teacher	0.998
Rwampara	74	668	681	30,937	teacher	1
Serere	103	844	1,076	40,271	room	0.941
Sheema	131	1,082	1,151	51,599	room	1
Sironko	110	888	967	42,369	room	0.982
Soroti	98	901	933	42,385	teacher	0.989
Ssembabule	183	1,276	1,334	60,602	teacher	0.959
Tororo	178	1,731	1,569	71,277	teacher	1
Wakiso	278	2,369	2,721	113,002	room	0.776
Yumbe	134	1,243	1,147	52,107	teacher	0.972
Zombo	92	683	662	30,074	teacher	0.999

One row per district; 135 districts on the pinned geography. Source: EPRAS run 6b2afcf6 (report/build/data/a_supply.csv).

C.4 The condition of schools, by district

What the census counted about the state of the stock: the share of schools on an improved drinking-water source, the share with a functional hand-washing facility with water and soap, the share with none at all, and — where the census publishes it at that level — the share disposing of waste properly. Government and private together, because the condition of a private school is a fact about the district's provision even where the public plan does not finance it. A blank is a dimension the census does not publish at that level, not a zero.

None of these columns is a gap. No service standard for them exists in this engine, so there is nothing to difference the count against, and nothing here is costed or carried into Annex C.5.

Table C.4: Schools by condition, by district and level

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Abim	PRI	75	1	0.413	0.333	
Adjumani	PRI	179	0.978	0.508	0.263	
Agago	PRI	180	0.972	0.306	0.456	
Alebtong	PRI	177	0.983	0.446	0.373	
Amolatar	PRI	142	0.993	0.289	0.542	
Amudat	PRI	26	0.962	0.423	0.385	
Amuria	PRI	175	0.994	0.537	0.291	
Amuru	PRI	193	0.912	0.42	0.373	
Apac	PRI	152	0.993	0.408	0.408	
Arua	PRI	483	0.967	0.549	0.257	
Budaka	PRI	260	0.996	0.504	0.346	
Bududa	PRI	157	0.79	0.42	0.427	
Bugiri	PRI	496	0.982	0.446	0.373	
Bugweri	PRI	199	0.99	0.417	0.357	
Buhweju	PRI	148	0.689	0.405	0.439	
Buikwe	PRI	696	0.81	0.668	0.148	
Bukedea	PRI	188	0.973	0.431	0.319	
Bukomansimbi	PRI	210	0.6	0.486	0.367	

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Bukwo	PRI	108	0.861	0.352	0.361	
Bulambuli	PRI	116	0.862	0.534	0.259	
Buliisa	PRI	93	0.903	0.602	0.204	
Bundibugyo	PRI	280	0.789	0.529	0.314	
Bunyangabu	PRI	201	0.861	0.498	0.333	
Bushenyi	PRI	287	0.854	0.662	0.206	
Busia	PRI	355	0.992	0.549	0.239	
Butaleja	PRI	193	0.979	0.57	0.228	
Butambala	PRI	193	0.788	0.425	0.295	
Butebo	PRI	123	0.984	0.463	0.366	
Buvuma	PRI	111	0.685	0.243	0.55	
Buyende	PRI	324	0.994	0.349	0.438	
Dokolo	PRI	134	0.97	0.463	0.336	
Gomba	PRI	345	0.678	0.284	0.417	
Gulu	PRI	281	0.996	0.68	0.146	
Hoima	PRI	426	0.857	0.556	0.254	
Ibanda	PRI	289	0.82	0.564	0.298	
Iganga	PRI	515	0.994	0.48	0.252	
Isingiro	PRI	565	0.573	0.434	0.439	
Jinja	PRI	608	0.962	0.533	0.306	
Kaabong	PRI	43	0.953	0.349	0.279	
Kabale	PRI	224	0.906	0.804	0.116	
Kabarole	PRI	313	0.812	0.425	0.297	
Kaberamaido	PRI	112	1	0.473	0.312	
Kagadi	PRI	451	0.867	0.517	0.348	
Kakumiro	PRI	461	0.905	0.488	0.395	
Kalaki	PRI	108	0.981	0.509	0.333	
Kalangala	PRI	60	0.45	0.667	0.167	
Kaliro	PRI	280	0.993	0.282	0.471	

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Kalungu	PRI	280	0.746	0.432	0.293	
Kampala	PRI	1,363	0.924	0.864	0.045	
Kamuli	PRI	638	0.994	0.439	0.357	
Kamwenge	PRI	353	0.89	0.289	0.527	
Kanungu	PRI	335	0.755	0.412	0.412	
Kapchorwa	PRI	128	0.93	0.414	0.312	
Kapelebyong	PRI	86	0.988	0.453	0.337	
Karenga	PRI	23	1	0.13	0.478	
Kasese	PRI	755	0.864	0.513	0.295	
Kassanda	PRI	520	0.802	0.448	0.387	
Katakwi	PRI	148	0.986	0.486	0.311	
Kayunga	PRI	644	0.947	0.576	0.191	
Kazo	PRI	277	0.451	0.491	0.422	
Kibaale	PRI	267	0.846	0.419	0.431	
Kiboga	PRI	293	0.792	0.451	0.287	
Kibuku	PRI	153	0.993	0.477	0.379	
Kikuube	PRI	302	0.854	0.427	0.417	
Kiruhura	PRI	294	0.51	0.483	0.333	
Kiryandongo	PRI	299	0.977	0.662	0.214	
Kisoro	PRI	302	0.51	0.44	0.381	
Kitagwenda	PRI	155	0.826	0.413	0.381	
Kitgum	PRI	184	0.973	0.516	0.332	
Koboko	PRI	145	0.945	0.421	0.241	
Kole	PRI	129	1	0.736	0.147	
Kotido	PRI	35	0.971	0.4	0.514	
Kumi	PRI	186	0.962	0.446	0.296	
Kwania	PRI	150	0.993	0.467	0.327	
Kween	PRI	126	0.881	0.278	0.524	
Kyankwanzi	PRI	395	0.868	0.367	0.451	

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Kyegegwa	PRI	428	0.643	0.313	0.495	
Kyenjojo	PRI	597	0.809	0.315	0.499	
Kyotera	PRI	342	0.778	0.573	0.228	
Lamwo	PRI	123	0.984	0.244	0.472	
Lira	PRI	324	0.991	0.617	0.173	
Luuka	PRI	199	0.99	0.477	0.382	
Luwero	PRI	1,117	0.905	0.641	0.201	
Lwengo	PRI	383	0.514	0.42	0.321	
Lyantonde	PRI	154	0.565	0.474	0.273	
Madi Okollo	PRI	106	0.953	0.368	0.396	
Manafwa	PRI	172	0.913	0.512	0.32	
Maracha	PRI	95	0.874	0.379	0.326	
Masaka	PRI	509	0.774	0.67	0.189	
Masindi	PRI	362	0.945	0.528	0.29	
Mayuge	PRI	552	0.96	0.518	0.29	
Mbale	PRI	466	0.942	0.564	0.174	
Mbarara	PRI	474	0.806	0.692	0.188	
Mitooma	PRI	208	0.721	0.442	0.298	
Mityana	PRI	753	0.818	0.7	0.163	
Moroto	PRI	42	1	0.548	0.286	
Moyo	PRI	77	0.961	0.623	0.208	
Mpigi	PRI	635	0.778	0.663	0.175	
Mubende	PRI	600	0.8	0.473	0.322	
Mukono	PRI	1,505	0.88	0.759	0.116	
Nablatuk	PRI	20	1	0.65	0.25	
Nakapiripirit	PRI	41	0.976	0.561	0.268	
Nakaseke	PRI	467	0.848	0.593	0.206	
Nakasongola	PRI	340	0.865	0.553	0.297	
Namayingo	PRI	168	0.708	0.452	0.28	

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Namisisindwa	PRI	171	0.93	0.421	0.392	
Namutumba	PRI	315	0.975	0.546	0.321	
Napak	PRI	73	0.973	0.507	0.342	
Nebbi	PRI	179	0.95	0.503	0.246	
Ngora	PRI	121	0.983	0.57	0.24	
Ntoroko	PRI	106	0.792	0.547	0.255	
Ntungamo	PRI	571	0.736	0.419	0.385	
Nwoya	PRI	137	0.956	0.489	0.387	
Obongi	PRI	59	0.949	0.475	0.237	
Omoro	PRI	155	0.987	0.542	0.252	
Otuke	PRI	82	1	0.476	0.293	
Oyam	PRI	250	0.984	0.512	0.304	
Pader	PRI	158	0.975	0.487	0.291	
Pakwach	PRI	106	0.953	0.387	0.434	
Pallisa	PRI	270	0.963	0.467	0.322	
Rakai	PRI	428	0.36	0.46	0.381	
Rubanda	PRI	238	0.601	0.454	0.378	
Rubirizi	PRI	147	0.755	0.483	0.361	
Rukiga	PRI	127	0.756	0.48	0.307	
Rukungiri	PRI	375	0.707	0.467	0.336	
Rwampara	PRI	142	0.768	0.585	0.296	
Serere	PRI	249	0.996	0.281	0.486	
Sheema	PRI	241	0.813	0.656	0.212	
Sironko	PRI	221	0.878	0.606	0.195	
Soroti	PRI	293	0.99	0.454	0.307	
Ssembabule	PRI	399	0.526	0.454	0.409	
Tororo	PRI	467	0.979	0.608	0.169	
Wakiso	PRI	5,159	0.85	0.804	0.069	
Yumbe	PRI	204	0.961	0.392	0.314	

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Zombo	PRI	165	0.903	0.521	0.291	
Abim	SEC	10	1	0.7	0.2	0
Adjumani	SEC	23	1	0.565	0.174	0
Agago	SEC	14	1	0.5	0.357	0
Alebtong	SEC	13	1	0.385	0.385	0
Amolatar	SEC	12	1	0.333	0.417	0
Amudat	SEC	3	1	0.667	0	0
Amuria	SEC	19	0.947	0.579	0.316	0
Amuru	SEC	13	1	0.615	0.231	0
Apac	SEC	11	0.909	0.909	0.091	0
Arua	SEC	74	1	0.689	0.135	0.054
Budaka	SEC	32	1	0.75	0.188	0.031
Bududa	SEC	15	0.8	0.4	0.133	0
Bugiri	SEC	46	1	0.478	0.239	0.022
Bugweri	SEC	26	1	0.615	0.115	0
Buhweju	SEC	19	0.947	0.421	0.368	0
Buikwe	SEC	109	0.826	0.734	0.11	0.073
Bukedea	SEC	29	0.966	0.448	0.241	0.069
Bukomansimbi	SEC	24	0.583	0.583	0.333	0.042
Bukwo	SEC	14	1	0.429	0.357	0
Bulambuli	SEC	18	0.944	0.667	0.056	0.056
Buliisa	SEC	12	1	0.667	0.25	0
Bundibugyo	SEC	27	0.852	0.667	0.185	0.037
Bunyangabu	SEC	25	0.96	0.48	0.28	0
Bushenyi	SEC	65	0.954	0.831	0.108	0.154
Busia	SEC	40	0.975	0.775	0.075	0
Butaleja	SEC	29	1	0.724	0.069	0.069
Butambala	SEC	30	0.967	0.467	0.3	0.033
Butebo	SEC	18	1	0.556	0.167	0
Buvuma	SEC	5	0.6	0.2	0.6	0
Buyende	SEC	32	0.969	0.469	0.406	0.031
Dokolo	SEC	15	1	0.333	0.467	0
Gomba	SEC	27	0.815	0.296	0.296	0
Gulu	SEC	43	1	0.651	0.163	0.093
Hoima	SEC	50	0.94	0.64	0.1	0.1

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Ibanda	SEC	49	0.939	0.694	0.163	0.102
Iganga	SEC	64	1	0.594	0.125	0.078
Isingiro	SEC	53	0.736	0.642	0.245	0
Jinja	SEC	102	1	0.657	0.108	0.157
Kaabong	SEC	3	1	0.667	0	0
Kabale	SEC	46	0.848	0.761	0.174	0.065
Kabarole	SEC	45	0.911	0.489	0.178	0.067
Kaberamaido	SEC	14	1	0.286	0.429	0
Kagadi	SEC	43	0.977	0.814	0.047	0.07
Kakumiro	SEC	36	0.917	0.583	0.25	0.028
Kalaki	SEC	18	1	0.556	0.333	0
Kalangala	SEC	5	0.4	0.2	0.4	0
Kaliro	SEC	34	0.971	0.471	0.235	0
Kalungu	SEC	51	0.863	0.569	0.176	0
Kampala	SEC	200	0.945	0.885	0.03	0.85
Kamuli	SEC	82	1	0.598	0.183	0.049
Kamwenge	SEC	33	0.909	0.606	0.121	0
Kanungu	SEC	58	0.914	0.638	0.224	0.017
Kapchorwa	SEC	19	1	0.684	0.053	0
Kapelebyong	SEC	11	1	0.455	0.545	0
Karenga	SEC	1	1	1	0	0
Kasese	SEC	110	0.936	0.518	0.218	0.045
Kassanda	SEC	47	0.894	0.638	0.191	0.021
Katakwi	SEC	19	1	0.579	0.158	0
Kayunga	SEC	71	0.958	0.732	0.113	0.042
Kazo	SEC	23	0.739	0.609	0.217	0
Kibaale	SEC	19	0.895	0.737	0.211	0
Kiboga	SEC	35	0.971	0.714	0.143	0.029
Kibuku	SEC	25	1	0.56	0.32	0
Kikuube	SEC	18	0.944	0.778	0	0.056
Kiruhura	SEC	20	0.8	0.45	0.3	0.05
Kiryandongo	SEC	49	0.939	0.776	0.061	0.061
Kisoro	SEC	39	0.692	0.615	0.231	0.026
Kitagwenda	SEC	24	0.958	0.542	0.292	0
Kitgum	SEC	24	1	0.375	0.375	0.042
Koboko	SEC	21	0.952	0.524	0.381	0.095

