LADLF Laos-Australia DEVELOPMENT LEARNING FACILITY
An Australian Aid project managed by Adam Smith International

Assessing BEQUAL's Targeting Approach in Lao PDR

November 2017

Adam Smith International

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Acronyms

BEQUAL	Basic Education Quality and Access in Lao PDR
CPR	Cohort completion Rate
DRR	Dropout Rate
EFA-FTI	Education for All Fast Track Initiative
NER	Net Enrolment Ratio
PCA	Principal Component Analysis
PCR	Pupil-Class Ratio
PEPI	Primary Education Performance Index
PTR	Pupil-Teacher Ratio
RPR	Repetition Rate
SVR	Survival Rate

Definition of Key Terms

Terms	Definitions
Primary education outcomes	Indicators gauging the level of children's access to primary education, children's achievements in primary education and the school effectiveness in keeping the children.
School resources	Basic inputs in education, including classrooms and teachers.
Primary education performance index	A measure of the progress of primary education at district level.
Principal component analysis	A statistical method used to reduce the number of variables into a smaller number of dimensions.
Correlation	A measure for describing the direction (positive or negative) and strength of mutual relationship between two or more variables.

Executive Summary

The purpose of this study is to assess the targeting approach of BEQUAL against criteria of education performance and poverty as well as to improve the targeting strategy based on the use of updated data and a broadened definition of district education performance.

The study involves an analysis of the correlation between poverty and education outcomes, the construction of an education performance index using the principal component analysis method and the classification of BEQUAL and non-BEQUAL districts into national education performance and poverty quintiles.

Based on data from the Lao EDUInfo database, the analysis of BEQUAL 67 districts shows that:

- BEQUAL currently targets 7 districts with middle education performance, 6 districts with high education performance and 6 districts with the highest education performance; while missing 12 districts that have low and lowest education performance.
- BEQUAL currently targets 15 moderately poor districts, 9 rich districts and 2 richest districts; while missing 19 districts that are classified as poor and poorest districts.
- BEQUAL currently targets 3 non-poor districts classified as 'middle education performance', 2 non-poor districts classified as 'high education performance' and 4 non-poor districts classified as 'highest education performance'; while missing 6 poor districts with low education performance.

The analysis of BEQUAL-67 concludes that:

- BEQUAL targeting can be improved based on a criterion of education performance, by replacing 19 BEQUAL districts that have middle, high and highest education performance with 12 non-BEQUAL districts that have low and lowest education performance.
- BEQUAL targeting can be improved based on a criterion of poverty, by replacing 26 BEQUAL non-poor districts with 19 non-BEQUAL poor districts.
- BEQUAL targeting can be improved based on criteria of education performance and poverty, by replacing 9 BEQUAL non-poor districts that have middle, high and highest education performance with 6 non-BEQUAL poor districts that have low education performance.

Furthermore, the analysis of BEQUAL 29 districts shows that:

- BEQUAL-29 currently targets 2 districts with middle education performance, 1 district with high education performance and 3 districts with the highest education performance; while missing 13 other-BEQUAL districts with the lowest education performance.

- BEQUAL-29 currently targets 6 moderately poor districts and 3 rich districts; while missing 10 other-BEQUAL poorest districts.

- BEQUAL-29 currently targets 2 non-poor districts classified as 'middle education performance', 1 non-poor district classified as 'high education performance' and 1 non-poor district classified as 'highest education performance'; while missing 13 other-BEQUAL poor districts with low and lowest education performance.

The analysis of BEQUAL-29 districts concludes that:

- BEQUAL-29 targeting can be improved based on a criterion of education performance, by replacing 6 BEQUAL-29 districts that have middle, high and highest education performance with 13 other-BEQUAL districts that have the lowest education performance.

- BEQUAL-29 targeting can be improved based on a criterion of poverty, by replacing 9 BEQUAL-29 non-poor districts with 10 other-BEQUAL poorest districts.

- BEQUAL-29 targeting can be improved based on criteria of education performance and poverty, by replacing 4 BEQUAL-29 non-poor districts that have middle, high and highest education performance with 13 other-BEQUAL poor districts that have low and lowest education performance.

1. Introduction

1.1 Background

Poverty is often associated with low primary education outcomes. Parents with low income and wealth are less likely to support their children to enrol and stay in a primary school until completion even if the return on education exceeds the cost. Lack of incentive to attend schools limits the opportunity for the poor to obtain basic skills to work in the formal labour market which could provide a better source of income and, hence, reduce poverty in rural areas of Lao PDR.

This issue is particularly pronounced in Laos where DFAT funds and operates the Basic Education Quality and Access in Laos (BEQUAL) program, a ten-year initiative that aims at improving access and quality of primary education for children that traditionally experience poorer education outcomes — girls, students with disabilities and children from more remote communities. Phase 1 of the program (2015-2019) targets 67 educationally disadvantaged districts (i.e. 45% of the total districts in Lao PDR) by training teachers from remote villages, developing new methods for teaching Lao language, building new classrooms and providing sanitation facilities. It also helps to strengthen the national education system through support to revise the national primary curriculum with textbooks for every school in Lao PDR and building capacity across the central, provincial and district levels.

1.2 Purpose and use

The purpose of this study is to assess the targeting approach of BEQUAL against criteria of education performance and poverty. It seeks to answer the following research question: "how well does the current BEQUAL targeting approach reach educationally disadvantaged districts in Lao PDR?"

The objective is to improve the relevance of BEQUAL targeting strategy, based on the use of updated data and a broadened definition of district education performance.

The analysis is conducted in three steps.

1. The first step involves an analysis of the correlation between poverty and education outcomes.
2. The second step entails the construction of a primary education performance index (PEPI) using the principal component analysis method.
3. The third step applies the derived index to all districts of Lao PDR, and classifies all BEQUAL and non-BEQUAL districts into national education performance and poverty quintiles.

The results of this study should feed into the upcoming mid-term review of BEQUAL, and in particular in the considerations on the appropriateness and relevance of BEQUAL design and on ways of improving it.

1.3 Methodology and limitations

In this study, we broaden the definition of education performance and include a wider set of education indicators selected on the basis of their relevance to BEQUAL's overarching objectives and data availability. The education indicators include net enrolment ratio, dropout rate, repetition rate, survival rate, completion rate, pupil-teacher ratio and pupil-class ratio. This set of indicators is used to construct a primary education performance index (PEPI) and consequentially to assess BEQUAL's targeting approach. The weight of each indicator within the PEPI is estimated by the method of principal component analysis (PCA), a statistical procedure that finds the underlying structure (called principal components) in a set of observations of possibly correlated variables. The key feature of PCA is that it reduces the number of primary education indicators into a smaller number of dimensions.

The selection of education indicators in this study is constrained by the availability of data across districts in Lao PDR. The selected education indicators are obtained from Lao EDUInfo's online database, which provides education data for all districts. Poverty rate is obtained from the Centre for Development and Environment, which constructs poverty rate across districts using both Lao Population Census 2015 and Lao Expenditure and Consumption Survey (2012/13). We sought to include an indicator for district budget in primary education but had to abandon the idea due to a lack of available data.

1.4 This report

This report contains the following sections:

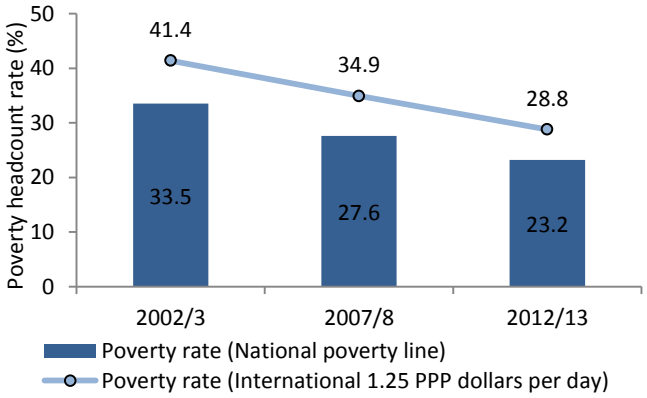
- Section 2 discusses the trends and correlation between poverty and selected primary education outcomes;
- Section 3 details the construction of the education performance index;
- Section 4 analyses the BEQUAL targeting approach;
- Section 5 concludes with programmatic implications.

2. Poverty and Primary Education in Lao PDR

2.1 National trends in poverty and primary education outcomes

Over the last decade poverty has reduced at a national level in Lao PDR. The poverty headcount rate based on the national poverty line (estimated at 203,614 LAK per month in 2012/13) fell from 33.5% in 2002/3 to 27.6% in 2007/8, and to 23.2% in 2012/13. Similarly, the poverty headcount rate based on the international 1.25 purchasing power parity (PPP) dollars per day decreased from 41.4% to 34.9% and 28.8% in the same period (Fig.1).

Fig.1: Poverty trend in Lao PDR, 2002/3 - 2012/13



Source: Pimhidzai et al., 2014, p.X.[1]

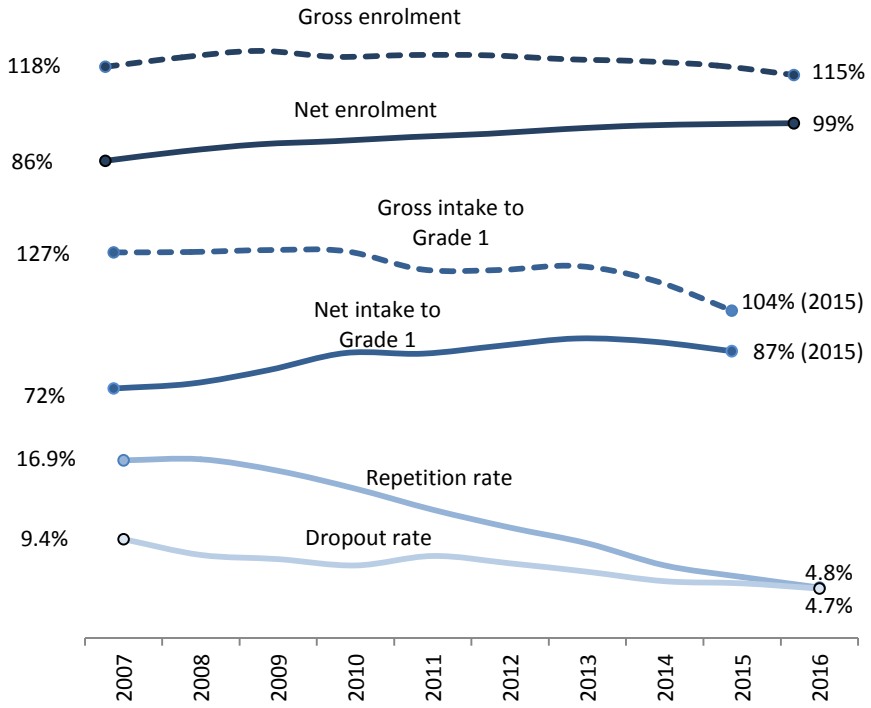
However, poverty rate, the percentage of the population living below the poverty line, varies across locations and socio-economic groups. In 2012/13, the majority of the poor were rural residents which accounted for 88% of total poor people. By ethnicity, the proportion of the poor remained highest in LaoTai (44.4% of total poor people), followed by Mon-Khmer (40.3% of total poor people) and Hmong-Lu-Mien (12.1% of total poor people). By gender of household head, poverty headcount rate was significantly lower among female headed (17%) than male headed households (24%) (Pimhidzai et al., 2014).

In parallel to poverty reduction, there are signs that primary education outcomes have improved at a national level. First, access by school-aged population to primary education has increased overall. The net enrolment ratio (school-aged population) has increased from 86% in 2007 to 99% in 2016. The net enrolment ratio of 99% in 2016 implies that universal primary education has almost been achieved in Lao PDR. Meanwhile, the gross enrolment ratio has decreased over the same period (see Fig.2).

[1] Pimhidzai, O., Fenton, N. C., Souksavath, P., & Sisoulath, V. (2014). Poverty Profile in Lao PDR. Vientiane Capital: Ministry of Planning and Investment.

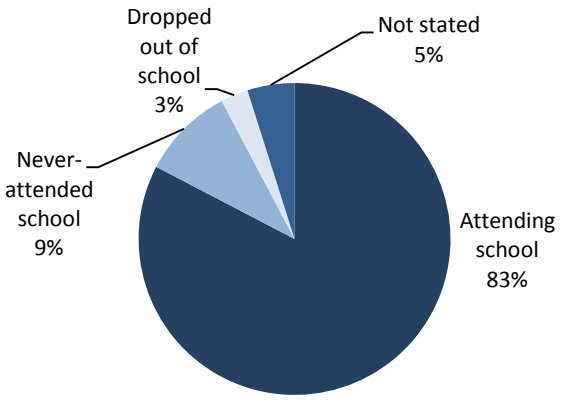
Improvements of primary education outcomes also include a reduction of the number of over-age children enrolled in Grade 1; the net intake to Grade 1 rose from 72% in 2007 to 87% in 2015, while the gross intake to Grade 1 decreased from 127% to 104% over the same period. The gap between gross and net intake rates has narrowed suggesting that proportionally more Grade 1 students are children of the right school-age in 2016 than in 2007. Furthermore, both repetition and dropout rates have reduced over the same period. The repetition rate fell from 16.9% in 2007 to 4.8% in 2016, and the dropout decreased from 9.4% in 2007 to 4.7% in 2016 (Fig.2).

Fig.2: Evolution of primary education outcomes in Lao PDR



Source: Author's calculation using data from Lao EDUInfo and UNESCO online databases.

Fig.3: Status of school attendance in Lao PDR (children aged 6-10)



Source: Author's estimation using data from Lao Population Census (2015).

Despite the progress in primary education outcomes, the country still faces challenges in terms of access and quality of primary education. One of these challenges is to keep children at school until completion.

Data from the latest Lao Population Census (2015) shows that there are 681,030 primary school-aged children (age 6-10) in Lao PDR, only 83% of which is currently attending school. A remaining 9% of total school-aged children have never attended school and 3% of total school-aged children have left school before completing primary education (Fig.3).

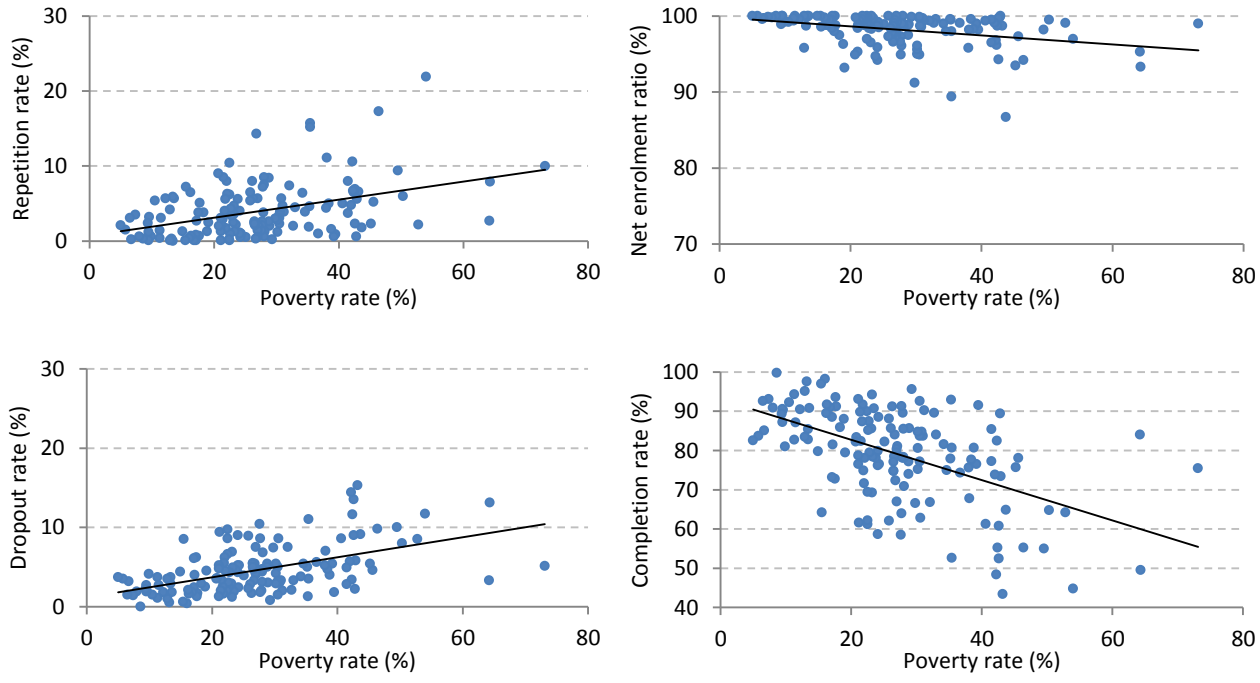
2.2 Correlation between poverty and selected primary education outcomes

In this section we explore the patterns of correlation between poverty and four primary education outcomes: net enrolment ratio, dropout rate, repetition rate, and cohort completion rate. The analysis is conducted in two steps. First, we visualise the relationship between poverty and primary education outcomes using a scatter plot. Second, we calculate the correlation coefficients to assess the strength and direction of the linear relationships between these variables.

Fig. 4 below illustrates the scatter plots between poverty and primary education outcomes. It reveals two features of correlation:

1. Poverty is negatively correlated with net enrolment ratio and cohort completion rate, while positively correlated with repetition rate and dropout rate. Districts with higher poverty rates are associated with lower net enrolment ratio and cohort completion rate and with greater repetition rate and dropout rate.
2. Second, slope coefficients in the scatter plots indicate that the correlation between poverty and primary education outcomes is low for repetition rate, dropout rate, and net enrolment ratio, and moderate for cohort completion rate.

Fig.4: Correlation between poverty and primary education outcomes



Source: Author's calculation.

Primary education outcomes in a few districts, however, show peculiar correlations with poverty rate (Fig.4). Xaychamphone District in Borikhamxay Province, for example, had a high cohort completion rate of 84% and a high poverty rate of 64%. Districts that do not conform to the correlation trends in scatter plots may reflect two possibilities. First, other factors could have stronger influence on primary education outcomes than poverty. Second, data on primary education outcomes might not be sufficiently accurate to reflect the reality of school performance in districts.

Findings about the relationship between poverty and primary education outcomes are confirmed by the analysis of correlation coefficients. Results from such analysis (see Table 1 below) reveal two features of the correlation between poverty and primary education outcomes. First, the correlation between poverty and primary education outcomes is low. The first column of Table 1 shows that correlation coefficients between poverty and primary education outcomes are less than 0.5 for net enrolment ratio and repetition rate, and slightly higher than 0.5 for dropout rate and cohort completion rate. Second, poverty is negatively correlated with net enrolment ratio and cohort completion rate while positively correlated with repetition rate and dropout rate.

Table 1: Correlation matrix of poverty rate and primary education outcomes

Variable	Poverty rate	Net enrolment ratio	Dropout rate	Repetition rate	Completion rate*
Poverty rate	1.000	-0.339	0.513	0.406	-0.531
Net enrolment ratio	-0.339	1.000	-0.377	-0.242	0.377
Dropout rate	0.513	-0.377	1.000	0.396	-0.989
Repetition rate	0.406	-0.242	0.396	1.000	-0.456
Completion rate*	-0.531	0.377	-0.989	-0.456	1.000

Note: *Cohort completion rate.
Source: Author's calculation.

The analysis of correlation coefficients in Table 1 also reveals that the correlation coefficients among primary education outcomes, except completion rate and dropout rate[2], are low. The correlation coefficient between net enrolment ratio and other primary education outcomes is lower than 0.5, indicating that a single education indicator is not sufficient to explain the variation of primary education performance across districts in Lao PDR. This reinforces the need to construct a composite index of primary education performance.

[2] The correlation coefficient between the completion rate and dropout rate is high (-0.989) due to the calculation method of cohort completion rate. According to UNESCO Institute for Statistics (2017), the cohort completion rate for primary education is defined as the percentage of a cohort of pupils enrolled in the first grade of primary education in a given school year who are expected to complete this level of education. It is calculated by dividing the number of graduates from primary education in a given year by the difference between enrolment in the last grade in the same year and repeaters in the last grade in the following year, and multiplying the result by the survival rate to the last grade of primary education in the given year and by 100. In this formula, the cohort completion rate is negatively related to the dropout rate through the survival rate.

3. The Primary Education Performance Index

3.1 Selection of indicators

According to the design, the selection of BEQUAL 67 districts is based on a selection of districts with the lowest net enrolment ratios (2008-09) that were already supported by the Education for All Fast Track Initiative program[3] (EFA-FTI) and an additional 9 districts with the lowest female survival rates to grade 5 (2012-13)[4]. In this study, we broaden the definition of education performance to include a wider set of education indicators selected on the basis of their relevance to BEQUAL's overarching objectives and data availability. This set of indicators is used to construct a primary education performance index (PEPI) and consequentially to assess BEQUAL's targeting approach.

There are 7 education indicators used for the construction of PEPI, which can be classified into three groups. Each group relates to one of BEQUAL's three overarching objectives. Classification of education indicators is illustrated in Fig. 5.

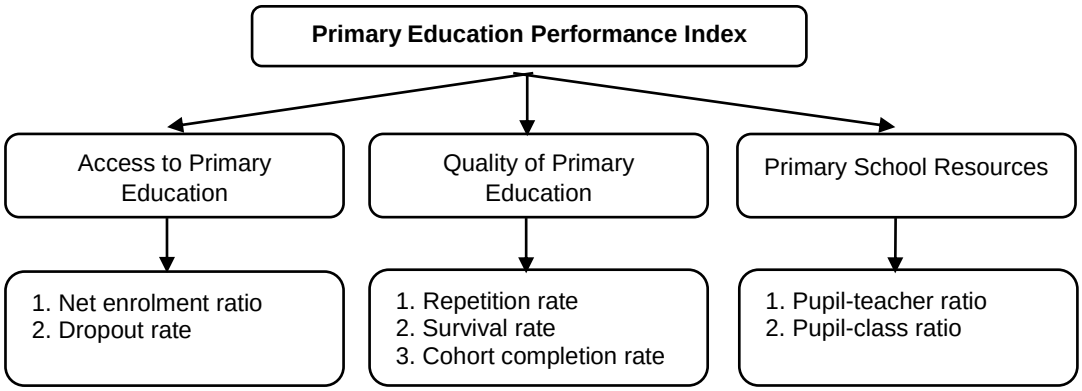
- The first group relates to access to primary education, which is proxy by net enrolment ratio (NER) and dropout rate (DRR).
- The second group relates to the quality of primary education, which is proxy by repetition rate (RPR), survival rate (SVR), and cohort completion rate (CPR).
- The third group relates to primary school resources, which is proxy by pupil-teacher ratio (PTR) and pupil-class ratio (PCR)[5].

[3] The EFA-FTI was a multilateral program that ran from 2010-14 and to which Australia was contributing, amongst other donors.

[4] See BEQUAL Design Document p.14 and p.84

[5] We sought to include an indicator about district budget for primary education but had to abandon the idea due to a lack of available data.

Fig.5: Structure of the primary education performance index



Source: Author's construction.

Data for all education indicators in 2017 are obtained from the Lao EDUInfo's online database, available at http://www.devinfo.org/laoeduinfo/libraries/aspx/home.aspx.

3.2 Summary of estimated results

The weight of each indicator within the PEPI is estimated by the method of principal component analysis (PCA) (see modelling strategy in Annex 1 and estimated results in Annex 2). We calculate a PEPI for each district which has a mean equal to zero and a standard deviation equal to 2.05 for both aggregate and female PEPI; the higher the PEPI of a district, the higher the education performance of that district (see ranking of all 148 districts based on aggregate PEPI in Annex 3 and based on female PEPI in Annex 4).

Table 2: Mean of education performance index by quintile

Quintile	No. of districts	Mean	
		Aggregate PEPI	Female PEPI
Lowest (20%)	30	-3.14	-3.10
Low (20%)	30	-0.67	-0.64
Middle (20%)	29	0.27	0.33
High (20%)	30	1.08	1.04
Highest (20%)	29	2.57	2.47

Source: Author's estimation.

To characterise districts into broad education performance categories we classify all 148 districts of Lao PDR into five groups based on the PEPI quintiles and calculate the mean for each quintile. Table 2 reports the classification of districts by the PEPI quintile. Number of districts by the quintiles of aggregate PEPI is similar for those of female PEPI. There are 30 districts in each quintile except for the middle and highest education performance groups where there are 29 districts in each.

3.3 Reliability of the index

Before applying the PEPI, we must test its reliability, i.e. its internal coherence. The PEPI performs well on three dimensions of sensitivity analysis. First, it is coherent with the individual indicators it contains since average values for each indicator differ markedly across the lowest, low, middle, high and highest education performance districts.[6] Second, it has a reasonable relationship with poverty rate at the district level. Thirdly, it is statistically robust to the groups of education indicators included; the removal of one group of indicators does not change substantially the quintile classification and individual ranking of districts.

3.3.1 Coherence with individual indicators

Table 3 compares the average value of each education indicator across the lowest, low, middle, high and highest performance districts using aggregate PEPI. We find large differences across groups for almost all education indicators. Net enrolment ratio is 97% for the lowest versus 98.56% for the middle and 99.28% for the highest education performance districts. Also, the lowest education performance districts have high repetition rate (7.22%) and dropout rate (9.24%) whereas the highest education performance districts have a low repetition rate (2.04%) and dropout rate (1.65%). Moreover, the lowest education performance districts have about 28 students per teacher and 28 students per classroom, whereas the highest education performance districts have about 16 students per teacher and 18 students per classroom. Clear distinction across five district groups is also found using female PEPI (see Annex 6, Table A6.1).