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Kole	SEC	21	0.952	0.81	0.048	0
Kotido	SEC	6	1	0.5	0.5	0
Kumi	SEC	24	0.917	0.542	0.25	0
Kwania	SEC	7	1	0.714	0.143	0
Kween	SEC	16	0.75	0.312	0.312	0
Kyankwanzi	SEC	35	0.943	0.457	0.314	0.029
Kyegegwa	SEC	36	0.917	0.417	0.333	0
Kyenjojo	SEC	68	0.912	0.515	0.235	0.015
Kyotera	SEC	48	0.896	0.646	0.188	0
Lamwo	SEC	14	1	0.571	0.071	0
Lira	SEC	61	0.984	0.59	0.148	0.082
Luuka	SEC	31	1	0.613	0.258	0
Luwero	SEC	152	0.928	0.77	0.105	0.092
Lwengo	SEC	53	0.868	0.547	0.151	0.057
Lyantonde	SEC	13	0.769	0.692	0	0
Madi Okollo	SEC	10	1	0.6	0	0
Manafwa	SEC	19	0.895	0.632	0.211	0
Maracha	SEC	13	1	0.615	0.231	0
Masaka	SEC	78	0.897	0.744	0.103	0.064
Masindi	SEC	41	0.854	0.683	0.171	0.073
Mayuge	SEC	57	0.947	0.509	0.228	0.07
Mbale	SEC	69	0.957	0.725	0.087	0.13
Mbarara	SEC	72	0.931	0.792	0.125	0.153
Mitooma	SEC	35	0.886	0.6	0.114	0.029
Mityana	SEC	105	0.857	0.714	0.076	0.048
Moroto	SEC	8	1	0.5	0	0
Moyo	SEC	14	1	0.571	0.214	0
Mpigi	SEC	104	0.933	0.731	0.135	0.019
Mubende	SEC	57	0.895	0.754	0.14	0.088
Mukono	SEC	206	0.932	0.83	0.053	0.083
Nabilatuk	SEC	3	1	0.667	0.333	0
Nakapiripirit	SEC	2	1	0.5	0.5	0
Nakaseke	SEC	54	0.963	0.778	0.037	0
Nakasongola	SEC	31	1	0.71	0.161	0.097
Namayingo	SEC	15	0.8	0.533	0.067	0
Namisindwa	SEC	20	0.95	0.4	0.4	0

District ID	Cycle Code	Schools	Water Improved Share	Handwash Soap Share	Handwash None Share	Garbage Proper Share
Namutumba	SEC	27	1	0.63	0.222	0.037
Napak	SEC	4	1	0.5	0.25	0
Nebbi	SEC	24	1	0.458	0.25	0
Ngora	SEC	23	0.957	0.565	0.304	0
Ntoroko	SEC	10	1	0.5	0.4	0
Ntungamo	SEC	80	0.912	0.562	0.275	0.025
Nwoya	SEC	13	1	0.769	0.154	0
Obongi	SEC	9	1	0.778	0.222	0
Omoro	SEC	18	0.944	0.667	0.111	0
Otuke	SEC	10	1	0.5	0.4	0
Oyam	SEC	16	1	0.562	0.25	0.062
Pader	SEC	17	1	0.529	0.235	0.118
Pakwach	SEC	11	1	0.455	0.364	0
Pallisa	SEC	31	1	0.548	0.161	0.065
Rakai	SEC	32	0.469	0.656	0.125	0
Rubanda	SEC	28	0.75	0.607	0.25	0
Rubirizi	SEC	20	0.85	0.4	0.35	0
Rukiga	SEC	20	0.85	0.65	0	0
Rukungiri	SEC	58	0.862	0.603	0.19	0
Rwampara	SEC	19	0.947	0.737	0.211	0
Serere	SEC	35	1	0.6	0.257	0.057
Sheema	SEC	62	0.935	0.677	0.177	0.032
Sironko	SEC	28	0.893	0.679	0.071	0.036
Soroti	SEC	48	1	0.5	0.167	0.042
Ssembabule	SEC	35	0.857	0.686	0.171	0.029
Tororo	SEC	68	1	0.676	0.162	0.132
Wakiso	SEC	658	0.913	0.827	0.05	0.233
Yumbe	SEC	28	1	0.464	0.143	0
Zombo	SEC	15	1	0.4	0.467	0

Government and private together, as counted by the census. A blank is a dimension the census does not publish at that level. Source: EPRAS run 6b2afc6 (report/build/data/a_facility_conditions.csv).

Two dimensions are published by the census at sub-region level and not by district, so they cannot appear in a district annex. The larger of them is learners reported with a difficulty, which is given here as published.

Table C.5: Learners with a difficulty by sub-region, as published

Sub Region	Pre Learners	Pri Learners	Pri Percent	Sec Learners	Sec Percent
Acholi	5,420	22,234	6	2,672	5.6
Ankole	19,655	45,583	6.4	14,955	6.9
Buganda	115,385	295,226	12.4	93,334	12.5
Bugisu	4,815	22,578	6.2	5,335	7.1
Bukedi	10,305	39,971	7	5,450	5.9
Bunyoro	17,024	73,224	13.6	11,446	12.7
Busoga	17,780	62,451	6.5	11,417	6.3
Kampala	11,514	35,040	14.3	11,850	11.9
Karamoja	1,612	8,873	11	838	9.4
Kigezi	5,308	19,717	5.8	4,710	5.1
Lango	4,711	22,129	4.9	2,927	5
Madi	1,708	6,097	5	948	5.2
Rwenzori	9,800	21,538	10.4	4,421	11.9
Sebei	872	4,089	5.4	952	5.8
Teso	7,397	44,514	8.3	6,444	7.3
Tooro	7,513	17,701	4.7	3,568	4.9
West-Nile	4,553	30,030	5.8	2,801	4.8

UBOS Baseline Education Census 2025. Published at this geography, and not apportioned to districts. Source: EPRAS run 6b2afcf6 (report/build/data/a_subregion_disability.csv).

C.5 The district gap matrix

Five dimensions, no total column and no rank column. Ranking is by an explicit criterion which is a pin of the run, and is named in the run manifest.

Table C.6: The district gap matrix in full

District ID	Oosc Primary	Oosc Lower Sec	Children Beyond 3Km	Place Gap Primary	Place Surplus Primary	Binding Primary	Classroom Gap Primary	Teacher Gap Primary	Teacher Gap Secondary	Untrained Primary	Stance Gap Primary	Quality Conditions Failing
Abim	23,114	19,436	6,548	248	0	room	110	104	0	34	111	1
Adjumani	11,168	21,829	3,999	25,678	0	teacher	584	793	196	56	653	3
Agago	24,150	27,702	8,328	17,447	0	teacher	593	714	49	261	557	4
Alebtong	27,619	30,437	5,288	7,178	0	room	364	317	77	91	282	2
Amolatar	18,973	19,849	5,512	1,782	0	room	186	141	74	52	134	1
Amudat	38,526	19,451	23,733	0	1,997	teacher	0	11	5	0	0	0
Amuria	21,213	21,395	3,998	12,135	0	room	444	438	65	56	440	3
Amuru	20,845	24,969	9,768	8,792	0	room	330	320	22	107	322	4
Apac	17,580	25,185	5,166	388	0	room	184	163	48	98	239	1
Arua	41,874	65,257	1,160	48,280	0	teacher	1,431	1,625	243	118	1,786	3
Budaka	1,519	17,222	0	31,574	0	teacher	658	871	171	41	917	3
Bududa	31,243	26,132	203	3,029	0	teacher	245	320	129	58	212	1
Bugiri	31,142	41,875	577	13,096	0	teacher	632	709	236	78	787	3
Bugweri	10,668	11,256	0	9,913	0	teacher	359	378	137	93	466	3
Buhweju	13,920	13,418	336	221	0	room	156	160	49	75	117	1
Buikwe	14,763	5,430	453	0	6,849	teacher	184	320	352	164	216	1
Bukedea	8,452	17,948	2,010	30,100	0	room	905	708	172	61	841	3
Bukomansimbi	5,559	9,752	0	0	8,453	room	26	8	125	41	77	1
Bukwo	6,052	8,979	681	149	0	room	143	146	0	154	66	2
Bulambuli	13,252	16,943	1,157	7,663	0	room	317	278	138	101	276	3
Buliisa	18,441	13,844	6,165	8,663	0	room	269	212	43	50	305	3
Bundibugyo	29,985	24,739	823	0	5,020	teacher	15	179	77	60	100	1
Bunyangabu	18,222	13,157	0	1,538	0	room	203	138	96	29	342	1
Bushenyi	0	0	153	0	8,091	teacher	46	255	319	83	0	0
Busia	16,450	27,759	0	14,195	0	room	636	659	236	192	779	3
Butaleja	8,907	27,531	193	39,162	0	room	1,106	1,116	186	80	1,319	3
Butambala	5,968	0	102	0	5,820	teacher	30	67	214	100	0	1
Butebo	9,518	10,672	0	14,399	0	room	391	275	77	81	507	3
Buvuma	19,898	9,914	8,166	2,235	0	teacher	77	112	28	65	117	3
Buyende	37,851	44,975	11,614	29,184	0	room	867	817	75	238	1,049	4
Dokolo	17,288	23,762	2,621	8,970	0	teacher	330	372	79	36	330	3
Gomba	7,327	9,732	2,766	0	3,901	teacher	0	178	264	81	0	0
Gulu	15,308	12,855	10,955	0	6,304	room	112	35	43	20	228	1

District ID	Oosc Primary	Oosc Lower Sec	Children Beyond 3Km	Place Gap Primary	Place Surplus Primary	Binding Primary	Classroom Gap Primary	Teacher Gap Primary	Teacher Gap Secondary	Untrained Primary	Stance Gap Primary	Quality Conditions Failing
Hoima	10,423	0	9,060	4,780	0	room	369	331	296	157	380	2
Ibanda	13,023	5,551	117	0	10,737	room	119	123	141	43	52	1
Iganga	4,354	13,029	0	15,162	0	room	613	366	153	236	762	2
Isingiro	49,897	52,656	18,449	9,315	0	teacher	580	754	345	263	484	1
Jinja	9,419	0	650	0	343	room	288	223	428	116	599	1
Kaabong	27,671	14,465	9,005	0	587	teacher	41	82	18	18	0	0
Kabale	3,629	453	0	0	5,581	room	252	204	153	56	868	1
Kabarole	8,785	0	399	6,187	0	teacher	297	363	186	37	459	2
Kaberamaido	4,113	14,064	2,994	10,830	0	room	358	276	29	25	377	3
Kagadi	39,865	31,123	1,575	6,214	0	teacher	447	533	236	334	385	2
Kakumiro	49,792	42,103	3,738	12,981	0	teacher	416	526	94	312	430	4
Kalaki	8,670	13,306	475	10,869	0	teacher	341	382	57	20	330	3
Kalangala	6,165	2,730	4,072	2,169	0	teacher	57	117	10	8	22	2
Kaliro	15,910	18,951	1,139	12,374	0	room	508	402	109	66	550	3
Kalungu	0	0	295	0	2,686	room	188	60	236	182	168	2
Kampala	48,541	2,191	0	23,261	0	teacher	702	752	930	85	1,229	3
Kamuli	20,775	34,792	193	452	0	room	515	400	183	273	742	1
Kamwenge	30,591	25,004	1,858	11,250	0	teacher	434	495	124	150	579	4
Kanungu	10,176	11,752	850	0	2,097	teacher	0	349	214	186	0	1
Kapchorwa	5,395	3,879	91	0	4,516	room	17	10	90	25	0	0
Kapelebyong	11,412	10,517	3,933	7,590	0	room	275	276	98	31	267	3
Karenga	16,163	7,638	7,089	502	0	teacher	55	75	5	13	14	1
Kasese	67,131	57,888	6,487	23,647	0	teacher	740	1,256	245	227	1,209	2
Kassanda	9,700	21,223	1,915	0	4,052	teacher	166	202	139	247	179	2
Katakwi	14,261	18,588	9,904	10,670	0	room	441	401	83	68	456	3
Kayunga	17,088	19,469	8,729	0	4,881	room	356	325	249	214	325	1
Kazo	17,706	16,440	1,205	0	2,789	teacher	102	125	115	65	82	1
Kibaale	19,156	17,671	1,150	2,073	0	room	185	188	21	175	140	3
Kiboga	8,585	6,227	2,182	0	6,966	teacher	0	99	110	78	0	0
Kibuku	23,452	20,946	826	19,396	0	room	548	364	106	156	741	4
Kikuube	35,302	35,065	4,149	12,585	0	room	472	429	82	133	592	3
Kiruhura	5,890	11,539	6,012	0	4,224	teacher	112	128	152	74	50	1
Kiryandongo	20,508	24,132	5,253	18,580	0	room	600	541	32	87	777	3
Kisoro	27,629	23,461	0	8,448	0	teacher	296	591	154	55	368	2
Kitagwenda	15,064	12,819	0	5,490	0	teacher	175	316	69	94	260	3
Kitgum	10,103	16,490	9,017	8,100	0	teacher	335	465	71	19	283	2
Koboko	28,851	24,605	4,806	10,378	0	teacher	380	430	42	41	410	3
Kole	20,827	24,478	1,061	17,422	0	room	536	397	90	34	654	3
Kotido	45,085	22,483	19,829	1,156	0	teacher	63	87	4	24	94	1
Kumi	0	24,189	6,388	33,948	0	room	966	748	229	20	997	3
Kwania	16,226	24,375	6,105	5,052	0	room	271	189	78	94	305	2

District ID	Oosc Primary	Oosc Lower Sec	Children Beyond 3Km	Place Gap Primary	Place Surplus Primary	Binding Primary	Classroom Gap Primary	Teacher Gap Primary	Teacher Gap Secondary	Untrained Primary	Stance Gap Primary	Quality Conditions Failing
Kween	9,367	7,414	3,853	0	3,553	teacher	38	41	47	68	0	1
Kyankwanzi	14,455	23,528	5,375	0	3,048	teacher	196	266	98	154	230	1
Kyegegwa	54,957	43,979	3,756	25,776	0	teacher	679	777	135	218	986	4
Kyenjojo	48,380	38,283	15,089	18,628	0	teacher	541	782	176	212	549	4
Kyotera	855	580	4,669	0	3,705	teacher	95	239	207	134	130	1
Lamwo	15,728	14,383	12,844	3,574	0	teacher	188	294	61	5	189	1
Lira	10,811	12,377	2,617	15,991	0	room	648	293	33	33	642	2
Luuka	29,042	24,283	0	0	3,688	room	168	48	62	50	231	1
Luwero	0	0	8,698	0	14,260	teacher	236	346	630	387	231	2
Lwengo	4,881	8,660	0	0	3,696	teacher	159	304	239	97	111	1
Lyantonde	5,694	7,732	1,282	449	0	teacher	88	159	109	68	82	1
Madi Okollo	10,399	17,820	3,376	16,377	0	teacher	458	564	30	32	461	3
Manafwa	11,207	12,377	0	4,858	0	room	272	285	82	81	345	3
Maracha	13,863	21,316	0	29,892	0	room	798	738	54	46	921	3
Masaka	0	0	3,186	0	5,302	room	157	112	367	79	187	1
Masindi	13,215	17,209	8,803	7,595	0	room	438	450	145	88	530	3
Mayuge	39,896	45,237	9,861	14,581	0	room	699	547	281	92	899	2
Mbale	9,346	6,218	0	31,265	0	room	1,012	818	609	85	1,320	3
Mbarara	0	0	835	0	3,628	room	332	77	448	50	280	1
Mitooma	4,831	3,397	0	0	2,916	room	243	222	156	109	104	1
Mityana	1,862	0	0	0	15,239	teacher	0	120	237	183	0	0
Moroto	23,345	10,845	9,895	0	801	room	44	25	16	5	48	1
Moyo	3,276	6,275	1,714	0	1,261	teacher	85	116	0	74	0	0
Mpigi	0	0	2,780	0	9,104	teacher	60	120	305	49	29	1
Mubende	34,420	32,889	24,090	7,154	0	room	469	372	281	346	489	3
Mukono	23,088	0	1,759	0	23,101	teacher	1	124	593	214	286	1
Nabilatuk	23,752	11,374	11,597	755	0	room	63	20	1	43	97	3
Nakapiripirit	23,581	12,953	8,671	0	25	room	81	72	0	61	119	2
Nakaseke	4,942	7,680	17,063	0	10,587	teacher	0	102	188	97	0	0
Nakasongola	10,824	11,640	6,338	0	18,383	teacher	0	15	172	297	0	1
Namayingo	18,426	24,833	491	27,234	0	teacher	681	840	182	20	811	3
Namisindwa	9,011	18,752	160	18,903	0	room	664	590	249	34	871	3
Namutumba	10,497	24,345	453	20,743	0	room	739	484	172	233	761	2
Napak	35,952	17,188	22,452	631	0	teacher	20	103	28	34	40	1
Nebbi	8,790	28,755	535	36,405	0	room	1,045	1,072	82	46	1,011	3
Ngora	14,040	12,680	2,474	6,681	0	room	303	275	81	2	333	3
Ntoroko	8,759	6,340	5,342	641	0	teacher	50	118	52	22	107	1
Ntungamo	20,431	19,525	511	0	16,730	teacher	245	348	383	381	190	1
Nwoya	39,116	28,158	21,668	678	0	room	138	84	46	81	72	1
Obongi	2,696	2,426	1,176	7,794	0	teacher	153	243	47	32	169	3
Omoro	21,875	21,463	5,646	0	2,306	room	138	83	34	31	93	1

District ID	Oosc Primary	Oosc Lower Sec	Children Beyond 3Km	Place Gap Primary	Place Surplus Primary	Binding Primary	Classroom Gap Primary	Teacher Gap Primary	Teacher Gap Secondary	Untrained Primary	Stance Gap Primary	Quality Conditions Failing
Otuke	11,074	13,709	7,750	10,401	0	room	346	269	70	20	306	3
Oyam	27,309	49,481	6,476	37,620	0	room	1,093	1,101	308	130	1,253	3
Pader	18,632	18,898	11,995	0	2,491	room	245	257	73	94	167	1
Pakwach	11,709	19,816	3,820	24,493	0	room	691	574	45	48	756	3
Pallisa	13,884	27,972	1,687	29,705	0	room	836	647	270	158	1,020	3
Rakai	25,823	28,576	1,663	0	2,241	room	295	227	147	136	352	1
Rubanda	16,666	15,628	2,438	0	5,555	room	195	180	81	55	480	1
Rubirizi	5,665	4,164	479	1,761	0	teacher	173	197	191	55	193	1
Rukiga	3,746	4,134	0	0	7,306	teacher	29	48	92	24	0	0
Rukungiri	10,979	6,686	185	0	11,289	teacher	18	261	401	112	0	0
Rwampara	8,009	8,214	0	0	4,929	teacher	83	108	95	21	94	1
Serere	27,378	30,965	6,231	23,935	0	room	786	636	169	83	941	3
Sheema	0	0	0	0	16,161	room	22	8	412	68	0	0
Sironko	7,221	22,395	1,198	14,802	0	room	615	612	89	92	681	3
Soroti	19,426	0	1,108	14,511	0	teacher	563	604	184	58	674	3
Ssembabule	7,292	22,718	3,261	0	9,853	teacher	290	310	130	171	231	1
Tororo	21,662	34,778	0	38,452	0	teacher	1,058	1,359	415	108	1,431	3
Wakiso	25,808	0	160,072	7,612	0	room	921	734	1,870	554	1,293	2
Yumbe	158,252	106,228	6,005	20,493	0	teacher	649	840	87	57	785	3
Zombo	27,446	32,764	49	27,441	0	teacher	777	871	20	59	803	3

One row per district; 135 districts on the pinned geography. Source: EPRAS run 6b2afcf6 (report/build/data/a_gaps.csv).

C.6 The requirement by district

The geographic view of the cost. It reconciles with the economic and programme views to within one part in ten thousand, and the run fails if it does not.

Table C.7: The base-year requirement by district

District ID	Amount
Abim	10,144,277,525
Adjumani	34,313,266,379
Agago	28,145,448,899
Alebtong	22,904,281,131
Amolatar	16,227,449,299
Amudat	3,225,767,629
Amuria	22,917,215,561
Amuru	16,539,092,732
Apac	19,056,784,291
Arua	72,167,524,775
Budaka	29,529,974,541
Bududa	24,255,094,843
Bugiri	40,566,078,157
Bugweri	21,388,808,068
Buhweju	15,508,773,226
Buikwe	44,794,422,588
Bukedea	38,886,568,463
Bukomansimbi	18,829,986,507
Bukwo	15,679,157,928
Bulambuli	26,504,615,189
Buliisa	10,603,478,936
Bundibugyo	19,350,819,934
Bunyangabu	20,326,512,292
Bushenyi	44,837,360,401
Busia	43,361,695,736
Butaleja	41,502,046,291
Butambala	26,823,724,345

District ID	Amount
Butebo	16,147,979,951
Buvuma	5,721,232,907
Buyende	29,784,523,420
Dokolo	19,926,470,932
Gomba	22,272,154,612
Gulu	32,499,465,434
Hoima	37,631,599,712
Ibanda	35,188,750,265
Iganga	41,795,797,343
Isingiro	61,710,999,869
Jinja	58,073,164,815
Kaabong	5,763,129,049
Kabale	41,368,823,863
Kabarole	36,771,125,551
Kaberamaido	15,303,647,279
Kagadi	39,958,219,642
Kakumiro	28,014,458,870
Kalaki	15,728,327,769
Kalangala	6,657,005,156
Kaliro	30,948,197,443
Kalungu	29,618,902,414
Kampala	94,394,763,790
Kamuli	51,808,684,593
Kamwenge	30,981,922,469
Kanungu	37,706,837,666
Kapchorwa	16,402,096,463
Kapelebyong	14,796,075,982
Karenga	4,875,784,508
Kasese	69,090,083,246
Kassanda	26,701,681,756
Katakwi	24,193,546,644
Kayunga	43,234,397,357

District ID	Amount
Kazo	17,000,335,073
Kibaale	12,503,829,677
Kiboga	16,530,778,972
Kibuku	22,529,674,088
Kikuube	24,774,363,539
Kiruhura	19,876,543,765
Kiryandongo	26,861,353,263
Kisoro	35,862,780,486
Kitagwenda	18,258,527,112
Kitgum	25,430,656,786
Koboko	24,291,645,870
Kole	24,633,697,890
Kotido	6,967,802,925
Kumi	39,200,600,791
Kwania	19,977,208,600
Kween	11,312,713,837
Kyankwanzi	24,030,267,805
Kyegegwa	30,071,223,309
Kyenjojo	36,885,912,220
Kyotera	33,126,574,639
Lamwo	19,699,033,850
Lira	38,208,758,367
Luuka	24,484,152,337
Luwero	74,324,285,694
Lwengo	34,729,442,039
Lyantonde	15,695,502,805
Madi Okollo	17,679,987,588
Manafwa	19,781,244,036
Maracha	24,109,789,151
Masaka	40,773,490,029
Masindi	36,518,119,897
Mayuge	45,020,024,697

District ID	Amount
Mbale	72,293,665,142
Mbarara	58,135,379,510
Mitooma	36,213,349,631
Mityana	34,506,712,469
Moroto	7,112,095,678
Moyo	10,735,188,204
Mpigi	33,829,451,986
Mubende	43,273,815,686
Mukono	68,006,674,659
Nabilatuk	5,020,441,713
Nakapiripirit	5,376,595,560
Nakaseke	26,800,346,328
Nakasongola	28,531,092,931
Namayingo	28,891,221,825
Namisindwa	35,271,237,599
Namutumba	35,357,924,729
Napak	8,035,833,733
Nebbi	33,624,977,394
Ngora	22,098,753,936
Ntoroko	9,087,953,929
Ntungamo	62,901,715,417
Nwoya	13,669,107,821
Obongi	9,187,162,285
Omoro	16,227,902,455
Otuke	16,250,508,892
Oyam	48,026,938,980
Pader	26,115,460,194
Pakwach	22,371,629,059
Pallisa	35,094,162,220
Rakai	33,709,186,198
Rubanda	25,938,032,155
Rubirizi	23,609,209,550

District ID	Amount
Rukiga	18,931,830,138
Rukungiri	60,840,105,635
Rwampara	19,318,238,423
Serere	39,329,748,123
Sheema	46,997,180,964
Sironko	32,852,255,126
Soroti	38,009,330,583
Ssembabule	34,777,573,156
Tororo	75,251,924,197
Wakiso	150,497,290,208
Yumbe	35,118,989,714
Zombo	26,443,752,680

One row per district; 135 districts on the pinned geography. Source: EPRAS run 6b2afcf6 (report/build/data/a_cost.csv).