Table 3: Means of variables used to compute the first principal component, by quintiles of aggregate PEPI

Variable	Lowest (20%)		Low (20%)		Middle (20%)		High (20%)		Highest (20%)	
	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean
Net enrolment ratio	30	97.00	30	97.46	29	98.56	30	98.95	29	99.28
Dropout rate	30	9.24	30	5.16	29	4.05	30	2.76	29	1.65
Repetition rate	30	7.22	30	4.34	29	2.88	30	3.07	29	2.04
Survival rate	30	63.86	30	78.25	29	83.01	30	88.28	29	92.78
Completion rate	30	60.99	30	76.21	29	80.94	30	86.64	29	91.79
Pupil-teacher ratio	30	28.36	30	23.81	29	21.95	30	20.78	29	16.54
Pupil-class ratio	30	28.09	30	24.57	29	23.54	30	22.36	29	18.03

Source: Author's estimation.

[6] Coherence refers to the consistency of variables used in the analysis.

3.3.2 Coherence with poverty rate

Table 4 compares the average poverty rate across the lowest, low, middle, high and highest education performance districts using aggregate PEPI. We find significant differences across groups. The lowest education performance districts have an average poverty rate of 37% whereas the highest education performance districts have the average poverty rate of 19%. The Spearman correlation coefficient for district rankings based on the PEPI and poverty rate is 0.48 and statistically significant at a 1% level. Significant difference in poverty rate across five district groups is also found using female PEPI (see Annex 6, Table A6.2).

Table 4: Mean of poverty rate, by quintiles of aggregate PEPI

Education performance of districts	Mean of poverty rate (%)
Lowest	37.27
Low	30.16
Middle	25.16
High	22.29
Highest	19.00
Spearman rank correlation coefficient, ranking of districts	0.48

Source: Author's estimation.

3.3.3 Robustness

The PEPI produces very similar classifications when different subsets of variables are used in its construction. Table 5 reports the percentage of districts classified in the lowest and low education performance (40%) when all indicators are used, compared with indices based on (1) all the variables except those related to school resources (i.e., pupil-teacher ratio, pupil-class ratio), (2) only indicators of primary education quality (i.e., repetition rate, survival rate, cohort completion rate), and (3) only indicators of access to primary education (i.e., net enrolment ratio, dropout rate). Almost no districts classified in the lowest and low district group by the index using all variables would be classified as 'high education performance' by any of the more limited measures (see Annex 6 for the robust of female PEPI, Table A6.3).

Table 5: Differences of the lowest and low education performance districts (40%) using aggregate PEPI

Quantiles	Base case: all variables	All variables except school resources	Only indicators of primary education quality	Only indicators of access to primary education
Lowest and low (40%)	100.00	90.00	88.33	78.33
Middle (20%)	0.00	10.00	11.67	18.33
High (20%)	0.00	0.00	0.00	3.33
Highest (20%)	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00
Spearman rank correlation coefficient, ranking of districts	1.00	0.85	0.85	0.40

Source: Author's estimation.

A more general measure of the PEPI robustness can be derived from the rank correlation coefficient which compares the degree to which two methods produce the same ranking of districts. For instance, even when the index is constructed with only indicators of the quality of primary education, the correlation with the base case index that uses all indicators is 0.85 (all correlation coefficients in Table 5 are statistically significant at 1% level). This means the correlation between two ranks is statistically significant. Adding more variables to the index only increases the similarity of the rankings.

4. Assessment of BEQUAL Targeting Approach

In this section, we assess the BEQUAL targeting approach against two criteria: the aggregate PEPI and poverty rate. All 148 districts are ranked against the PEPI and the reciprocal of poverty rate and are divided into quintiles: the first quintile represents the lowest education performance for the PEPI and the poorest for poverty rate, while the fifth quintile represents the highest education performance for the PEPI and the richest for poverty rate.

BEQUAL districts are assessed in three steps. First, all BEQUAL and non-BEQUAL districts are classified according to their PEPI score. Second, both BEQUAL and non-BEQUAL districts are classified according to their poverty rate. Third, we cross both variables (education and poverty) and analyse the ranking of both BEQUAL and non-BEQUAL districts.

BEQUAL districts are classified into two groups: BEQUAL-67 districts and BEQUAL-29 districts. The group of BEQUAL-67 districts consists of all BEQUAL 67 districts. The group of BEQUAL-29 districts is a subset of BEQUAL-67 districts, which includes 29 districts. These districts are listed in Annex 5.

4.1 Assessment of BEQUAL-67 targeting

The assessment of BEQUAL-67 districts reveals three salient features of BEQUAL targeting. First, BEQUAL targeting can be improved based on a criterion of education performance, by replacing 19 BEQUAL districts that have middle, high and highest education performance with 12 non-BEQUAL districts that have low and lowest education performance. Second, BEQUAL targeting can be improved based on a criterion of poverty, by replacing 26 BEQUAL non-poor districts with 19 non-BEQUAL poor districts. Third, BEQUAL targeting can be improved based on criteria of education performance and poverty, by replacing 9 BEQUAL non-poor districts that have middle, high and highest education performance with 6 non-BEQUAL poor districts that have low education performance.

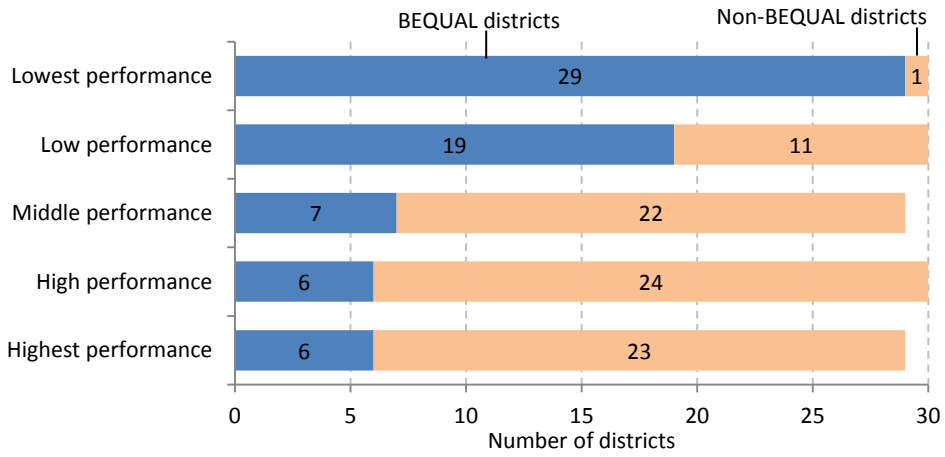
4.1.1 BEQUAL-67 districts and education performance

Fig. 6 shows the classification of all BEQUAL and non-BEQUAL districts by education performance quintiles. It suggests the following findings.

1. BEQUAL is targeting 29 districts with lowest education performance and 19 districts with low education performance. BEQUAL districts with lowest and low education performance account for 72% of total BEQUAL districts or 80% of total lowest and low education performance districts in Lao PDR.
2. BEQUAL is targeting 7 districts with middle education performance, 6 districts with high education performance, and 6 districts with highest education performance. This is at odd with the principle of targeting educationally disadvantaged districts, i.e. districts with low education performance.

3. There are 11 low education performance districts that are not targeted by BEQUAL: 1 lowest education performance district and 11 low education performance districts. Non-BEQUAL districts with the lowest and low education performance account for 20% of the total of the lowest and low education performance districts in Lao PDR.

Fig.6: Classification of districts, by education performance categories



Source: Author's calculation.

These findings suggest that there is a possibility to improve the effectiveness of BEQUAL targeting based on a criterion of education performance. This can be done by replacing BEQUAL districts that have middle, high and highest education performance with non-BEQUAL districts that have the lowest and low education performance.

Table 6 shows the list of 19 BEQUAL districts that could be replaced: 5 districts in Huaphan, 3 districts in Luangnamtha, 3 districts in Oudomxay, 2 districts in Phongsaly, 2 districts in Xiengkhuang, and 1 district in Borikhamxay, Khammuane, Luangprabang, and Vientiane Province.

Table 6: Classification of BEQUAL districts, by middle, high and highest education performance category

No.	Education performance	District	Province	Aggregate PEPI
1	Middle	Meun	Vientiane Province	-0.037
2	Middle	Xaychamphone	Borikhamxay	-0.022
3	Middle	Morkmay	Xiengkhuang	0.097
4	Middle	Ngoi	Luangprabang	0.395
5	Middle	Phongsaly	Phongsaly	0.449
6	Middle	Add	Huaphanh	0.495
7	Middle	Sing	Luangnamtha	0.603
8	High	Khoua	Phongsaly	0.638
9	High	Namor	Oudomxay	0.765
10	High	Khoune	Xiengkhuang	0.882
11	High	Xamneua	Huaphanh	0.897
12	High	Xamtay	Huaphanh	0.938
13	High	Sone	Huaphanh	1.228
14	Highest	Viengphouka	Luangnamtha	1.757
15	Highest	Xebangfay	Khammuane	1.785
16	Highest	La	Oudomxay	2.077
17	Highest	Beng	Oudomxay	2.601
18	Highest	Viengxay	Huaphanh	2.801
19	Highest	Nalae	Luangnamtha	2.819

Source: Author's calculation.

Table 7 shows the list of 12 non-BEQUAL districts with lowest and low education performance that could be used to partially replace BEQUAL districts listed in Table 6. These include 2 districts in Xaysomboun, 2 districts in Champasack, 2 districts in Saravane, and 1 district in Borikhamxay, Huaphanh, Luangprabang, Savannakhet, Xekong and Xiengkhuang.

Table 7: Classification of non-BEQUAL districts, by lowest and low education performance categories

No.	Education performance	District	Province	Aggregate PEPI
1	Lowest	Park Ou	Luangprabang	-1.600
2	Low	Anouvong	Xaysomboune	-1.038
3	Low	Lakhonepheng	Saravane	-0.780
4	Low	Khong	Champasack	-0.673
5	Low	Lamarm	Sekong	-0.639
6	Low	Atsaphangthong	Savanakhet	-0.493
7	Low	Phaxay	Xiengkhuang	-0.421
8	Low	Xiengkhor	Huaphanh	-0.402
9	Low	Longsan	Xaysomboune	-0.400
10	Low	Vapy	Saravane	-0.389
11	Low	Khamkeut	Borikhamxay	-0.166
12	Low	Champasak	Champasack	-0.123

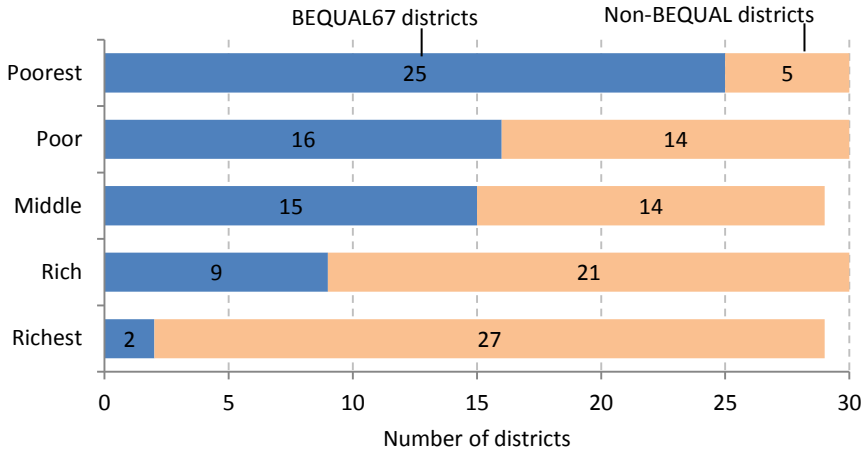
Source: Author's calculation.

4.1.2 BEQUAL-67 districts and poverty

Fig.7 illustrates the classification of BEQUAL and non-BEQUAL districts by poverty quintiles. It shows that:

- Currently, BEQUAL is targeting 25 poorest districts and 16 poor districts, accounting for 61% of total BEQUAL districts or 68% of total poorest and poor districts in Lao PDR.
- BEQUAL is targeting 15 moderately poor districts, 9 rich districts and 2 richest districts. This is at odds with the principle of targeting economically disadvantaged districts, i.e. districts with high poverty rate.
- There are 19 poorest and poor districts that are not targeted by BEQUAL: 5 are poorest districts and 14 are poor districts. Non-BEQUAL poorest and poor districts account for 32% of total poorest and poor districts in Lao PDR.

Fig.7: Classification of districts, by poverty categories



Source: Author's calculation.

These findings suggest that there is a possibility to improve the effectiveness of BEQUAL targeting, based on a criterion of poverty. This can be done by replacing BEQUAL non-poor districts with non-BEQUAL poor districts.