C.7 C.7 What each rule buys, by district

New places under each scenario and each optimiser objective. The same money, allocated by different rules, reaching different districts. No column is recommended.

Table C.8: New places by district under each scenario

District ID	A Current Trajectory	B Universal Basic Completion	C Foundational Learning	D Post-Basic Expansion	E Geographic Equity	F Demographic Pressure	Opt Enrolment	Opt Equity Weighted $\Gamma=2.0$
Abim	0	0	0	0	0	0	0	0
Adjumani	0	8,185	8,185	0	8,185	8,185	8,185	8,185
Agago	0	4,112	4,112	0	4,112	0	4,112	4,112
Alebtong	0	0	0	0	0	0	0	0
Amolatar	0	0	0	0	0	0	0	0
Amudat	0	1,381	0	0	1,381	5,345	1,381	1,381
Amuria	0	0	0	0	0	0	0	0
Amuru	0	0	0	0	0	0	0	0
Apac	0	0	0	0	0	0	0	0
Arua	0	5,547	96,294	0	5,547	5,547	5,547	5,547
Budaka	0	0	8,189	0	37,132	0	8,189	37,132
Bududa	0	2,856	0	0	0	2,856	2,856	2,856
Bugiri	0	2,028	2,028	0	0	2,028	2,028	2,028
Bugweri	0	55.81	0	0	0	0	55.81	55.81
Buhweju	0	0	0	0	0	0	0	0
Buikwe	0	5,126	0	0	0	5,126	5,126	5,126
Bukedea	0	0	0	0	0	0	0	0
Bukomansimbi	0	0	0	0	0	0	0	0
Bukwo	0	0	0	0	0	0	0	0
Bulambuli	0	0	0	0	0	0	0	0
Buliisa	0	0	0	0	0	0	0	0
Bundibugyo	0	1,536	0	0	0	1,536	1,536	1,536
Bunyangabu	0	0	0	0	0	0	0	0
Bushenyi	0	0	9,371	0	0	12,543	9,371	9,371
Busia	0	0	0	0	0	0	0	0
Butaleja	0	0	0	0	0	0	59,857	0
Butambala	0	0	0	0	0	0	0	0
Butebo	0	0	0	0	0	0	0	0
Buvuma	0	1,434	0	0	1,434	8,533	1,434	1,434
Buyende	0	0	0	0	0	0	0	0
Dokolo	0	1,188	0	0	0	0	1,188	1,188
Gomba	0	0	0	0	0	0	0	0

District ID	A Current Trajectory	B Universal Basic Completion	C Foundational Learning	D Post-Basic Expansion	E Geographic Equity	F Demographic Pressure	Opt Enrolment	Opt Equity Weighted $\Gamma=2.0$
Gulu	0	0	0	0	0	0	0	0
Hoima	0	0	0	0	0	0	0	0
Ibanda	0	0	0	0	0	0	0	0
Iganga	0	0	0	0	0	0	0	0
Isingiro	0	34,413	6,575	0	6,575	6,575	6,575	6,575
Jinja	0	0	0	0	0	0	0	0
Kaabong	0	1,791	0	0	1,791	7,250	1,791	1,791
Kabale	0	0	0	0	0	0	0	0
Kabarole	0	0	0	0	0	2,335	2,335	2,335
Kaberamaido	0	0	0	0	0	0	0	0
Kagadi	0	2,888	2,888	0	2,888	2,888	2,888	2,888
Kakumiro	0	27,636	4,049	0	4,049	4,049	4,049	4,049
Kalaki	0	0	1,072	0	1,072	1,072	1,072	1,072
Kalangala	0	0	0	0	11,100	11,100	2,608	11,100
Kaliro	0	0	0	0	0	0	0	0
Kalungu	0	0	0	0	0	0	0	0
Kampala	0	44,788	62,331	0	661	62,331	30,283	661
Kamuli	0	0	0	0	0	0	0	0
Kamwenge	0	1,782	1,782	0	1,782	1,782	1,782	1,782
Kanungu	0	7,013	0	0	0	7,013	7,013	7,013
Kapchorwa	0	0	0	0	0	0	0	0
Kapelebyong	0	0	0	0	0	0	0	0
Karenga	0	816	0	0	816	5,543	816	816
Kasese	0	51,651	21,775	0	21,775	21,775	21,775	21,775
Kassanda	0	1,222	0	0	0	1,222	1,222	1,222
Katakwi	0	0	0	0	0	0	0	0
Kayunga	0	0	0	0	0	0	0	0
Kazo	0	823	0	0	0	9,486	823	823
Kibaale	0	0	0	0	0	0	0	0
Kiboga	0	0	0	0	0	0	0	0
Kibuku	0	0	0	0	0	0	0	0
Kikuube	0	0	0	0	0	0	0	0
Kiruhura	0	0	0	0	0	11,485	472	472
Kiryandongo	0	0	0	0	0	0	0	0
Kisoro	0	12,718	12,718	0	12,718	12,718	12,718	12,718
Kitagwenda	0	5,981	5,981	0	5,981	5,981	5,981	5,981
Kitgum	0	5,144	5,144	0	0	5,144	5,144	5,144
Koboko	0	1,411	1,411	0	1,411	1,411	1,411	1,411
Kole	0	0	0	0	0	0	0	0

District ID	A Current Trajectory	B Universal Basic Completion	C Foundational Learning	D Post-Basic Expansion	E Geographic Equity	F Demographic Pressure	Opt Enrolment	Opt Equity Weighted $\Gamma=2.0$
Kotido	0	945	945	0	8,751	13,288	945	8,751
Kumi	0	0	0	0	0	0	0	0
Kwania	0	0	0	0	0	0	0	0
Kween	0	0	0	0	0	0	0	0
Kyankwanzi	0	2,734	0	0	0	2,734	2,734	2,734
Kyegegwa	0	45,807	2,909	0	2,909	2,909	2,909	2,909
Kyenjojo	0	9,763	9,763	0	9,763	9,763	9,763	9,763
Kyotera	0	0	0	0	0	3,270	3,270	3,270
Lamwo	0	3,441	0	0	0	0	3,441	3,441
Lira	0	0	0	0	0	0	0	0
Luuka	0	0	0	0	0	0	0	0
Luwero	0	0	0	0	0	0	0	0
Lwengo	0	0	0	0	0	5,183	5,183	5,183
Lyantonde	0	0	0	0	0	3,001	3,001	3,001
Madi Okollo	0	3,757	3,757	0	3,757	3,757	3,757	3,757
Manafwa	0	0	0	0	0	0	0	0
Maracha	0	0	0	0	56,671	0	56,671	56,671
Masaka	0	0	0	0	0	0	0	0
Masindi	0	0	0	0	0	0	0	0
Mayuge	0	0	0	0	0	0	0	0
Mbale	0	0	0	0	0	0	0	0
Mbarara	0	0	0	0	0	34,830	0	0
Mitooma	0	0	0	0	0	19,377	0	0
Mityana	0	0	0	0	0	0	0	0
Moroto	0	0	0	0	0	4,593	0	0
Moyo	0	0	0	0	0	0	0	0
Mpigi	0	0	0	0	0	0	0	0
Mubende	0	0	0	0	0	0	0	0
Mukono	0	0	0	0	0	0	0	0
Nabilatuk	0	0	0	0	0	7,864	0	0
Nakapiripirit	0	0	0	0	0	8,579	0	0
Nakaseke	0	0	0	0	0	0	0	0
Nakasongola	0	0	0	0	0	0	0	0
Namayingo	0	5,690	5,690	0	5,690	5,690	5,690	5,690
Namisindwa	0	0	0	0	0	0	0	0
Namutumba	0	0	0	0	0	0	0	0
Napak	0	3,703	0	0	3,703	7,908	3,703	3,703
Nebbi	0	0	53,635	0	59,901	0	59,901	59,901
Ngora	0	0	0	0	0	0	0	0

District ID	A Current Trajectory	B Universal Basic Completion	C Foundational Learning	D Post-Basic Expansion	E Geographic Equity	F Demographic Pressure	Opt Enrolment	Opt Equity Weighted $\Gamma=2.0$
Ntoroko	0	0	0	0	0	2,983	2,983	2,983
Ntungamo	0	4,135	4,135	0	0	4,135	4,135	4,135
Nwoya	0	0	0	0	0	0	0	0
Obongi	0	0	0	0	3,716	0	3,716	3,716
Omoro	0	0	0	0	0	0	0	0
Otuke	0	0	0	0	0	0	0	0
Oyam	0	0	0	0	0	0	0	0
Pader	0	0	0	0	0	0	0	0
Pakwach	0	0	0	0	44,238	0	0	44,238
Pallisa	0	0	0	0	0	0	0	0
Rakai	0	0	0	0	0	0	0	0
Rubanda	0	0	0	0	0	0	0	0
Rubirizi	0	0	0	0	713	713	713	713
Rukiga	0	0	0	0	0	0	0	0
Rukungiri	0	0	0	0	0	0	0	0
Rwampara	0	0	0	0	0	935	935	935
Serere	0	0	0	0	0	0	0	0
Sheema	0	0	0	0	0	0	0	0
Sironko	0	0	0	0	0	0	0	0
Soroti	0	571	571	0	571	0	571	571
Ssembabule	0	0	0	0	0	245	245	245
Tororo	0	11,282	11,282	0	11,282	0	11,282	11,282
Wakiso	0	0	0	0	0	0	0	0
Yumbe	0	44,930	7,206	0	7,206	7,206	7,206	7,206
Zombo	0	2,525	2,525	0	2,525	2,525	2,525	2,525

The same money, allocated by different rules. Source: EPRAS run 6b2afcf6 (report/build/data/a_alloc.csv).

ANNEX D

D Glossary and abbreviations

D.1 D.1 Terms used in this report

Adjusted net attendance rate (ANAR). The share of children of a cycle's official age attending that cycle *or any other level*. The census publishes a net attendance rate, which counts only children attending the level for their age; this report adjusts it with factors computed from the census's own age-by-class tables, because a child of primary age in a pre-primary class is in school. See §5 for the derivation and its limits.

Assumed. The weakest quality tier: a coefficient with no published source, carried with a note explaining what was assumed and why. Any result that uses one inherits the tier.

Binding constraint. Of the two ways to make a place — a room and a teacher — the one that runs out first in a district. Recorded for every district and cycle, because a teacher-bound district given a classroom grant gains nothing.

Bill of materials. The list of inputs and cadres one learner-year consumes, each with a quantity, the share of learners it reaches, a wastage allowance and a lifespan.

Boarding status. Whether a school takes day learners, boarders, or both, as the census classifies it. Reported by district at primary and by sub-region at secondary. The unit costs in this report are for day provision, so a boarding place is costed as a day place and the understatement is recorded rather than estimated.

Capitation grant. The per-learner recurrent transfer to a school. Part of the committed envelope, and part of what makes a classroom into a place.

Committed and discretionary. The envelope split into what is already contractually spent — the existing wage bill and capitation — and what is genuinely available to allocate. Computed before any allocation is shown.

Constant prices. Money expressed in base-year purchasing power. All result tables are in constant base-year Uganda shillings; only the MTEF also carries a nominal column, and it is labelled.

Cycle. A stage of the structure: pre-primary, primary, lower secondary, upper secondary. Each has an entry age, a number of grades and, in this structure, a terminal examination.

Discretionary space. See *committed and discretionary*.

Difficulty, learner reported with a. The census asks whether a learner has difficulty in a functional domain — seeing, hearing, walking, remembering, self-care, communicating — rather than recording a diagnosis or a special-needs registration. It is a wider net than a register and is published by sub-region only. No special-needs requirement is costed in this report, because no norm for one exists in the engine.

Dropout rate (δ). The residual of the flow identity: the share of a grade's learners who neither repeat nor are promoted. A negative residual is recorded as re-entry or error and never discarded.

EMIS. Education Management Information System — the annual school census and the Statistical Abstract published from it.

EPRAS. Education Planning and Resource Allocation System: the engine that computed every number in this report.

Factor trace. The decomposition of a result into the factors that produced it, each with its value, unit, source, source year and quality tier. Reachable through `explain()`.

Fill rate. The share of newly created places that are actually taken up. New places do not fill to one hundred per cent, and the engine does not assume they do.

Functional hand-washing facility. A hand-washing station the census found working at the time of enumeration. Counted in three classes — with water and soap, with water only, and none — so the three are reported separately and the middle class is never merged with either end.

Gate. A pre-run data-quality check that aborts rather than produce a misleading number. A gate the published data cannot satisfy may be waived by name on an exploratory run, and the waiver is recorded in the manifest.

Gross enrolment ratio (GER). Enrolment in a cycle over the population of that cycle's official age. Can exceed one where over-age learners are enrolled.

Gross intake rate (GIR). New entrants to the first grade over the population at the entry age. Above one means late or early entry, not over-enrolment.

Imputed. A quality tier: a value derived from other measured values by a stated method, rather than observed.

Improved drinking-water source. The census's classification of a school's main source of drinking water as improved or un-improved, following the standard water-and-sanitation definitions. Counted at every school and reported by district; no service standard for it exists in this engine, so it is not differenced into a gap.

Induced recurrent cost. What a capital item obliges the budget to pay every year afterwards — the teacher, the capitation, the maintenance. Never separated from the capital figure.

Learner-year. One learner enrolled for one school year: the unit a place norm and a unit cost are denominated in.

Measured. The strongest quality tier: a value observed and published by a named source in a named year.

MTEF. Medium-Term Expenditure Framework: the multi-year budget projection the plan terminates in.

Multigrade. Teaching two or more grades together in one class, which small schools do out of necessity; carried as a factor on the classes formed.

Normed. A quality tier: a value taken from an approved standard rather than observed in the field.

Non-teaching staff. School staff who do not teach: bursars, cooks, matrons, caretakers, security. Counted by the census and paid from the same budgets as teachers, but outside the teacher requirement, which is built from the timetable and computes teaching posts only.

Norm version. The pinned set of coefficients a run uses. Approved versions are immutable; a run pinned to an old version reproduces its original numbers.

Pins. The identifiers that fix a run: country, base year, horizon, structure version, geography version, norm version, price vintage, target set, scenario, ranking criterion, seed and solver settings. Two runs with identical pins produce identical numbers.

Place. A funded seat: a room, a teacher and capitation together. A classroom alone is not a place.

Promotion rate (π). The share of a grade's learners who move to the next grade the following year.

Pupil–classroom ratio (PCR), pupil–teacher ratio (PTR). Descriptive ratios. Used as reporting statistics and as quality conditions, never to derive the teacher requirement.

Quality tier. One of measured, normed, imputed, assumed. A result inherits the worst tier among its inputs.

Recurrent tail. The stream of recurrent costs a capital programme leaves behind after the plan horizon ends.

Repetition rate (p). The share of a grade's learners who are in the same grade the following year.

Requirement. What the norms say is needed, before any budget constraint. The difference between the requirement and the allocation is the financing gap.

Small-school correction. The adjustment that recovers the sum of per-school integer class counts when only district totals are available.

Split factor. The number of teaching groups a class divides into for a practical subject with a maximum group size.

Structure version. The pinned description of the education ladder: cycles, grades, entry ages, transitions.

Sub-region. The seventeen statistical regions UBOS groups districts into. The census publishes some dimensions at this geography and not by district; this report holds them there and never apportions them down, because splitting a sub-region total between its districts would require an assumption the source does not support.

Surplus. Supply in excess of requirement in a district, stored separately from the gap and never netted against it.

Proper waste disposal. The census's classification of a school's waste disposal method as proper or improper. Reported as counted; almost no government school outside Kampala qualifies, and no standard exists here to cost the remedy.

Teaching load. The periods per week a full-time teacher teaches. With the curriculum it determines the teacher requirement.

Transition rate (τ). The share of a cycle's terminal-grade learners who enter the first grade of the next cycle.

Unmeasured. A quantity that has not been observed and has not been imputed: reported as such, never as zero.

D.2 D.2 Abbreviations

AEGDB	Africa Education GIS database
ANAR	adjusted net attendance rate
CI	confidence or credible interval
COD-AB	Common Operational Dataset — administrative boundaries
DHS	Demographic and Health Survey
EM-01 ... EM-10	the ten modules of the planning chain
EMIS	Education Management Information System
EPRAS	Education Planning and Resource Allocation System
FTE	full-time equivalent
FY	financial year (FY2025/26 ends in 2026)
GER	gross enrolment ratio
GIR	gross intake rate
GoU	Government of Uganda
ISCED	International Standard Classification of Education
LG	local government
LSE	lower secondary education
LSMS-ISA	Living Standards Measurement Study — Integrated Surveys on Agriculture
MILP	mixed-integer linear programme
MoES	Ministry of Education and Sports
MoFPED	Ministry of Finance, Planning and Economic Development
MTEF	Medium-Term Expenditure Framework
NDP	National Development Plan
ODbL	Open Database Licence

OSM	OpenStreetMap
PCHIP	piecewise cubic Hermite interpolating polynomial
PCR	pupil–classroom ratio
PRE	pre-primary
PRI	primary
PTR	pupil–teacher ratio
SDG4	Sustainable Development Goal 4
TVET	technical and vocational education and training
UBOS	Uganda Bureau of Statistics
UGX	Uganda shilling
UIS	UNESCO Institute for Statistics
UNPS	Uganda National Panel Survey
UPE	Universal Primary Education
USE	upper secondary education
WASH	water, sanitation and hygiene
WDI	World Development Indicators

ANNEX E

E References

Every number in this report comes from one of the sources below, from the engine's own computation on them, or from the norm set printed in Annex B. The in-text citations are author–date in parentheses; entries are grouped by the kind of evidence they are, because the kind matters as much as the citation: an administrative census, a household survey, a policy standard and a published effect size carry different weight and are treated differently by the engine.

Where a source has a licence that travels with derived work — the share-alike condition on OpenStreetMap-derived geodata, the non-redistribution condition on DHS microdata — the condition is stated with the entry and is respected in this report and in the engine.

E.1 Administrative data: the school census and the public accounts

UBOS (2026). *The Baseline Education Census 2025 Report*. Kampala: Uganda Bureau of Statistics. The first nationwide census of Uganda's formal education system, covering every government and private school implementing the national curriculum, with reference year 2025. It supplies, by district and city and for pre-primary, primary, secondary and non-tertiary institutions: schools by ownership; learners by sex and ownership; teaching and non-teaching staff; pupil-teacher, pupil-classroom and pupil-stance ratios; net and gross attendance rates; learners by age and class; learners with a disability; learners by nationality; day and boarding status; and water, sanitation and hygiene. It is the source of the measured supply, the public-private split, the seed year of the projection and the out-of-school estimate in this edition, and it supersedes the 2017 abstracts as the latest district-level count of Uganda's schools. The annex tables were read from the published document; every extracted column reconciles exactly with the national totals the report prints, and the three rows repaired under the tables' own arithmetic identities are logged with the extraction. Government publication, public.

MoES (2017). *Education Statistical Abstract 2017*. Kampala: Ministry of Education and Sports. Primary and secondary enrolment by grade, sex and district; repeaters; primary teachers by qualification; schools and enrolment by ownership; pupil-classroom and pupil-stance ratios; pre-primary enrolment. School census year 2017. Until UBOS (2026) it was the latest district-level school data in the country, and it remains the only source for the grade profile within a cycle and for the repetition, promotion and dropout rates, which a single-year census cannot produce. Extracted from the published PDF annexes by `scripts/extract_emis_abstracts.py`; national totals reconcile exactly with UIS and the World Bank (primary enrolment 8,840,589; repeaters 778,349; primary teachers 207,238). The 2017 pupil-teacher annex is not used: it correlates 0.28 with the ratio implied by the enrolment and teacher tables and ranges from 1 to 532, and the rejection is recorded as `SRC_PTR_2017`. Government publication, public.

MoES (2016). *Education Statistical Abstract 2016*. Kampala: Ministry of Education and Sports. The prior-year census, used with MoES (2017) to reconstruct repetition, promotion and dropout from two consecutive years.

MoES (2022). *Local Government Planning, Budgeting and Implementation Guidelines, FY2022/23*. Kampala: Ministry of Education and Sports. The Construction Management Unit unit costs (classroom blocks, science blocks, latrines, teachers' houses, furniture, full primary and seed-secondary packages); the capitation rates for UPE, USE, UPOLET, special needs and hard-to-reach schools; inspection and monitoring rates; and the minimum service delivery standards used as norms in this report — pupil-classroom 1:53 at primary and 1:60 at secondary, one

desk per three learners, one latrine stance per forty learners. Construction costs are engineers' estimates and are rebased to constant 2026 prices with the GDP deflator.

MoFPED (2025). *Approved Budget Estimates FY2025/26, National*. Kampala: Ministry of Finance, Planning and Economic Development. The local-government education conditional grants that constitute the envelope of Chapter 11: primary wage UGX 1,029.8 bn, secondary wage 870.3 bn, primary non-wage 292.9 bn, secondary non-wage 173.1 bn, primary development 75.9 bn.

MoFPED (2015–2026). *Approved Budget Estimates, National*, financial years 2015/16, 2016/17, 2019/20, 2020/21, 2021/22, 2022/23, 2024/25, 2025/26 and 2026/27. The spending series of Chapters 1 and 13. The series is the sum over central-government votes whose name identifies an education institution, across every funding line in each workbook; it therefore excludes the local-government grants that finance most of primary schooling, and the FY2021/22 workbook carries a narrower set of funding lines than its neighbours.

MoPS (2025). *Salary Structure FY2025/26, Circular Standing Instruction No. 1 of 2025*. Kampala: Ministry of Public Service. Every teacher and school-leader scale used to price the wage bill. The published document is a scan with no text layer; the figures were transcribed page by page and are flagged `transcribed_from_scan` in the price catalogue. A reviewer should check these first, because the secondary science scale alone carries a large share of the lower-secondary wage bill.

E.2 E.2 Population

UBOS (2023). *Uganda National Population and Housing Census 2022: sub-national population by age, sex and district*. Kampala: Uganda Bureau of Statistics, distributed through the OCHA Common Operational Dataset (`cod-ps-uga`). Population in five-year bands for 135 districts, reference year

1. The base of every population figure in this report; single years of age are graduated from it and are therefore `imputed`. Licensed CC-BY.

WorldPop (2020). *Uganda 100 m constrained population, 2020*. University of Southampton. Held in the AICTEM estate and **not used** in this edition; named here because it is what a population-weighted access measure would need. Licensed CC-BY-4.0.

E.3 E.3 International statistical series

UIS (2025). *UNESCO Institute for Statistics data for Uganda*: enrolment, repetition and survival by grade, completion, out-of-school rates, school-age population, learning proficiency (SDG indicator 4.1.1), fertility, infant mortality and population growth. Used for the participation anchors of Chapter 5, the bridge calibration, and the national reading-proficiency baseline. Aggregates redistributable with attribution.

World Bank (2026). *World Development Indicators*, edition 2026-06-30. Enrolment, completion, pupil–teacher ratio and public education spending series for Uganda; the GDP deflator used to rebase prices to constant 2026 shillings. Licensed CC-BY-4.0.

UNICEF (2018). *Education indicators for Uganda*, SDMX dissemination: adjusted net attendance, completion and out-of-school rates by sex and by wealth quintile, 2016 reference year. The household-survey counterpart to the administrative participation rates of Chapter 5. Aggregates only.

DHS Program (1995–2025). *Uganda Demographic and Health Surveys and Malaria Indicator Surveys*, educational attainment and literacy series, 1995 to 2024/25. Used in this report **as published aggregates only**: the DHS terms of use forbid redistribution of microdata, and no DHS record is held in the engine's database.

UBOS and World Bank (2020). *Uganda National Panel Survey 2019/20 (LSMS-ISA), education module and official poverty file*. The source of the household cost of schooling in Chapter 3. Access is licensed through the World Bank

Microdata Library; the report publishes aggregates only, and names the questionnaire's own variable codes because the codebook that labels each cost item is not held on this system.

Uwezo (2013). *Are our children learning? Annual learning assessment, Uganda.* The only district-level learning assessment in the estate, now a decade old, which is why learning in Chapter 12 is modelled at national level.

E.4 E.4 Spatial data

OCHA (2022). *Uganda common operational dataset — administrative boundaries (COD-AB), admin level 2.* 135 district polygons with P-codes matching the UBOS population file. The pinned geography of every map and every district table in this report. Licensed CC-BY-IGO-3.0.

AEGDB (2026). *Africa Education GIS Database, Uganda extract:* 34,652 school points, 81,746 settlement points and settlement-to-nearest-school distances, derived from OpenStreetMap. The basis of the access measure of Chapter 7 and the siting solve of Chapter 10. Distances are straight-line, and settlement population is missing for 98 per cent of points, so coverage is weighted by settlement count rather than by people — recorded as SRC_ACCESS_EUCLID. OpenStreetMap contributors, licensed ODbL; the share-alike condition attaches to derived geodata, including the GeoJSON exports of this engine.

HOT (2026). *Uganda education facilities, OpenStreetMap export of 2026-09-06.* Humanitarian OpenStreetMap Team, via the Humanitarian Data Exchange. An independent school layer carrying district P-codes on the current district set, used in Chapter 3 as a cross-check on coverage. Licensed ODbL.