Table 8 shows the list of 26 BEQUAL non-poor districts that could be replaced. About 73% of these districts are from 5 provinces; Champasack, Attapeu, Phongsaly, Luangnamtha, and Oudomxay.

Table 8: BEQUAL districts, by middle, rich and richest categories

No.	Poverty category	District	Province	Poverty rate (%)
1	Middle	Viengxay	Huaphanh	27.7
2	Middle	Nhommalat	Khammuane	27.7
3	Middle	Samphanh	Phongsaly	27.6
4	Middle	Mahaxay	Khammuane	27.0
5	Middle	Ngoi	Luangprabang	27.0
6	Middle	Sanamxay	Attapeu	26.8
7	Middle	Sukuma	Champasack	26.5
8	Middle	Viengphouka	Luangnamtha	26.3
9	Middle	Namor	Oudomxay	26.1
10	Middle	Thateng	Sekong	25.8
11	Middle	Khoua	Phongsaly	24.3
12	Middle	Bachiangchaleunsook	Champasack	24.1
13	Middle	Pathoomphone	Champasack	24.1
14	Middle	Nambak	Luangprabang	24.1
15	Middle	Long	Luangnamtha	23.8
16	Rich	La	Oudomxay	22.8
17	Rich	Sanxay	Attapeu	22.5
18	Rich	Sanasomboun	Champasack	22.5
19	Rich	Phouvong	Attapeu	22.0
20	Rich	Beng	Oudomxay	21.4
21	Rich	Nhot Ou	Phongsaly	21.1
22	Rich	Tonpheung	Bokeo	19.1
23	Rich	Sing	Luangnamtha	18.3
24	Rich	Phongsaly	Phongsaly	17.5
25	Richest	Paksong	Champasack	15.5
26	Richest	Xaysetha	Attapeu	12.9

Source: Author's calculation.

Table 9 shows the list of 19 non-BEQUAL poor districts that could be used to partially replace BEQUAL districts listed in Table 8. About 79% of non-BEQUAL poor districts are from 5 provinces; Luangprabang, Saravane, Savannakhet, Xaysomboune, and Xiengkhuang.

Table 9: Classification of non-BEQUAL districts, by poorest and poor categories

No.	Poverty category	District	Province	Poverty rate (%)
1	Poorest	Vapy	Saravane	42.9
2	Poorest	Khongxedone	Saravane	41.5
3	Poorest	Nonghed	Xiengkhuang	41.5
4	Poorest	Lakhonepheng	Saravane	38.4
5	Poorest	Xiengkhor	Huaphanh	38.0
6	Poor	Phookood	Xiengkhuang	35.3
7	Poor	Hom	Xaysomboune	35.2
8	Poor	Atsaphangthong	Savanakhet	34.6
9	Poor	Viengthong	Borikhamxay	32.7
10	Poor	Kham	Xiengkhuang	31.2
11	Poor	Viengkham	Luangprabang	30.5
12	Poor	Phonxay	Luangprabang	30.5
13	Poor	Pak Xeng	Luangprabang	30.2
14	Poor	Champhone	Savanakhet	30.2
15	Poor	Longsan	Xaysomboune	30.2
16	Poor	Viengthong (Hiem)	Huaphanh	29.3
17	Poor	Xaybuly	Savanakhet	28.0
18	Poor	Lamarm	Sekong	28.0
19	Poor	Longcheng	Xaysomboune	27.8

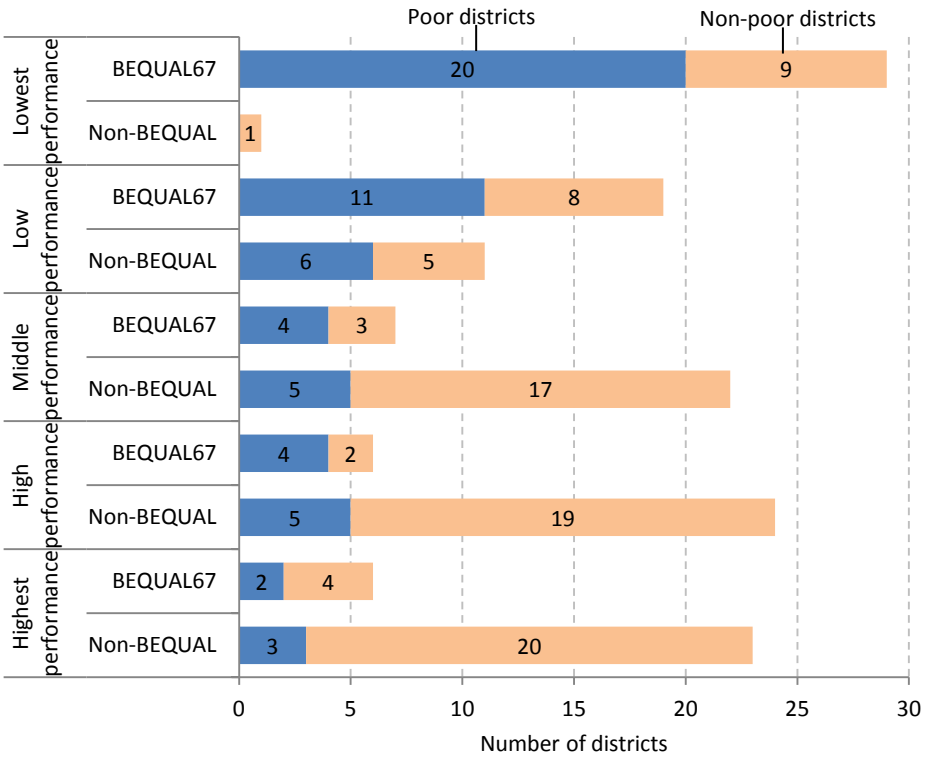
Source: Author's calculation.

4.1.3 BEQUAL-67 districts, education performance, and poverty

Fig.8 illustrates the classification of BEQUAL and non-BEQUAL districts by education performance and poverty categories. It shows that:

- BEQUAL is targeting 20 lowest education performance and poor districts and 11 low education performance and poor districts. The combination of these two groups account for 46% of total BEQUAL districts or 84% of total number of low education performance and poor districts in Lao PDR.
- BEQUAL is targeting 3 districts classified as 'middle education performance' and 'non-poor', 2 districts classified as 'high education performance' and 'non-poor', and 4 district classified as 'highest education performance' and 'non-poor'. This is at odd with the principle of targeting disadvantaged districts, i.e. districts with low education performance and high poverty rate.
- There are 6 'low education performance' and 'poor' districts that are not targeted by BEQUAL. These districts account for 16% of total number of low education performance and poor districts in Lao PDR.

Fig.8: Classification of districts, by education performance and poverty categories



Note: 'Poor' districts are those located in the bottom first and second quintiles of the reciprocal of poverty rate. 'Non-poor' refers to the districts based in the third, fourth and fifth quintiles of the reciprocal of poverty rate.

Source: Author's calculation.

These findings suggest a possibility to improve BEQUAL targeting, based on criteria of education performance and poverty. This can be done by replacing BEQUAL non-poor districts that have middle, high and highest education performance, with non-BEQUAL poor districts that have low education performance.

Table 10 shows the list of 9 BEQUAL non-poor districts with middle, high and highest education performance that could be replaced. These include 3 districts in Oudomxay, 2 districts in Luangnamtha, 2 districts in Phongsaly, and 1 district in Huaphanh and Luangprabang.

Table 10: Classification of BEQUAL non-poor districts, by middle, high and highest education performance categories

No.	Education performance	Poverty status	District	Province	Aggregate PEPI	Poverty rate (%)
1	Middle	Middle	Ngoi	Luangprabang	0.395	27.0
2	Middle	Rich	Phongsaly	Phongsaly	0.449	17.5
3	Middle	Rich	Sing	Luangnamtha	0.603	18.3
4	High	Middle	Khoua	Phongsaly	0.638	24.3
5	High	Middle	Namor	Oudomxay	0.765	26.1
6	Highest	Middle	Viengphouka	Luangnamtha	1.757	26.3
7	Highest	Rich	La	Oudomxay	2.077	22.8
8	Highest	Rich	Beng	Oudomxay	2.601	21.4
9	Highest	Middle	Viengxay	Huaphanh	2.801	27.7

Source: Author's calculation.

Table 11 shows the list of 6 non-BEQUAL poor districts with low education performance that could be used to partially replace BEQUAL districts listed in Table 10. These include 2 districts in Saravane and 1 district in Huaphanh, Savannakhet, Sekong, and Xaysomboune.

Table 11: Classification of non-BEQUAL poor districts, by lowest and low education performance categories

No.	Education performance	Poverty status	District	Province	Aggregate PEPI	Poverty rate (%)
1	Low	Poorest	Lakhonepheng	Saravane	-0.780	38.4
2	Low	Poor	Lamarm	Sekong	-0.639	28.0
3	Low	Poor	Atsaphangthong	Savannakhet	-0.493	34.6
4	Low	Poorest	Xiengkhor	Huaphanh	-0.402	38.0
5	Low	Poor	Longsan	Xaysomboune	-0.400	30.2
6	Low	Poorest	Vapy	Saravane	-0.389	42.9

Source: Author's calculation.

4.2 Assessment of BEQUAL-29 districts

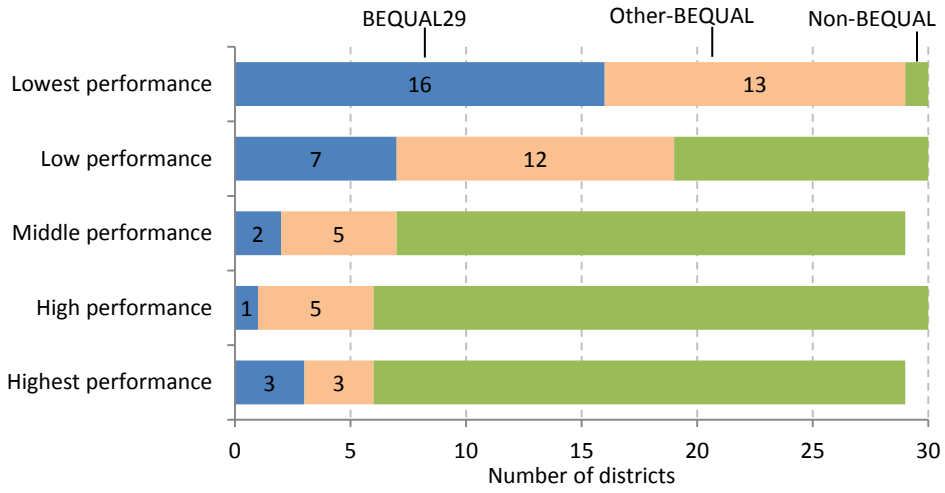
The assessment of BEQUAL-29 districts reveals three salient features of BEQUAL-29 targeting. First, BEQUAL-29 targeting can be improved based on a criterion of education performance, by replacing 6 BEQUAL-29 districts that have middle, high and highest education performance with 13 other-BEQUAL districts that have the lowest education performance. Second, BEQUAL-29 targeting can be improved based on a criterion of poverty, by replacing 9 BEQUAL-29 non-poor districts with 10 other-BEQUAL poorest districts. Third, BEQUAL-29 targeting can be improved based on criteria of education performance and poverty, by replacing 4 BEQUAL-29 non-poor districts that have middle, high and highest education performance with 13 other-BEQUAL poor districts that have low and lowest education performance.

4.2.1 BEQUAL-29 districts and education performance

Fig. 9 shows the classification of BEQUAL-29, other-BEQUAL, and non-BEQUAL districts by education performance quintiles. BEQUAL-29 districts refer to a subset of BEQUAL-67 districts, which include 29 districts. The other-BEQUAL districts refer to BEQUAL districts, which exclude BEQUAL-29 districts (see Annex 5 for a complete list of BEQUAL-67 and BEQUAL-29 districts). The assessment of BEQUAL-29 districts against education performance reveals that:

1. BEQUAL-29 is targeting 16 districts with lowest education performance and 7 districts with low education performance. BEQUAL-29 districts with lowest and low education performance account for 79% of total BEQUAL-29 districts or 48% of the total of the lowest and low education performance BEQUAL districts.
2. BEQUAL-29 is targeting 2 districts with middle education performance, 1 district with high education performance, and 3 districts with highest education performance. This is at odd with the principle of targeting educationally disadvantaged districts, i.e. districts with low education performance.
3. There are 25 low education performance districts that are included in BEQUAL-67 districts but are not targeted by BEQUAL-29: 13 lowest education performance districts and 12 low education performance districts. The other-BEQUAL districts with the lowest and low education performance account for 52% of the total of the lowest and low education performance BEQUAL districts.

Fig.9: Classification of districts, by education performance categories



Source: Author's calculation.

These findings suggest that there is a possibility to improve the effectiveness of BEQUAL-29 targeting based on a criterion of education performance. This can be done by replacing BEQUAL-29 districts that have middle, high and highest education performance with other-BEQUAL districts that have the lowest education performance.