AFRICON and IT Power UK (2004). *Uganda schools: primary, secondary, post- primary, non-formal and other education facilities.* 21,193 school records with EMIS number, district, ownership, status and 2004 capacity attributes, prepared for a rural electrification study and held in the AICTEM infrastructure estate. Loaded as a historical vintage: its learner, teacher and classroom counts are never used as current supply. Its value is that it is the only layer holding EMIS numbers with coordinates. The accompanying metadata declares no licence, and this report does not assume one.

E.5 E.5 Evidence for effects

These are the effect sizes the outcome chain of Chapter 12 is permitted to use. Each enters the norm set with its interval, an evidence grade and a transfer discount; no effect that is not in this table is used, and where none exists the engine reports "no evidence available" rather than zero.

Duflo, E., Dupas, P. and Kremer, M. (2015). "School governance, teacher incentives, and pupil–teacher ratios: experimental evidence from Kenyan primary schools." *Journal of Public Economics* 123: 92–110. Class-size reduction, 0.03 SD per ten fewer pupils (0.00–0.07), randomised, transfer discount 0.5. This is the coefficient that drives the learning results of Chapter 12.

Burde, D. and Linden, L. (2013). "Bringing education to Afghan girls: a randomized controlled trial of village-based schools." *American Economic Journal: Applied Economics* 5(3): 27–40. Distance to school, used with Muralidharan and Prakash for the participation effect of bringing a child within the walking norm (0.10, 0.05–0.19), transfer discount 0.5.

Muralidharan, K. and Prakash, N. (2017). "Cycling to school: increasing secondary school enrollment for girls in India." *American Economic Journal: Applied Economics* 9(3): 321–350.

Glewwe, P., Kremer, M. and Moulin, S. (2009). "Many children left behind? Textbooks and test scores in Kenya." *American Economic Journal: Applied Economics* 1(1): 112–135. Textbook provision, 0.05 SD (0.00–0.10).

Evans, D. and Popova, A. (2016). "What really works to improve learning in developing countries? An analysis of divergent findings in systematic reviews." *World Bank Research Observer* 31(2): 242–270. Teacher training, 0.08 SD (0.02–0.14), quasi-experimental.

Alderman, H., Gilligan, D. and Lehrer, K. (2012). "The impact of food for education programs on school participation in northern Uganda." *Economic Development and Cultural Change* 61(1): 187–218. School feeding, 0.05 percentage points of attendance (0.02–0.08).

Adukia, A. (2017). "Sanitation and education." *American Economic Journal: Applied Economics* 9(2): 23–59. School sanitation and the attendance of adolescent girls, 0.02 percentage points (0.00–0.05).

World Bank project documentation (P166570, P160250, P133780, P110803). Textbook unit cost delivered (US\$1.98), per-school construction contract estimates, universal secondary capitation history and spending-per-student benchmarks, used in the price catalogue.

E.6 The engine, its specification and its own outputs

AICTEM (2026a). *Education Planning and Resource Allocation System (EPRAS): technical manual*, chapters 00–21. The specification this engine is built to, and the source of every method described in Chapters 2 to 13 of this report.

AICTEM (2026b). *EPRAS run `6b2afcf6`*, structure UGA-7-4-2-LSC2020, norm version UGA-EPRAS-2026-DRAFT, price vintage UGA-2026, target set UGA-ESSP-PATH, horizon 2026–2030. Every result table, figure and map in this report is produced by this run and is reproducible from it; the data pack is `report/build/data`, and the commands that rebuild the whole document are printed on the "About this report" page.

AICTEM (2026c). *AICTEM education estimation library* (`src/Estimation`, module `AICTEMEducation`). The source of the independent enrolment forecast, the teacher redeployment, the multi-criteria ranking and the cost–benefit ratio of Chapter 16.

AICTEM (2026d). *EPRAS conformance register*, technical manual chapter 21. What the build owes its own specification, which is the basis of the "what is not computed" statements throughout this report.

ANNEX F**F The engine and its application**

Everything in this report is computed by a program, and the program is not a black box. It ships with a browsable application that carries the same numbers, the same maps and the same provenance, one page per planning question. This annex shows what that application looks like and explains what each screen is for, so a reader who will never run Julia can still see where any figure in this document came from.

The application is static: the run writes every page to disk, and a small server serves them. There is no database query behind a screen and no way for a screen to show a number the run did not compute. That is a deliberate constraint — it means a printed figure and a screen figure cannot diverge — and it is the reason the application can be handed to a district office on a memory stick.

F.1 F.1 The plan overview

The landing page is the whole plan in one screen: the headline quantities, a narrative generated from the result tables rather than written by hand, and the six questions as the navigation.

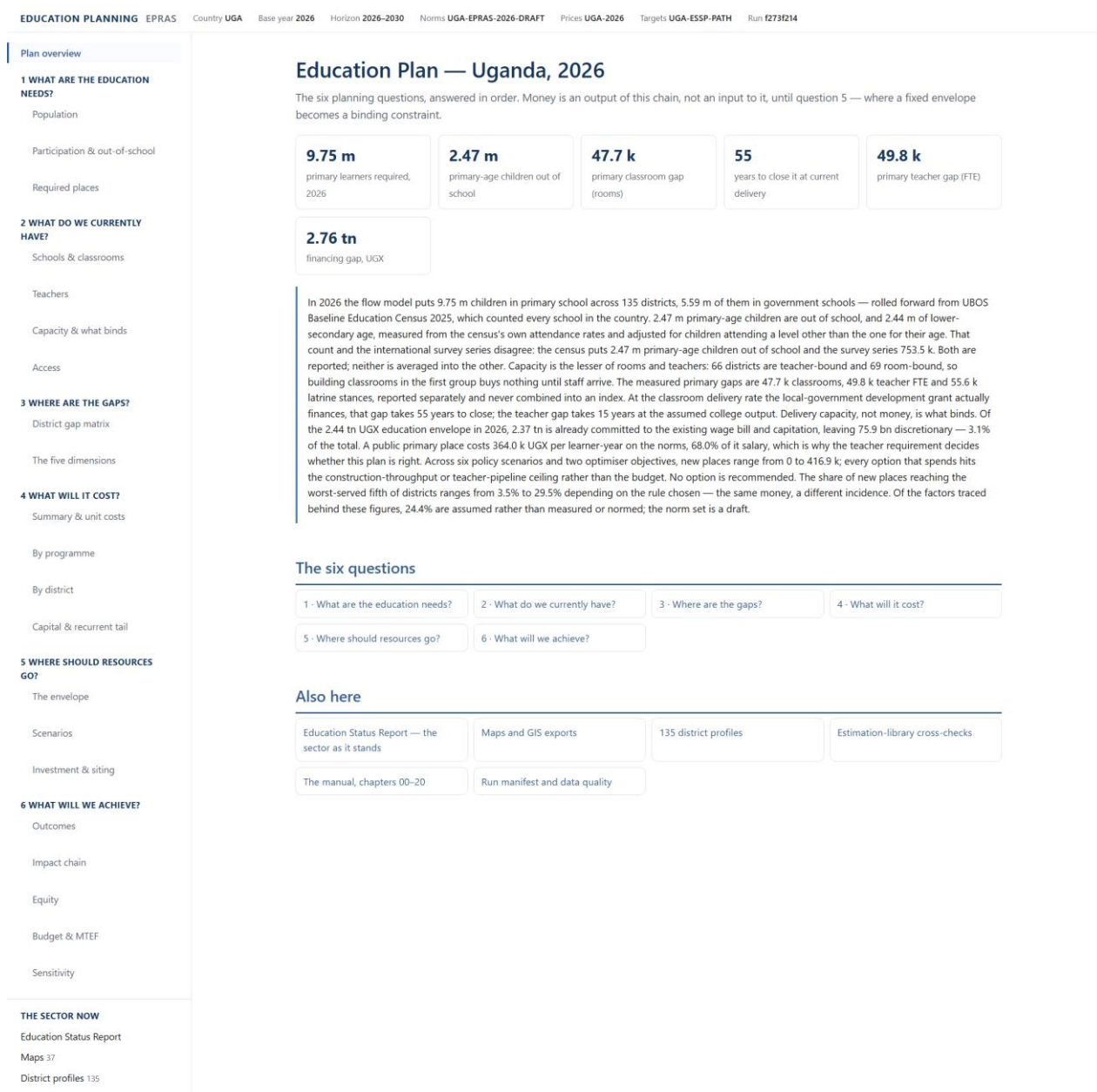


Figure F.1: The plan overview: headline figures, the generated narrative, and the six planning questions as navigation

Figure F.1 shows the discipline the engine is built to. The header bar is permanent and carries the run's pins — country, base year, horizon, norm version, price vintage, target set and run identifier — because a screenshot of this system will end up in a meeting and must be self-describing when it does. The narrative beneath the figures is assembled from result cells, so it cannot drift from the tables: when the arithmetic changes, the sentence changes with it. The left rail is the six questions of Chapter 1, in order, and it is the same on every page.

F.2 Question 2: what the system has, and what binds it

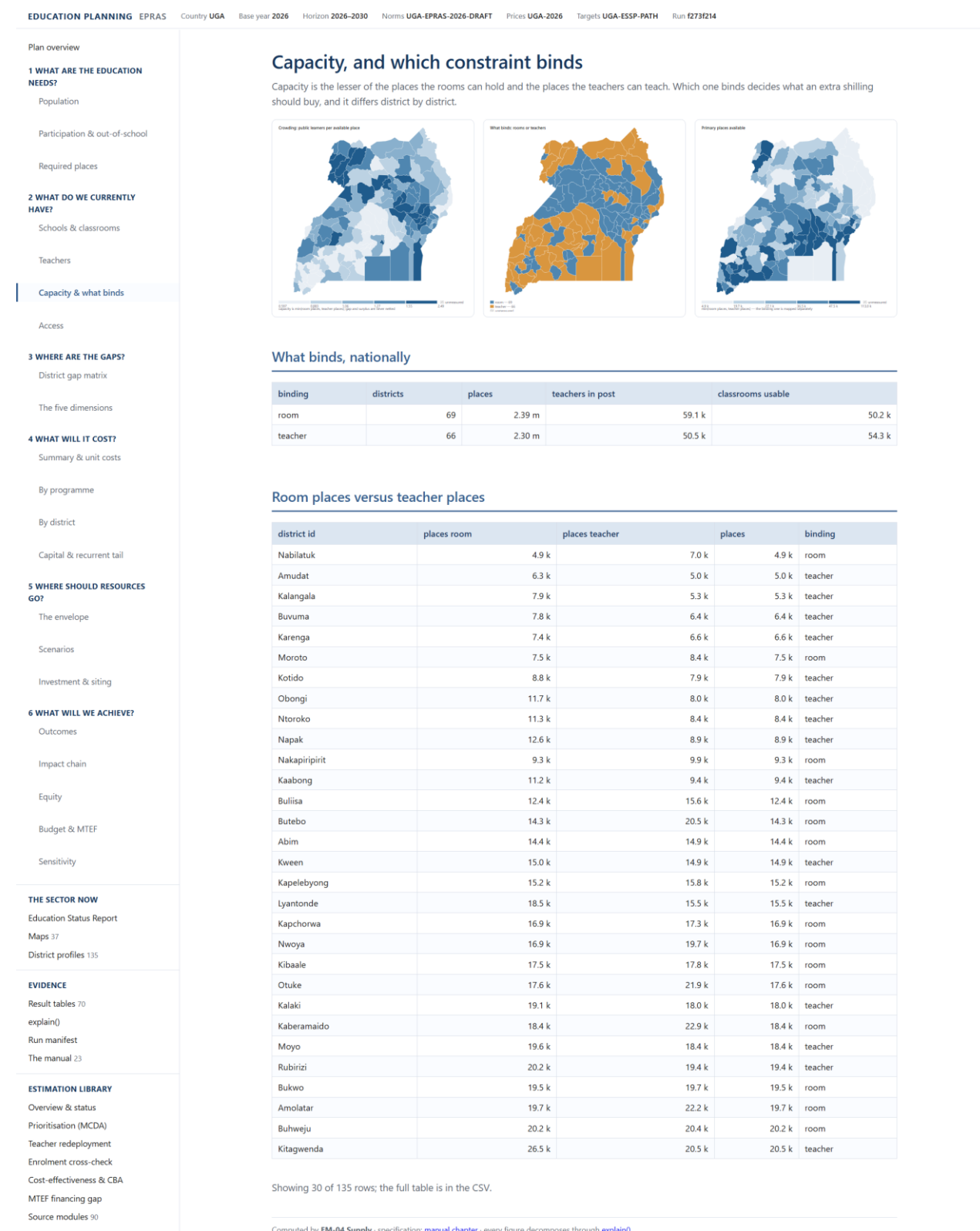


Figure F.2: Capacity and the binding constraint: the maps, the national split and the district table that EM-04 produces

Figure F.2 is the screen behind Chapter 7. Capacity is the lesser of the places the rooms can hold and the places the teachers can teach, and the middle map is a class map rather than a ramp: it names which of the two binds in each district. The table below it carries both quantities side by side for every district, so a reader can check the claim rather than take it. At the foot of the page — on this page and every other — sits the provenance line: which

module computed the screen, a link to the chapter of the technical manual that specifies it, and a link into the factor decomposition.