Table 12 shows the list of 6 BEQUAL-29 districts that could be replaced: 3 districts in Luangnamtha, 2 districts in Phongsaly, and 1 district in Khammuane.

Table 12: Classification of BEQUAL-29 districts, by middle, high, and highest education performance

No.	Education performance	District	Province	Aggregate PEPI
1	Middle	Phongsaly	Phongsaly	0.449
2	Middle	Sing	Luangnamtha	0.603
3	High	Khoua	Phongsaly	0.638
4	Highest	Viengphouka	Luangnamtha	1.757
5	Highest	Xebangfay	Khammuane	1.785
6	Highest	Nalae	Luangnamtha	2.819

Source: Author's calculation.

Table 13 shows the list of 13 other-BEQUAL districts with lowest education performance that could be used to replace BEQUAL-29 districts listed in Table 12. These include 3 districts in Attapeu, 3 districts in Champasack, 3 districts in Oudomxay, 3 districts in Sekong, and 1 district in Bokeo.

Table 13: Classification of other-BEQUAL districts, by lowest and low education performance

No.	Education performance	District	Province	Aggregate PEPI
1	Lowest	Dakcheung	Sekong	-5.679
2	Lowest	Kaleum	Sekong	-4.468
3	Lowest	Bachiangchaleunsook	Champasack	-3.080
4	Lowest	Thateng	Sekong	-2.927
5	Lowest	Paksong	Champasack	-2.849
6	Lowest	Sanamxay	Attapeu	-2.820
7	Lowest	Sanxay	Attapeu	-2.543
8	Lowest	Paktha	Bokeo	-2.185
9	Lowest	Pakbeng	Oudomxay	-2.031
10	Lowest	Nga	Oudomxay	-1.903
11	Lowest	Sanasomboun	Champasack	-1.863
12	Lowest	Phouvong	Attapeu	-1.836
13	Lowest	Hoon	Oudomxay	-1.650

Source: Author's calculation.

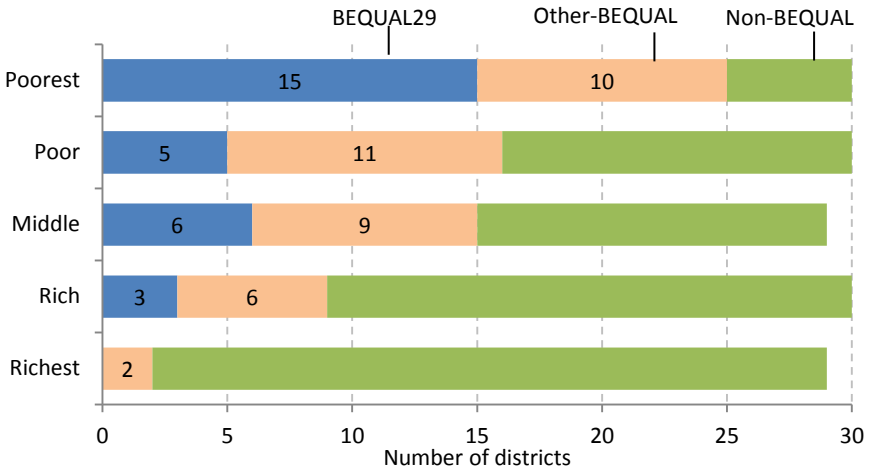
4.2.2 BEQUAL-29 districts and poverty

Fig.10 illustrates the classification of BEQUAL-29, other-BEQUAL, and non-BEQUAL districts by poverty quintiles. It shows that:

- BEQUAL-29 is targeting 15 poorest districts and 5 poor districts, accounting for 69% of total BEQUAL-29 districts or 49% of the total of the poorest and poor BEQUAL districts.
- BEQUAL-29 is targeting 6 moderately poor districts and 3 rich districts. This is at odds with the principle of targeting economically disadvantaged districts, i.e. districts with high poverty rate.

- There are 21 poorest and poor districts that are included in BEQUAL-67 districts but are not targeted by BEQUAL-29: 10 are poorest districts and 11 are poor districts. The other-BEQUAL poorest and poor districts account for 51% of the total of the poorest and poor BEQUAL districts.

Fig.10: Classification of districts, by poverty categories



Source: Author's calculation.

The assessment of BEQUAL-29 districts against poverty suggests that there is a possibility to improve the effectiveness of BEQUAL-29 targeting, based on a criterion of poverty. This can be done by replacing BEQUAL-29 non-poor districts with other BEQUAL-67 poor districts.

Table 14 shows the list of 9 BEQUAL-29 non-poor districts that could be replaced. These include 4 districts in Phongsaly, 3 districts in Luangnamtha, and 2 districts in Khammuane.

Table 14: Classification of BEQUAL-29 districts, by middle and rich categories

No.	Poverty category	District	Province	Poverty rate (%)
1	Middle	Nhommalat	Khammuane	27.7
2	Middle	Samphanh	Phongsaly	27.6
3	Middle	Mahaxay	Khammuane	27.0
4	Middle	Viengphouka	Luangnamtha	26.3
5	Middle	Khoua	Phongsaly	24.3
6	Middle	Long	Luangnamtha	23.8
7	Rich	Nhot Ou	Phongsaly	21.1
8	Rich	Sing	Luangnamtha	18.3
9	Rich	Phongsaly	Phongsaly	17.5

Source: Author's calculation.

Table 15 shows the list of 10 other-BEQUAL poorest districts that could be used to replace BEQUAL-29 districts listed in Table 14. These include 6 districts in Huaphanh and 1 district in Borikhamxay, Oudomxay, Sekong, and Xiengkhuang.

Table 15: Classification of other-BEQUAL districts, by poorest category

No.	Poverty category	District	Province	Poverty rate (%)
1	Poorest	Xaychamphone	Borikhamxay	64.2
2	Poorest	Kaleum	Sekong	46.4
3	Poorest	Huameuang	Huaphanh	45.6
4	Poorest	Quanh	Huaphanh	45.2
5	Poorest	Sone	Huaphanh	42.8
6	Poorest	Morkmay	Xiengkhuang	42.3
7	Poorest	Xamtay	Huaphanh	39.5
8	Poorest	Add	Huaphanh	38.8
9	Poorest	Pakbeng	Oudomxay	38.1
10	Poorest	Sopbao	Huaphanh	36.7

Source: Author's calculation.

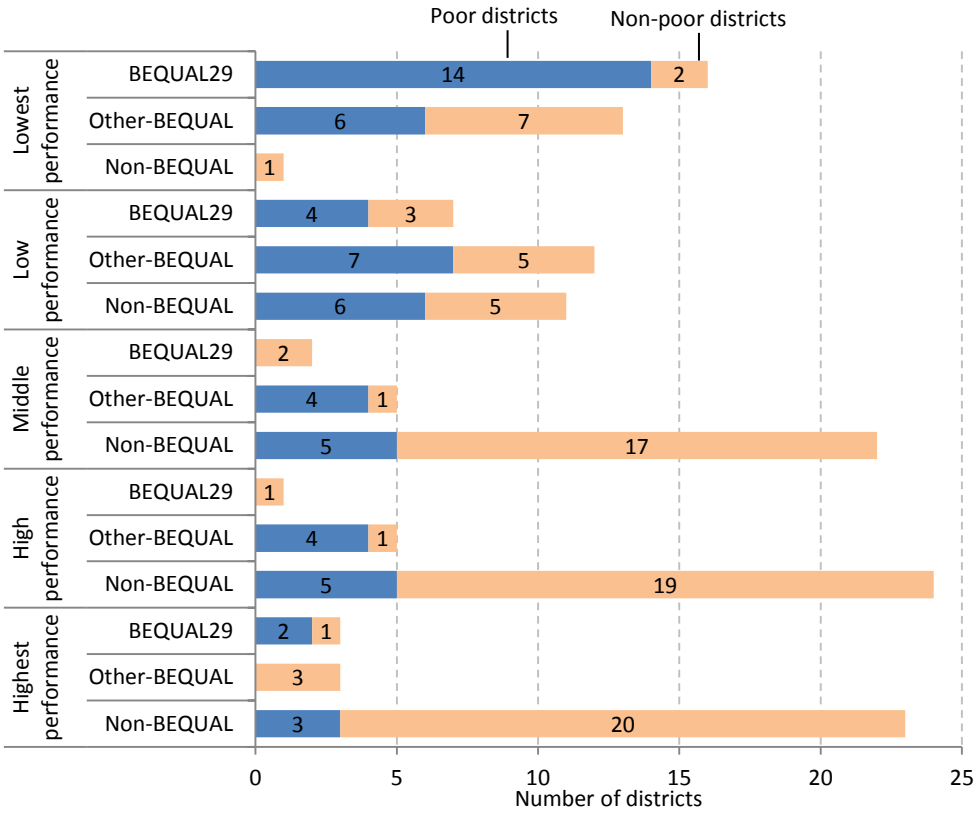
4.2.3 BEQUAL-29 districts, education performance, and poverty

Fig.11 illustrates the classification of BEQUAL-29, other-BEQUAL, and non-BEQUAL districts by education performance and poverty categories. It shows that:

- BEQUAL-29 is targeting 14 lowest education performance and poor districts and 4 low education performance and poor districts. The combination of these two groups account for 62% of total BEQUAL-29 districts or 58% of total number of low education performance and poor districts in BEQUAL-67.
- BEQUAL-29 is targeting 2 districts classified as 'middle education performance' and 'non-poor', 1 district classified as 'high education performance' and 'non-poor', and 1 district classified as 'highest education performance' and 'non-poor'. This is at odd with the principle of targeting disadvantaged districts, i.e. districts with low education performance and high poverty rate.
- There are 13 'low education performance' and 'poor' districts that are included in BEQUAL-67 districts but are not targeted by BEQUAL-29: 6 lowest education performance districts and 7 low performance districts. The combination of these two groups account for 42% of total number of low education performance and poor districts in BEQUAL-67.

The assessment of BEQUAL-29 districts against education performance and poverty suggests a possibility to improve BEQUAL-29 targeting, based on criteria of education performance and poverty. This can be done by replacing BEQUAL-29 non-poor districts that have middle, high and highest education performance, with other-BEQUAL poor districts that have lowest and low education performance.

Fig.11: Classification of districts, by education performance and poverty categories



Source: Author's calculation.

Table 16 shows the list of 4 BEQUAL-29 non-poor districts with middle, high and highest education performance that could be replaced. These include 2 districts in Luangnamtha and 2 districts in Phongsaly.

Table 16: Classification of BEQUAL-29 non-poor districts, by middle, high and highest education performance categories

No.	Education performance	Poverty status	District	Province	Aggregate PEPI	Poverty rate (%)
1	Middle	Rich	Phongsaly	Phongsaly	0.449	17.5
2	Middle	Rich	Sing	Luangnamtha	0.603	18.3
3	High	Middle	Khoua	Phongsaly	0.638	24.3
4	Highest	Middle	Viengphouka	Luangnamtha	1.757	26.3

Source: Author's calculation.

Table 17 shows the list of 13 other-BEQUAL poor districts with low and lowest education performance that could be used to replace BEQUAL-29 districts listed in Table 16. These include 3 districts in Bokeo, 3 districts in Huaphanh, 3 districts in Oudomxay, 2 districts in Sekong, and 1 district in Luangprabang and Xayaboury.

Table 17: Classification of other-BEQUAL poor districts, by lowest and low education performance categories

No.	Education performance	Poverty status	District	Province	Aggregate PEPI	Poverty rate (%)
1	Lowest	Poor	Dakcheung	Sekong	-5.679	35.4
2	Lowest	Poorest	Kaleum	Sekong	-4.468	46.4
3	Lowest	Poor	Paktha	Bokeo	-2.185	29.8
4	Lowest	Poorest	Pakbeng	Oudomxay	-2.031	38.1
5	Lowest	Poor	Nga	Oudomxay	-1.903	30.6
6	Lowest	Poor	Hoon	Oudomxay	-1.650	28.8
7	Low	Poorest	Quanh	Huaphanh	-1.422	45.2
8	Low	Poor	Meung	Bokeo	-1.314	28.1
9	Low	Poor	Phonthong	Luangprabang	-1.282	30.5
10	Low	Poorest	Huameuang	Huaphanh	-1.008	45.6
11	Low	Poor	Xaysathan	Xayaboury	-0.860	35.4
12	Low	Poor	Pha Oudom	Bokeo	-0.523	34.2
13	Low	Poorest	Sopbao	Huaphanh	-0.083	36.7

Source: Author's calculation.

5. Conclusions

The objective of this study is to assess BEQUAL's targeting approach by analysing BEQUAL-67 districts and BEQUAL-29 districts. The analysis uses a primary education performance index that broadens the definition of education performance, utilises a weighting model calibrated on BEQUAL objectives and includes 7 education indicators.

Based on the most updated data from the Lao EDUInfo database, the analysis of BEQUAL-67 districts reveals that:

- BEQUAL-67 targeting can be improved based on a criterion of education performance, by replacing 19 BEQUAL districts that have middle, high and highest education performance with 12 non-BEQUAL districts that have low and lowest education performance.
- BEQUAL-67 targeting can be improved based on a criterion of poverty, by replacing 26 BEQUAL non-poor districts with 19 non-BEQUAL poor districts.
- BEQUAL-67 targeting can be improved based on criteria of education performance and poverty, by replacing 9 BEQUAL non-poor districts that have middle, high and highest education performance with 6 non-BEQUAL poor districts that have low education performance.

Furthermore, the analysis of BEQUAL-29 reveals that:

- BEQUAL-29 targeting can be improved based on a criterion of education performance, by replacing 6 BEQUAL-29 districts that have middle, high and highest education performance with 13 other-BEQUAL districts that have the lowest education performance.
- BEQUAL-29 targeting can be improved based on a criterion of poverty, by replacing 9 BEQUAL-29 non-poor districts with 10 other-BEQUAL poorest districts.
- BEQUAL-29 targeting can be improved based on criteria of education performance and poverty, by replacing 4 BEQUAL-29 non-poor districts that have middle, high and highest education performance with 13 other-BEQUAL poor districts that have low and lowest education performance.

Annexes

Annex 1 - Modelling Strategy

The weight of each indicator within the PEPI is estimated by the method of principal component analysis (PCA), a statistical procedure that finds the underlying structure (called principal components) in a set of observations of possibly correlated variables. The key feature of PCA is that it reduces the number of primary education indicators into a smaller number of dimensions. The empirical model of PCA for primary education performance can be formulated as follows:

$$PCA_1 = \alpha_{11}NER + \alpha_{12}DRR + \alpha_{13}RPR + \alpha_{14}SVR + \alpha_{15}CPR + \alpha_{16}PTR + \alpha_{17}SCR$$

$$\vdots$$

$$PCA_7 = \alpha_{71}NER + \alpha_{72}DRR + \alpha_{73}RPR + \alpha_{74}SVR + \alpha_{75}CPR + \alpha_{76}PTR + \alpha_{77}SCR$$

where;

α	Weight for the principal component	*SVR*	Survival rate
PCA	Principal component	*CPR*	Completion rate
NER	Net enrolment ratio	*PTR*	Pupil-teacher ratio
DRR	Dropout rate	*PCR*	Pupil-class ratio
RPR	Repetition rate		

The weights for each principal component are given by the eigenvectors of the correlation matrix. The variance for each principal component is given by the eigenvalue of the corresponding eigenvector. The components are ordered so that the first component (PCA_1) explains the largest possible amount of variation in the original data, subject to the constraint that the sum of the squared weights is equal to one. The second component (PCA_2) is completely uncorrelated with the first component and explains additional but less variation than the first component, subject to the same constraint. Subsequent components are uncorrelated with previous components. Therefore, each component captures an additional dimension in the data while explaining smaller and smaller proportions of the variation of the original indicators. The higher the degree of correlation among the original indicators in the data, the fewer components required to capture common information.

Annex 2 - Estimated Results

We use the first principal component to construct both aggregate PEPI and female PEPI at the district level. Table A2.1 reports the estimation results from PCA for aggregate PEPI. There are seven principal components with different eigenvalues (variance) that indicates the percentage of variation in the total data explained. Components with associated eigenvalues greater than one are selected for the index. In our analysis, the first and second components have eigenvalues of 4.19 and 1.19, respectively and together explain about 77% of variation in the total data. The first component is selected for the construction of index because it can explain about 60% of variation in the total data while the second component can explain only 17%.

Table A2.1: Estimation results of principal components for aggregate PEPI

Component	Eigenvalue	Difference	Proportion of variation in total (%)	Cumulative variation (%)
PCA_1	4.19	3.00	60%	60%
PCA_2	1.19	0.39	17%	77%
PCA_3	0.81	0.07	12%	88%
PCA_4	0.73	0.68	10%	99%
PCA_5	0.06	0.05	1%	100%
PCA_6	0.01	0.01	0%	100%
PCA_7	0.01	.	0%	100%

Source: Author's estimation.

The estimation results from PCA for female PEPI are similar to those for aggregate PEPI. Table A2.2 shows that the first and second components have eigenvalues of 4.20 and 1.23, respectively, and together explain about 78% of variation in the total data. The first component can explain about 60% of variation in the total data while the second component can explain only 18%.

Table A2.2: Estimation results of principal components for female PEPI

Component	Eigenvalue	Difference	Proportion of variation in total (%)	Cumulative variation (%)
PCA_1	4.20	2.97	60%	60%
PCA_2	1.23	0.40	18%	78%
PCA_3	0.83	0.17	12%	89%
PCA_4	0.66	0.60	9%	99%
PCA_5	0.06	0.05	1%	100%
PCA_6	0.01	0.01	0%	100%
PCA_7	0.01	.	0%	100%

Source: Author's estimation.

Table A2.3 below reports the weights (factor score) of education indicators for both aggregate and female PEPI. For aggregate PEPI, cohort completion rate has the highest weight (0.46), followed by survival rate (0.45) and dropout rate (0.45). In addition:

- The group of indicators for the quality of primary education has the largest weight of 1.19 : 0.46 for cohort completion rate, 0.45 for survival rate and 0.28 for repetition rate.
- The group of indicators for school resources has the second largest weight of 0.71 : 0.37 for pupil-teacher ratio and 0.34 for pupil-class ratio.
- The group of indicators for access to primary education has the lowest weight of 0.69 : 0.45 for dropout rate and 0.24 for net enrolment ratio.

Table A2.3: Estimated weights of education indicators

Indicator	Estimated weights for PEPI	
	Aggregate	Female
Access to primary education	***0.69***	***0.67***
Net enrolment ratio	0.24	0.22
Dropout rate*	0.45	0.45
Quality of primary education	***1.19***	***1.22***
Repetition rate*	0.28	0.31
Survival rate	0.45	0.45
Completion rate	0.46	0.46
School resources	***0.71***	***0.69***
Pupil-teacher ratio*	0.37	0.36
Pupil-class ratio*	0.34	0.34

Note: * To ease the interpretation of PCA results, we transform four indicators (i.e., dropout rate, repetition rate, pupil-teacher ratio, and pupil-class ratio) for the calculation of weights so that they have positive correlation coefficients with education performance. Dropout rate* = 100 - Dropout rate; Repetition rate* = 100 - Repetition rate; Pupil-teacher ratio* = 1/(Pupil-teacher ratio); Pupil-class ratio* = 1/(Pupil-class ratio).
Source: Author's estimation.

Female PEPI has similar weight structure as aggregate PEPI. As to individual indicators, the highest weight for female PEPI is from cohort completion rate (0.46), followed by survival rate (0.45) and dropout rate (0.45). As to groups of indicators, the quality of primary education has the highest weight, followed by school resources and access to primary education.

Annex 3 - Ranking of Districts by Aggregate PEPI

Ranking	District	Province	PEPI	PEPI quintiles	Net enrolment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)	Pupil-teacher ratio	Pupil-class ratio	Poverty rate (%)
1	Botene	Xayaboury	4.243	5	98.7	0.5	0.3	98.0	97.6	12.9	14.3	13.2
2	Keo Oudom	Vientiane Province	3.952	5	99.7	1.9	1.2	90.6	90.6	10.9	14.3	9.5
3	Thongmixay	Xayaboury	3.847	5	99.7	1.1	0.4	95.8	94.3	13.4	14.8	11.3
4	Viengthong	Huaphanh	3.756	5	99.9	0.8	0.2	95.6	95.6	14.9	14.7	29.3
5	Thaphabat	Borikhamxay	3.372	5	100.0	0.0	0.3	99.8	99.8	17.4	18.6	8.6
6	Paklai	Xayaboury	3.323	5	99.8	0.4	0.4	98.6	98.2	16.4	18.3	16.0
7	Kenethao	Xayaboury	3.043	5	100.0	0.6	0.1	97.0	97.0	17.5	18.8	15.4
8	Bounneua	Phongsaly	2.879	5	100.0	1.3	0.7	95.7	93.6	17.3	17.5	17.6
9	Nalae	Luangnamtha	2.819	5	99.0	2.0	3.8	91.2	89.6	14.9	14.6	27.9
10	Phookood	Xienkhuang	2.804	5	99.5	1.3	4.6	93.6	92.9	14.1	17.8	35.3
11	Viengxay	Huaphanh	2.801	5	97.3	1.8	2.1	91.4	91.3	14.8	15.1	27.7
12	Beng	Oudomxay	2.601	5	99.4	2.0	2.9	91.1	89.8	14.7	17.0	21.4
13	Hongsa	Xayaboury	2.480	5	98.4	1.3	3.1	94.1	93.1	16.2	18.2	21.1
14	Pakxanh	Borikhamxay	2.467	5	99.8	1.9	0.6	91.7	90.9	16.8	18.4	8.0
15	Viengkham	Vientiane Pro	2.382	5	99.7	3.2	0.2	86.4	85.1	13.3	18.1	6.7
16	Nan	Luangprabang	2.260	5	98.8	1.6	0.7	92.1	91.7	18.2	18.6	16.3
17	Xayabury	Xayaboury	2.251	5	100.0	1.6	5.6	92.1	91.7	15.9	18.8	21.8
18	Nongbok	Khammuane	2.235	5	99.7	2.0	0.2	91.7	90.0	18.8	18.3	22.4
19	Sangthong	Vientiane Capital	2.201	5	99.6	1.8	5.7	92.6	90.5	16.5	17.7	12.2
20	Pakngeum	Vientiane Capital	2.137	5	100.0	1.0	0.1	95.8	95.1	22.3	22.5	12.9
21	La	Oudomxay	2.077	5	98.4	4.3	3.4	81.2	79.5	13.1	13.8	22.8
22	Vangvieng	Vientiane Province	1.926	5	99.5	1.8	0.1	94.4	91.0	20.8	21.6	16.8
23	Ngeun	Xayaboury	1.889	5	98.3	1.2	4.7	94.5	94.2	18.9	20.7	23.2
24	Xaysettha	Vientiane Capital	1.858	5	99.6	1.5	3.1	96.1	92.6	20.3	22.5	6.5
25	Kham	Xienkhuang	1.842	5	99.4	2.0	3.9	90.6	90.2	16.9	20.7	31.2
26	Xebangfay	Khammuane	1.785	5	98.9	3.0	2.0	87.2	85.7	16.9	17.7	28.9
27	Xayphoothong	Savannakhet	1.778	5	98.4	2.4	0.8	89.1	88.5	18.2	19.3	17.1
28	Viengphouka	Luangnamtha	1.757	5	97.8	1.7	5.7	91.9	91.2	18.3	18.3	26.3
29	Phieng	Xayaboury	1.735	5	99.7	1.9	2.2	90.7	90.7	19.2	21.7	23.5
30	Thoulakhom	Vientiane Province	1.726	4	100.0	2.7	0.1	91.4	87.2	18.4	22.3	9.5
31	Pek	Xienkhuang	1.642	4	100.0	1.8	5.7	91.6	90.8	19.0	20.9	13.6