F.3 Question 3: the gaps, kept separate

EDUCATION PLANNING EPRAS Country UGA Base year 2026 Horizon 2026-2030 Norms UGA-EPRAS-2026-DRAFT Prices UGA-2026 Targets UGA-ESSP-PATH Run f273f214

Plan overview

1 WHAT ARE THE EDUCATION NEEDS?

Population

Participation & out-of-school

Required places

2 WHAT DO WE CURRENTLY HAVE?

Schools & classrooms

Teachers

Capacity & what binds

Access

3 WHERE ARE THE GAPS?

District gap matrix

The five dimensions

4 WHAT WILL IT COST?

Summary & unit costs

By programme

By district

Capital & recurrent tall

5 WHERE SHOULD RESOURCES GO?

The envelope

Scenarios

Investment & siting

6 WHAT WILL WE ACHIEVE?

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Impact chain

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Prioritisation (MCDA)

Teacher redeployment

Enrolment cross-check

Cost-effectiveness & CBA

MTEF financing gap

Source modules 90

the documentation

The district gap matrix

One row per district, one column per dimension. No total column, no rank column, no composite score: sorting is a stated choice, and here it is by primary out-of-school children.

Gap matrix

district id	oosc primary	oosc lower sec	children beyond 3km	place gap primary	place surplus primary	binding primary	classroom gap primary	teacher gap primary	teacher gap secondary	untrained primary	stance gap primary	quality conditions failing
Yumbe	158.3 k	106.2 k	6.0 k	20.5 k	0.000	teacher	649	840	87	57	785	3.00
Kasese	67.1 k	57.9 k	6.5 k	23.6 k	0.000	teacher	740	1.3 k	245	227	1.2 k	2.00
Kyegegwa	55.0 k	44.0 k	3.8 k	25.8 k	0.000	teacher	679	777	135	218	986	4.00
Isingiro	49.9 k	52.7 k	18.4 k	9.3 k	0.000	teacher	580	754	345	263	484	1.00
Kakumiro	49.8 k	42.1 k	3.7 k	13.0 k	0.000	teacher	416	526	94	312	430	4.00
Kampala	48.5 k	2.2 k	0.000	23.3 k	0.000	teacher	702	752	930	85	1.2 k	3.00
Kyenjojo	48.4 k	38.3 k	15.1 k	18.6 k	0.000	teacher	541	782	176	212	549	4.00
Kotido	45.1 k	22.5 k	19.8 k	1.2 k	0.000	teacher	63	87	4.48	24	94	1.00
Arua	41.9 k	65.3 k	1.2 k	48.3 k	0.000	teacher	1.4 k	1.6 k	243	118	1.8 k	3.00
Mayuge	39.9 k	45.2 k	9.9 k	14.6 k	0.000	room	699	547	281	92	899	2.00
Kagadi	39.9 k	31.1 k	1.6 k	6.2 k	0.000	teacher	447	533	236	334	385	2.00
Nwoya	39.1 k	28.2 k	21.7 k	678	0.000	room	138	84	46	81	72	1.00
Amudat	38.5 k	19.5 k	23.7 k	0.000	2.0 k	teacher	0.000	11	4.72	0.000	0.000	0.000
Buyende	37.9 k	45.0 k	11.6 k	29.2 k	0.000	room	867	817	75	238	1.0 k	4.00
Napak	36.0 k	17.2 k	22.5 k	631	0.000	teacher	20	103	28	34	40	1.00
Kikuube	35.3 k	35.1 k	4.1 k	12.6 k	0.000	room	472	429	82	133	592	3.00
Mubende	34.4 k	32.9 k	24.1 k	7.2 k	0.000	room	469	372	281	346	489	3.00
Bududa	31.2 k	26.1 k	203	3.0 k	0.000	teacher	245	320	129	58	212	1.00
Bugiri	31.1 k	41.9 k	577	13.1 k	0.000	teacher	632	709	236	78	787	3.00
Kamwenge	30.6 k	25.0 k	1.9 k	11.2 k	0.000	teacher	434	495	124	150	579	4.00
Bundibugyo	30.0 k	24.7 k	823	0.000	5.0 k	teacher	15	179	77	60	100	1.00
Luuka	29.0 k	24.3 k	0.000	0.000	3.7 k	room	168	48	62	50	231	1.00
Koboko	28.9 k	24.6 k	4.8 k	10.4 k	0.000	teacher	380	430	42	41	410	3.00
Kaabong	27.7 k	14.5 k	9.0 k	0.000	587	teacher	41	82	18	18	0.000	0.000
Kisoro	27.6 k	23.5 k	0.000	8.4 k	0.000	teacher	296	591	154	55	368	2.00
Alebtong	27.6 k	30.4 k	5.3 k	7.2 k	0.000	room	364	317	77	91	282	2.00
Zombo	27.4 k	32.8 k	49	27.4 k	0.000	teacher	777	871	20	59	803	3.00
Serere	27.4 k	31.0 k	6.2 k	23.9 k	0.000	room	786	636	169	83	941	3.00
Oyam	27.3 k	49.5 k	6.5 k	37.6 k	0.000	room	1.1 k	1.1 k	308	130	1.3 k	3.00
Rakai	25.8 k	28.6 k	1.7 k	0.000	2.2 k	room	295	227	147	136	352	1.00

Figure F.3: The district gap matrix: five dimensions, no total column and no rank column

Figure F.3 is the matrix of Chapter 8 as the application presents it. It has no total column and no rank column, because the engine refuses to produce either; sorting is by an explicit criterion which is a pin of the run and is printed in the manifest. A reader who wants a ranking must say what they are ranking on, which is the point.

F.4 F.4 The atlas

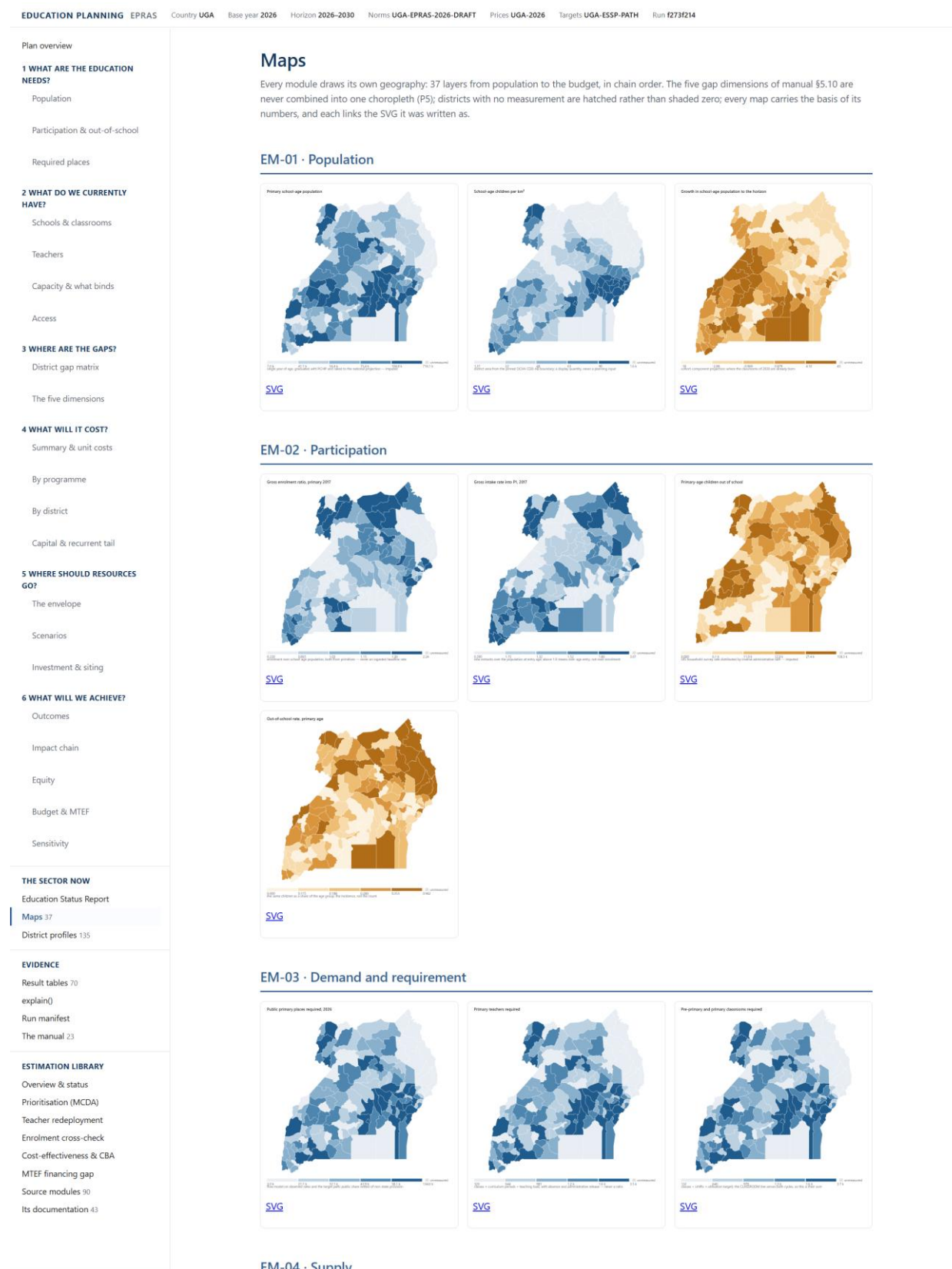


Figure F.4: The map gallery: thirty-seven layers, grouped by the module that computed each one

Figure F.4 is the atlas of Chapter 14. Every module puts what it computes on the map — population and pressure from EM-01, participation and out-of-school children from EM-02, requirements from EM-03, supply, access and the eight school-condition layers the census added from EM-04, the five gap dimensions from EM-05, cost from EM-06, investment and siting from EM-07, allocation and the financing gap from EM-08, outcomes from EM-09, the budget share from EM-10, and the redeployment cross-check from the estimation library. Each layer links the SVG it was drawn as, and the whole set is exported as GeoJSON for anyone who would rather open it in a geographic information system than look at a picture of it.

F.5 F.5 Question 5: the options, side by side



Figure F.5: The scenario comparison: six rules and two optimiser objectives on the same metrics, none recommended

Figure F.5 is Chapter 11 on screen. The six rule-based scenarios and the two optimiser objectives appear on one table, on the same metrics, with the binding constraint and the solver's status beside each. No row is highlighted, no row is starred and no row is called best: the comparison is the product, and the choice is not the system's to make.

F.6 F.6 The district profile

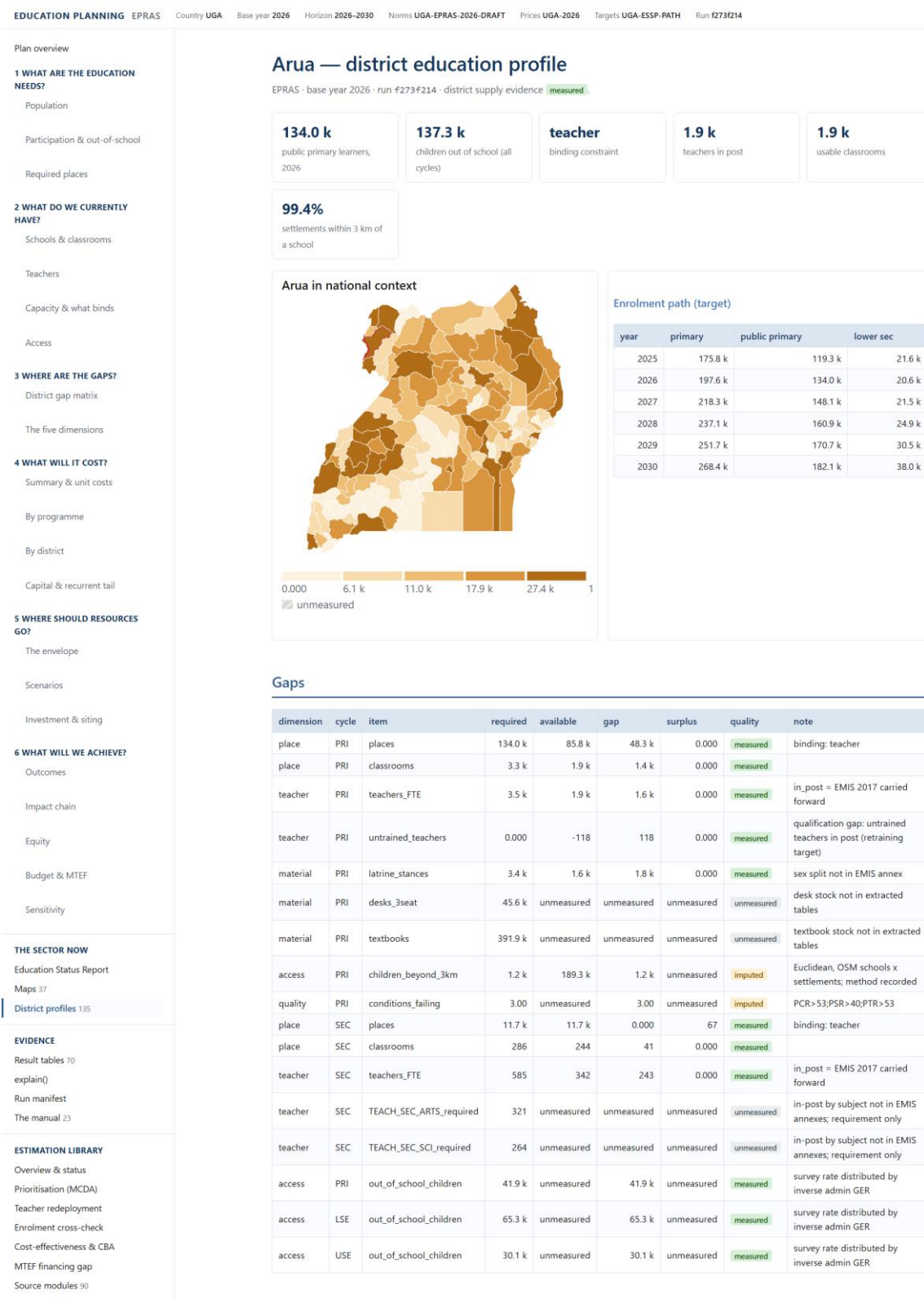


Figure F.6: A district profile: one district's needs, supply, gaps, costs and proposed sites on a single page

Figure F.6 is the page that gets used most. Each of the 135 districts has one, carrying that district's own population, participation, supply, gaps, cost and any proposed school sites, with a locator map. It is also the engine's best data-quality instrument: a district education officer who reads their own page will recognise within a minute whether the schools, the classrooms and the teachers are right, and that correction is worth more than any amount of additional modelling.

F.7 F.7 Provenance: `explain()`

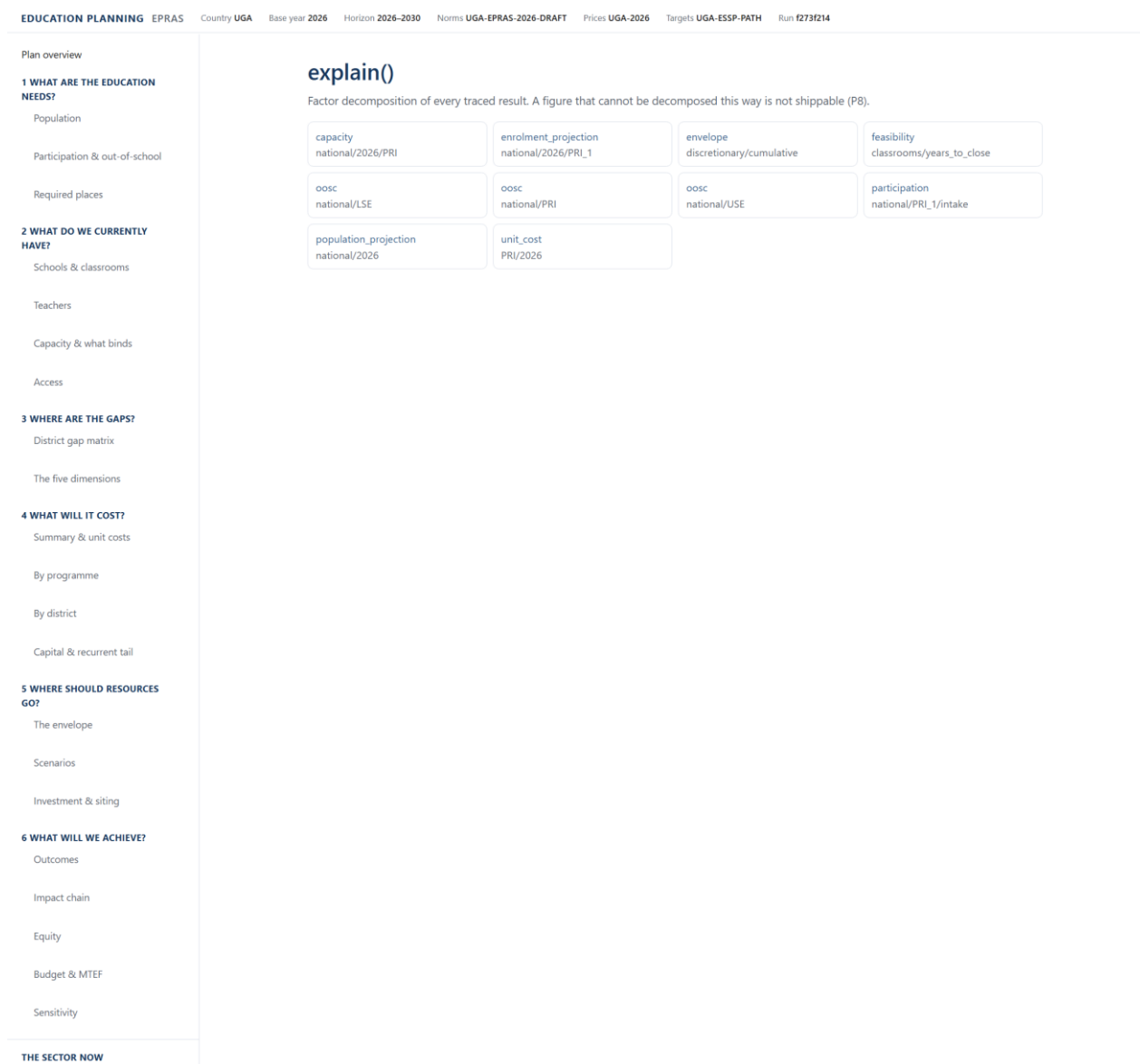


Figure F.7: The factor decomposition: every traced result broken into its factors, each with its source, year and quality tier

Figure F.7 is what makes the rest defensible. Any traced figure decomposes into the factors that produced it — the cohort, the flow rates, the target, the norm and the price — each with its value, its unit, its source, the year of that source and its quality tier. A figure that cannot be decomposed this way is not shippable, and the suite tests that the decomposition exists.

F.8 The estimation library

EDUCATION PLANNING
EPRAS
Country UGA
Base year 2026
Horizon 2026-2030
Norms UGA-EPRAS-2026-DRAFT
Prices UGA-2026
Targets UGA-ESSP-PATH
Run f273f214

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1 WHAT ARE THE EDUCATION NEEDS?
Population
Participation & out-of-school
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2 WHAT DO WE CURRENTLY HAVE?
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Capacity & what binds
Access
3 WHERE ARE THE GAPS?
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The five dimensions
4 WHAT WILL IT COST?
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By district
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The estimation library

The AICTEM education **estimation** system: 90 modules, 11546 lines, 43 chapters. It is part of this repository — `src/Estimation`, `docs/estimation`, one Project and one Manifest with the planning chain — and its components run in the same process as the run they check (manual ch.20). EPRAS still does not re-implement what it does: estimation is its side of the boundary (\$0.4).

Component status

component	state	detail
mcda	ok	ok: 135 districts ranked; top=Yumbe; rank stability under ± 0.1 weight shifts = 0.7
teacher_redeployment	ok	ok: 14722 teachers would move between districts at a target PTR of 53, no hiring
enrolment_forecast	ok	ok: max difference 0.15% against EPRAS's own baseline path
cost_benefit	ok	ok: benefit-cost ratio 3.16 on assumed Mincerian parameters
mtcf_financing_gap	ok	ok

Browse

Source modules (90)
Its documentation (43)
Manual ch.20: the component register

Figure F.8: The estimation library in the application: component status and the cross-checks it produces

Figure F.8 is Chapter 15 on screen. The estimation library is part of the same package as the planning chain and runs in the same process, so these cross-checks are computed from the tables of the run they report on. The page carries the status of each component, the tables it produced, all ninety of its source modules and all of its own documentation, because a second opinion that cannot be inspected is not a second opinion.

F.9 F.9 The run manifest and the gates

EDUCATION PLANNING

EPRAS

Country UGA

Base year 2026

Horizon 2026-2030

Norms UGA-EPRAS-2026-DRAFT

Prices UGA-2026

Targets UGA-ESSP-PATH

Run f273f214

Plan overview

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explain()

Run manifest

Run manifest

```
{
  "aegdb_build": "aegdb.sqlite (africa-education-gis, OSM education layer, read 2026-09-22)",
  "created_at": "2026-10-08T13:43:03.351",
  "target_set": "UGA-ESSP-PATH",
  "horizon": "2026-2030",
  "gates waived": [
    "G2",
    "G9"
  ],
  "scenario": "A",
  "structure_version": "UGA-7-4-2-LSC2020",
  "run_id": "703b8516-11b3-4369-a0c8-c40f9011c456",
  "status": "draft",
  "solver": {
    "mip_gap": 0.005,
    "time_limit_s": 600,
    "engine": "HIGHS via JuMP"
  },
  "non_compliant": true,
  "chain_seconds": 101.7,
  "country": "UGA",
  "geography_version": "UGA-UBOS-2022",
  "price_vintage": "UGA-2026",
  "ranking_criterion": "oosc_primary",
  "base_year": 2026,
  "norm_version": "UGA-EPRAS-2026-DRAFT",
  "stubs": [
    "FINEX envelope (5% real growth assumed)",
    "CDCGE (payload only)",
    "MEL (payload only)"
  ],
  "seed": 20260922,
  "exploratory": true
}
```

Data quality findings

check code	severity	subject	detail
SRC_PTR_2017	warning	MoES Abstract 2017, primary annex VIII PTR	published district PTR correlates 0.28 with enrolment/teacher-count tables and ranges 1-532; column rejected, teachers taken from the qualification annex (reconciles to UIS 207,238)
SRC_EMIS_VINTAGE	warning	EMIS district data	superseded: the Baseline Education Census 2025 now supplies district-level schools, learners, teachers and attendance. The 2016 and 2017 abstracts remain the only source for the grade profile within a cycle and for the flow rates, so those are still carried from 2017
SRC_ACCESS_EUCLID	warning	accessibility	straight-line settlement-to-school distance on OSM layers; no friction surface; settlement points unweighted by population for 98% of settlements
SRC_SEC_TEACHERS	note	secondary teachers 2017	grand total per district from the qualification annex; gov/private split by enrolment share
SRC_BEC_2025	note	UBOS Baseline Education Census 2025	first nationwide census of government and private schools, reference year 2025, published May 2026; supplies measured schools, learners, teachers, classrooms, stances and net attendance by district and supersedes the 2017 abstracts as the engine's supply and seed
SRC_BEC_RATIO_DERIVED	note	census classrooms and stances	published by district as pupil-classroom and pupil-stance ratios rather than counts; derived per census unit before aggregation and raked to the published national totals, so the counts are imputed from measured ratios
SRC_BEC_CITY_FOLD	note	census geography	the census reports 146 units; ten cities and Terego are folded into their parent districts to match UGA-UBOS-2022, and every unit's rule is recorded in bec_district_crosswalk
SRC_BEC_WASH	note	school water, hygiene and waste	the census counts schools by drinking-water source, by functional hand-washing facility and by waste disposal, at pre-primary, primary and secondary; these are loaded as counted into bec facilities and reported, but no capital standard exists for them in this engine, so they are not costed and not part of any gap dimension
SRC_BEC_ORIGIN_INTERNAL	note	census tables 3.5A and 4.7A, learners by country of origin	table 4.7A's country rows sum to two learners fewer than its own total row, in 2,008,133; and table 3.5A's sex split of primary learners differs from table 3.4A's by 4,612 while the grand total agrees exactly. Both are reported as published: the origin detail is used only for the distribution across countries, never for a sex split

Figure F.9: The run manifest and the data-quality findings, including the gates that were waived and why

Figure F.9 closes the loop. It prints the manifest — every pin, the solver settings, the chain time, the stubs the run depends on and the gates that were waived by name — alongside the data-quality findings and the norm coefficients flagged assumed. A reader who wants to know how much to trust this report should start here and then read Chapter 17.

F.10 F.10 Running it

The application is rebuilt from a run with two commands, and the whole report with one more:

```
`` ./run.ps1 run # EM-01 to EM-10, writes outputs/latest ./run.ps1 serve #
rebuilds the application and serves it on port 8000 ./run.ps1 sector-report # rebuilds this
document from the same run ``
```

Nothing in the application is hand-maintained: the pages, the maps, the narrative and the tables are all written by the run that produced the numbers in this report, which is why the two cannot disagree.