Ranking	District	Province	PEPI	PEPI quintiles	Net enrolment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)	Pupil-teacher ratio	Pupil-class ratio	Poverty rate (%)
32	Namtha	Luangnamtha	1.625	4	99.6	2.1	6.5	89.8	89.5	18.6	18.6	16.2
33	Xieng Ngeun	Luangprabang	1.511	4	98.9	2.5	4.3	88.5	87.5	18.7	18.6	22.7
34	Xay	Oudomxay	1.462	4	98.8	1.7	5.1	91.2	91.2	19.1	22.1	17.7
35	Phonxay	Luangprabang	1.359	4	99.9	1.5	2.3	93.8	92.6	25.2	25.4	30.5
36	Kasy	Vientiane Province	1.336	4	99.2	2.4	0.5	91.4	88.5	21.2	24.3	24.2
37	Sikhottabong	Vientiane Capital	1.335	4	99.9	1.4	3.5	94.6	93.1	24.1	26.4	7.4
38	Xienghon	Xayaboury	1.330	4	99.8	3.6	2.0	86.5	83.4	18.0	19.8	20.8
39	Sone	Huaphanh	1.228	4	99.8	2.2	0.6	90.3	89.4	24.2	24.2	42.8
40	Hadxaiphong	Vientiane Capital	1.215	4	100.0	2.0	3.2	91.1	90.3	23.7	23.7	9.6
41	Xaybuly	Savannakhet	1.154	4	99.0	3.1	0.6	88.7	85.5	22.0	21.1	28.0
42	Luangprabang	Luangprabang	1.112	4	100.0	2.7	3.1	88.8	87.1	20.9	23.3	11.5
43	Sisattanak	Vientiane Capital	1.075	4	100.0	3.5	1.5	84.7	83.7	17.9	23.3	5.8
44	Naxaithong	Vientiane Capital	1.021	4	99.2	1.5	5.4	93.5	92.3	24.0	26.6	10.5
45	Xaythany	Vientiane Capital	1.012	4	98.9	2.2	2.4	90.5	89.3	23.0	25.2	9.4
46	Phoukhoun	Luangprabang	0.976	4	99.5	3.3	0.3	84.5	84.0	21.4	21.6	26.7
47	Xamtay	Huaphanh	0.938	4	98.2	1.8	0.9	92.7	91.5	27.6	27.1	39.5
48	Xamneua	Huaphanh	0.897	4	98.6	3.0	5.7	86.7	84.8	19.2	20.4	30.8
49	Khoune	Xienkhuang	0.882	4	99.7	3.3	4.7	84.3	83.7	18.7	21.3	31.0
50	Met	Vientiane Province	0.859	4	99.4	5.5	1.7	80.6	74.9	15.7	18.4	21.9
51	Thathom	Xaysomboune	0.808	4	97.3	2.3	6.5	88.5	88.1	18.8	23.4	25.8
52	Phonhong	Vientiane Province	0.779	4	99.2	4.1	0.6	84.1	81.0	19.0	22.7	9.9
53	Viengthong	Borikhamxay	0.770	4	99.1	2.1	2.0	90.5	89.6	27.2	27.1	32.7
54	Namor	Oudomxay	0.765	4	98.4	2.8	8.0	87.5	85.7	19.4	20.6	26.1
55	Nonghed	Xienkhuang	0.756	4	96.5	2.8	8.0	86.7	85.4	18.2	19.1	41.5
56	Pak Xeng	Luangprabang	0.728	4	95.6	2.9	2.8	86.1	84.8	20.5	19.8	30.2
57	Phonthong	Champasack	0.660	4	96.5	2.9	2.5	87.8	85.6	20.4	23.6	23.1
58	Songkhone	Savannakhet	0.658	4	98.9	3.9	0.5	83.7	82.2	22.4	21.3	25.1
59	Khoua	Phongsaly	0.638	4	98.5	5.2	1.0	78.2	76.5	17.1	18.6	24.3
60	Samakkhixay	Attapeu	0.604	3	100.0	2.9	5.9	87.4	85.4	22.4	23.9	13.4
61	Sing	Luangnamtha	0.603	3	97.5	2.9	3.8	86.8	85.9	22.2	22.3	18.3
62	Kaison	Savannakhet	0.579	3	99.9	3.7	0.0	83.3	82.8	22.6	24.8	13.4
63	Bolikhanh	Borikhamxay	0.563	3	99.8	3.0	1.0	87.4	85.2	25.5	27.3	22.6
64	Thakhek	Khammuane	0.560	3	100.0	4.0	2.7	83.1	81.5	21.3	22.1	17.2
65	Viengkham	Luangprabang	0.548	3	99.7	3.2	3.5	84.5	83.7	22.2	23.7	30.5
66	Add	Huaphanh	0.495	3	98.3	4.0	1.6	81.9	80.7	20.9	21.0	38.8
67	Xanakham	Vientiane Province	0.475	3	99.4	3.7	1.4	87.6	82.7	22.9	26.5	11.3
68	Phongsaly	Phongsaly	0.449	3	98.0	6.2	3.8	73.9	72.8	15.1	16.2	17.5

Ranking	District	Province	PEPI	PEPI quintiles	Net enrolment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)	Pupil-teacher ratio	Pupil-class ratio	Poverty rate (%)
69	Ngoi	Luangprabang	0.395	3	98.2	4.2	1.4	80.4	79.5	20.1	21.3	27.0
70	Huoixai	Bokeo	0.346	3	99.6	2.5	4.0	89.6	87.4	27.9	29.6	21.7
71	Chomphet	Luangprabang	0.343	3	97.6	5.5	2.5	75.6	74.8	16.8	17.7	26.5
72	Moonlapamok	Champasack	0.339	3	99.2	4.1	2.0	82.2	81.1	21.8	23.2	27.1
73	Khounkham	Khammuane	0.294	3	100.0	4.2	0.5	80.7	80.4	23.4	23.8	27.0
74	Hom	Xaysomboune	0.275	3	99.6	5.0	1.9	79.7	77.9	18.5	23.5	35.2
75	Pakkading	Borikhamxay	0.197	3	96.3	2.5	1.3	88.8	88.0	27.8	29.2	18.9
76	Hinboon	Khammuane	0.162	3	99.6	4.9	1.3	79.3	78.4	22.1	22.1	23.3
77	Khop	Xayaboury	0.154	3	99.8	4.5	6.3	79.4	78.1	20.1	20.2	22.1
78	Champhone	Savannakhet	0.144	3	96.1	4.2	1.2	84.0	80.6	22.2	22.1	30.2
79	Chanthabuly	Vientiane Capital	0.103	3	100.0	3.7	2.1	85.0	82.6	26.4	28.4	5.0
80	Morkmay	Xienkhuang	0.097	3	96.2	3.4	6.7	85.9	82.5	19.9	23.2	42.3
81	Hinheup	Vientiane Province	0.080	3	99.5	6.1	0.1	77.7	73.2	18.6	21.9	17.1
82	Pakse	Champasack	0.074	3	100.0	4.4	1.3	80.7	79.8	22.3	26.9	14.9
83	Bountay	Phongsaly	0.018	3	94.9	3.5	9.0	87.2	82.2	20.4	20.1	20.7
84	Khongxedone	Saravane	-0.014	3	99.5	4.9	3.7	79.8	77.3	21.3	22.2	41.5
85	Xaychamphone	Borikhamxay	-0.022	3	95.3	3.3	2.7	86.5	84.0	23.8	25.7	64.2
86	Feuang	Vientiane Province	-0.035	3	98.6	5.2	0.1	81.8	76.5	21.2	25.3	21.1
87	Meun	Vientiane Province	-0.037	3	99.6	3.3	4.5	86.9	84.0	28.4	28.8	33.0
88	Longcheng	Xaysomboune	-0.072	3	96.1	4.5	7.2	80.2	78.2	18.4	19.5	27.8
89	Sopbao	Huaphanh	-0.083	2	99.1	5.6	1.0	74.7	74.3	20.7	20.4	36.7
90	May	Phongsaly	-0.090	2	97.5	5.0	2.6	79.0	77.2	21.8	20.5	28.8
91	Nhot Ou	Phongsaly	-0.114	2	95.3	4.8	1.3	79.8	78.7	20.8	21.2	21.1
92	Champasak	Champasack	-0.123	2	99.1	4.7	2.1	79.8	78.5	22.6	24.8	26.6
93	Khamkeut	Borikhamxay	-0.166	2	99.1	3.4	8.5	87.4	82.4	25.4	25.8	21.5
94	Xaybouathong	Khammuane	-0.280	2	99.0	5.4	0.6	77.1	76.5	23.6	23.4	39.2
95	Pathoomphone	Champasack	-0.381	2	95.9	4.3	4.0	80.7	79.9	23.2	22.9	24.1
96	Vapy	Saravane	-0.389	2	100.0	5.8	5.6	74.0	73.4	19.8	20.7	42.9
97	Longsan	Xaysomboune	-0.400	2	95.0	5.4	3.1	76.7	75.2	17.8	21.6	30.2
98	Xiengkhor	Huaphanh	-0.402	2	95.8	5.2	4.4	77.0	75.6	20.2	19.7	38.0
99	Phaxay	Xienkhuang	-0.421	2	100.0	8.6	6.2	66.7	62.2	14.0	16.4	22.5
100	Atsaphone	Savannakhet	-0.422	2	99.1	5.7	4.8	76.0	73.8	20.9	20.9	42.0
101	Atsaphangthong	Savannakhet	-0.493	2	98.0	5.4	3.9	78.8	75.0	22.4	22.5	34.6
102	Pha Oudom	Bokeo	-0.523	2	99.0	3.8	6.4	82.9	81.6	26.9	28.9	34.2
103	Lamarm	Sekong	-0.639	2	100.0	4.7	8.5	80.1	78.1	24.1	25.5	28.0
104	Khong	Champasack	-0.673	2	98.7	5.0	2.3	78.4	77.1	25.9	27.6	26.5
105	Long	Luangnamtha	-0.702	2	94.7	4.6	5.6	79.1	78.1	22.2	22.3	23.8

Ranking	District	Province	PEPI	PEPI quintiles	Net enrolment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)	Pupil-teacher ratio	Pupil-class ratio	Poverty rate (%)
106	Xaysetha	Attapeu	-0.731	2	95.8	3.5	4.2	84.5	83.5	30.6	30.4	12.9
107	Lakhonepheng	Saravane	-0.780	2	99.6	4.7	5.0	80.2	77.7	27.7	29.1	38.4
108	Tonpheung	Bokeo	-0.815	2	93.2	4.5	2.5	80.6	79.5	24.5	24.9	19.1
109	Xaysathan	Xayaboury	-0.860	2	98.0	3.5	15.2	85.5	80.7	23.4	26.0	35.4
110	Huameuang	Huaphanh	-1.008	2	97.3	4.6	5.2	79.6	78.1	27.8	28.2	45.6
111	Anouvong	Xaysomboune	-1.038	2	100.0	6.9	3.6	70.7	69.3	22.0	23.2	23.2
112	Outhoomphone	Savannakhet	-1.049	2	99.0	4.4	7.5	83.2	78.3	31.0	31.0	28.0
113	Sukuma	Champasack	-1.166	2	96.6	5.4	2.6	77.2	74.7	26.6	27.7	26.5
114	Mahaxay	Khammuane	-1.214	2	97.6	7.5	5.7	68.4	67.0	19.0	19.6	27.0
115	Nambak	Luangprabang	-1.246	2	94.2	5.2	1.1	78.9	76.2	27.5	28.7	24.1
116	Phonthong	Luangprabang	-1.282	2	94.9	5.0	3.1	78.8	77.2	28.6	28.3	30.5
117	Meung	Bokeo	-1.314	2	98.7	6.8	1.3	74.3	70.9	26.3	28.2	28.1
118	Quanh	Huaphanh	-1.422	2	93.5	5.4	2.3	77.4	75.7	27.1	27.0	45.2
119	Park Ou	Luangprabang	-1.600	1	98.9	9.4	2.2	62.4	61.6	19.5	19.8	21.2
120	Samuoi	Saravane	-1.634	1	99.1	8.5	2.2	70.2	64.2	23.9	23.6	52.8
121	Hoon	Oudomxay	-1.650	1	98.8	5.4	8.4	76.0	74.0	28.6	30.7	28.8
122	Phouvong	Attapeu	-1.836	1	98.8	6.2	8.0	73.0	71.6	28.3	28.3	22.0
123	Sanasomboun	Champasack	-1.863	1	99.0	9.7	0.1	62.2	61.2	21.2	22.5	22.5
124	Toomlarn	Saravane	-1.878	1	99.0	5.1	10.0	78.4	75.5	34.8	34.3	73.1
125	Nga	Oudomxay	-1.903	1	98.7	8.6	3.9	64.7	62.8	22.0	22.4	30.6
126	Pakbeng	Oudomxay	-2.031	1	98.2	7.0	11.1	70.5	67.8	22.9	24.5	38.1
127	Paktha	Bokeo	-2.185	1	91.2	7.4	3.0	69.5	66.6	22.0	23.0	29.8
128	Saravane	Saravane	-2.321	1	99.5	8.0	6.0	66.7	64.8	27.1	27.8	50.3
129	Vilabuly	Savannakhet	-2.395	1	99.4	7.5	7.4	67.1	66.8	30.1	28.0	32.1
130	Thapangthong	Savannakhet	-2.433	1	99.4	8.6	5.0	67.7	61.3	27.3	27.4	40.6
131	Sanxay	Attapeu	-2.543	1	97.0	6.6	10.4	71.6	69.4	29.8	29.8	22.5
132	Nhommalat	Khammuane	-2.591	1	94.9	8.6	2.6	64.8	64.0	25.6	25.7	27.7
133	Samphanh	Phongsaly	-2.792	1	96.6	10.4	1.4	60.1	58.5	23.5	24.4	27.6
134	Sanamxay	Attapeu	-2.820	1	97.2	5.4	14.3	75.3	72.4	36.6	37.1	26.8
135	Paksong	Champasack	-2.849	1	98.6	8.5	7.2	65.4	64.2	28.3	30.9	15.5
136	Thateng	Sekong	-2.927	1	100.0	8.9	5.4	65.9	62.1	32.2	34.1	25.8
137	Bachiang	Champasack	-3.080	1	98.7	9.0	1.0	61.0	58.7	33.0	33.4	24.1
138	Xonbuly	Savannakhet	-3.110	1	98.2	10.0	9.4	64.4	55.0	26.1	22.2	49.5
139	Lao ngarm	Saravane	-3.114	1	99.7	9.0	6.9	63.8	60.8	33.4	30.1	42.6
140	Bualapha	Khammuane	-3.758	1	86.7	9.1	1.8	65.6	64.9	31.5	27.1	43.7
141	Phine	Savannakhet	-4.014	1	98.7	11.6	6.5	57.9	55.2	31.0	31.4	42.4
142	Nakai	Khammuane	-4.158	1	94.3	13.5	2.3	54.8	52.5	25.6	24.7	42.6

Ranking	District	Province	PEPI	PEPI quintiles	Net enrolment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)	Pupil-teacher ratio	Pupil-class ratio	Poverty rate (%)
143	Kaleum	Sekong	-4.468	1	94.2	9.8	17.3	61.9	55.2	27.5	25.1	46.4
144	Sepone	Savannakhet	-5.428	1	96.8	14.4	10.6	51.3	48.4	31.2	29.9	42.2
145	Phalanxay	Savannakhet	-5.430	1	98.7	15.3	6.6	47.1	43.4	33.3	28.8	43.2
146	Ta Oi	Saravane	-5.676	1	93.3	13.1	7.9	52.0	49.5	35.0	36.2	64.3
147	Dakcheung	Sekong	-5.679	1	89.4	11.0	15.7	54.0	52.6	28.2	28.3	35.4
148	Nong	Savannakhet	-6.083	1	97.0	11.7	21.9	50.5	44.8	31.3	31.1	54.0

Source: Author's estimation.

Annex 4 - Ranking of Districts by Female PEPI

Ranking by Female PEPI	Ranking by Agg. PEPI	Area	Province	PEPI	PEPI Quintiles	Net enrollment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)
1	1	Botene	Xayaboury	4.12	5	99.4	0.3	0.1	98.5	98.5
2	2	Keo Oudom	Vientiane Province	4.02	5	99.7	1.3	0.9	93.9	93.9
3	4	Viengthong	Huaphanh	3.55	5	99.4	0.6	0.1	96.8	96.8
4	3	Thongmixay	Xayaboury	3.39	5	99.7	1.4	0.3	94.1	92.5
5	6	Paklai	Xayaboury	3.22	5	99.9	0.1	0.2	99.9	99.7
6	5	Thaphabat	Borikhamxay	3.13	5	100.0	0.0	0.0	100.0	100.0
7	15	Viengkham	Vientiane Province	2.94	5	99.8	1.7	0.1	94.2	91.9
8	7	Kenethao	Xayaboury	2.90	5	100.0	0.4	0.1	98.3	98.3
9	14	Pakxanh	Borikhamxay	2.58	5	99.8	1.2	0.4	94.8	94.3
10	8	Bounneua	Phongsaly	2.55	5	99.5	1.4	0.2	95.2	93.1
11	18	Nongbok	Khammuane	2.54	5	98.8	0.7	0.2	96.8	96.5
12	13	Hongsa	Xayaboury	2.53	5	98.0	0.7	2.1	96.1	96.1
13	12	Beng	Oudomxay	2.52	5	99.2	1.6	2.5	92.4	92.0
14	11	Viengxay	Huaphanh	2.47	5	96.5	1.9	1.6	91.0	91.0
15	10	Phookood	Xienkhuang	2.39	5	99.2	1.6	4.1	93.1	91.7
16	9	Nalae	Luangnamtha	2.34	5	99.3	2.5	3.6	89.1	87.6
17	59	Khoua	Phongsaly	2.23	5	98.8	1.6	0.9	94.5	92.2
18	24	Xaysettha	Vientiane Capital	2.17	5	99.6	0.4	2.0	99.6	98.0
19	19	Sangthong	Vientiane Capital	2.07	5	97.9	1.3	5.2	96.1	93.4
20	16	Nan	Luangprabang	1.98	5	99.3	1.7	0.6	90.8	90.8
21	27	Xayphoothong	Savannakhet	1.97	5	99.4	1.9	0.5	92.3	91.0
22	22	Vangvieng	Vientiane Province	1.93	5	99.5	1.5	0.2	97.9	92.7
23	20	Pakngeum	Vientiane Capital	1.88	5	100.0	1.0	0.1	95.2	95.2
24	17	Xayabury	Xayaboury	1.85	5	100.0	2.2	3.3	89.7	89.0
25	23	Ngeun	Xayaboury	1.73	5	98.9	1.1	4.7	95.4	94.9
26	25	Kham	Xienkhuang	1.72	5	99.4	1.8	3.0	91.6	90.7
27	28	Viengphouka	Luangnamtha	1.65	5	97.6	1.6	4.2	92.6	92.0
28	29	Phieng	Xayaboury	1.58	5	99.6	1.8	1.2	90.8	90.8
29	37	Sikhottabong	Vientiane Capital	1.58	5	100.0	0.6	2.1	98.1	96.7
30	30	Thoulakhom	Vientiane Province	1.53	4	100.0	2.7	0.1	92.0	87.2
31	31	Pek	Xienkhuang	1.51	4	100.0	1.6	4.8	92.5	92.0
32	41	Xaybuly	Savannakhet	1.50	4	100.0	2.2	0.4	92.4	89.9
33	21	La	Oudomxay	1.27	4	97.8	5.2	3.5	76.2	75.1

Ranking by Female PEPI	Ranking by Agg. PEPI	Area	Province	PEPI	PEPI Quintiles	Net enrollment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)
34	32	Namtha	Luangnamtha	1.20	4	99.6	2.7	4.5	87.4	86.7
35	33	Xieng Ngeun	Luangprabang	1.20	4	98.8	2.7	3.5	87.4	86.6
36	43	Sisattanak	Vientiane Capital	1.18	4	99.2	2.8	0.8	88.2	86.5
37	35	Phonxay	Luangprabang	1.16	4	100.0	1.5	1.8	94.1	92.4
38	34	Xay	Oudomxay	1.16	4	98.7	1.9	4.4	90.7	90.7
39	40	Hadxaiphong	Vientiane Capital	1.15	4	100.0	1.8	2.2	91.8	91.6
40	36	Kasy	Vientiane Province	1.15	4	98.9	2.5	0.2	92.4	88.4
41	39	Sone	Huaphanh	1.13	4	99.2	1.8	0.5	91.6	90.9
42	72	Moonlapamok	Champasack	1.11	4	99.1	2.1	1.3	90.4	89.4
43	52	Phonhong	Vientiane Province	1.07	4	99.5	3.3	0.3	88.5	84.5
44	62	Kaison	Savannakhet	1.03	4	100.0	2.4	0.0	89.1	88.4
45	26	Xebangfay	Khammuane	0.98	4	97.9	4.1	1.5	82.7	80.8
46	56	Pak Xeng	Luangprabang	0.96	4	95.2	2.1	1.7	88.8	88.6
47	54	Namor	Oudomxay	0.95	4	97.9	2.0	6.5	91.4	89.5
48	42	Luangprabang	Luangprabang	0.93	4	100.0	2.5	2.8	88.3	88.0
49	38	Xienghon	Xayaboury	0.92	4	99.8	3.9	1.7	83.8	82.0
50	46	Phoukhoun	Luangprabang	0.91	4	99.5	3.0	0.2	85.4	85.0
51	60	Samakkhixay	Attapeu	0.90	4	100.0	1.9	5.2	92.7	90.0
52	76	Hinboon	Khammuane	0.86	4	99.9	3.0	1.0	86.1	86.1
53	57	Phonthong	Champasack	0.86	4	97.2	2.4	2.1	90.9	88.1
54	45	Xaythany	Vientiane Capital	0.83	4	99.6	2.3	1.9	89.2	89.2
55	82	Pakse	Champasack	0.77	4	100.0	2.7	0.8	88.6	87.5
56	84	Khongxedone	Saravane	0.77	4	99.4	2.9	2.5	87.3	85.9
57	119	Park Ou	Luangprabang	0.77	4	97.5	3.3	1.8	85.0	83.9
58	68	Phongsaly	Phongsaly	0.76	4	97.8	5.2	3.4	78.3	77.7
59	47	Xamtay	Huaphanh	0.76	4	98.1	1.8	0.6	92.8	91.4
60	75	Pakkading	Borikhamxay	0.76	3	96.9	1.3	0.8	94.5	94.0
61	53	Viengthong	Borikhamxay	0.74	3	98.6	1.8	1.3	92.1	91.5
62	49	Khoune	Xienkhuang	0.69	3	99.1	3.4	3.3	84.6	83.8
63	63	Bolikhanh	Borikhamxay	0.65	3	99.8	2.6	0.8	90.8	87.4
64	44	Naxaithong	Vientiane Capital	0.65	3	99.3	2.2	3.3	91.8	89.2
65	64	Thakhek	Khammuane	0.63	3	100.0	3.4	2.2	84.9	84.0
66	78	Champhone	Savannakhet	0.58	3	96.7	3.0	1.1	87.9	85.8
67	92	Champasak	Champasack	0.57	3	99.3	3.0	1.2	86.6	85.8
68	77	Khop	Xayaboury	0.57	3	100.0	3.4	4.8	83.6	83.6
69	58	Songkhone	Savannakhet	0.56	3	98.5	3.6	0.4	83.9	83.6
70	61	Sing	Luangnamtha	0.50	3	97.3	2.9	2.6	87.4	86.2
71	50	Met	Vientiane Province	0.47	3	99.6	6.3	1.5	80.9	71.6

Ranking by Female PEPI	Ranking by Agg. PEPI	Area	Province	PEPI	PEPI Quintiles	Net enrollment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)
72	69	Ngoi	Luangprabang	0.43	3	97.8	3.9	1.0	83.1	81.3
73	55	Nonghed	Xienkhuang	0.42	3	97.0	3.2	7.0	84.6	84.1
74	67	Xanakham	Vientiane Province	0.41	3	99.0	3.4	1.2	89.3	83.8
75	51	Thathom	Xaysomboune	0.31	3	96.1	3.0	4.8	86.6	85.7
76	65	Viengkham	Luangprabang	0.21	3	99.1	3.3	2.8	83.4	82.4
77	86	Feuang	Vientiane Province	0.19	3	98.4	4.5	0.1	86.7	79.1
78	48	Xamneua	Huaphanh	0.19	3	97.6	4.1	4.1	82.4	80.5
79	98	Xiengkhor	Huaphanh	0.18	3	96.1	3.8	3.6	82.2	82.2
80	99	Phaxay	Xienkhuang	0.16	3	100.0	7.3	4.3	73.6	67.1
81	79	Chanthabuly	Vientiane Capital	0.10	3	100.0	3.5	1.2	86.2	83.9
82	71	Chomphet	Luangprabang	0.08	3	98.2	5.9	2.2	73.9	73.5
83	95	Pathoomphone	Champasack	-0.03	3	95.6	3.3	2.9	84.4	84.4
84	70	Huoixai	Bokeo	-0.03	3	99.5	3.0	3.5	89.3	85.1
85	88	Longcheng	Xaysomboune	-0.06	3	96.2	4.3	6.4	81.1	81.1
86	97	Longsan	Xaysomboune	-0.06	3	92.5	4.2	2.2	83.8	80.4
87	94	Xaybouathong	Khammuane	-0.09	3	100.0	4.8	0.5	79.0	78.4
88	101	Atsaphangthong	Savannakhet	-0.12	3	97.6	4.2	3.2	83.3	80.1
89	93	Khamkeut	Borikhamxay	-0.12	2	98.4	2.9	6.8	89.6	85.2
90	73	Khounkham	Khammuane	-0.12	2	100.0	4.7	0.5	78.3	78.3
91	89	Sopbao	Huaphanh	-0.15	2	99.3	5.5	0.6	74.9	74.5
92	91	Nhot Ou	Phongsaly	-0.27	2	95.0	4.8	1.2	79.3	78.8
93	106	Xaysetha	Attapeu	-0.31	2	96.4	2.4	4.1	89.9	87.8
94	66	Add	Huaphanh	-0.32	2	97.7	5.2	1.6	76.4	75.6
95	96	Vapy	Saravane	-0.33	2	100.0	5.4	4.6	76.3	74.9
96	87	Meun	Vientiane Province	-0.40	2	99.6	4.0	3.5	86.4	81.4
97	80	Morkmay	Xienkhuang	-0.43	2	96.5	4.4	5.4	82.7	78.0
98	103	Lamarm	Sekong	-0.44	2	100.0	3.6	8.4	84.0	82.7
99	100	Atsaphone	Savannakhet	-0.44	2	99.1	5.4	4.3	77.5	75.0
100	111	Anouvong	Xaysomboune	-0.47	2	100.0	5.4	2.9	77.3	75.1
101	81	Hinheup	Vientiane Province	-0.48	2	99.1	7.0	0.0	74.6	69.7
102	105	Long	Luangnamtha	-0.54	2	94.0	4.0	5.0	83.2	81.1
103	114	Mahaxay	Khammuane	-0.55	2	97.8	5.9	4.3	74.1	73.6
104	83	Bountay	Phongsaly	-0.57	2	93.6	3.8	8.6	83.6	80.8
105	112	Outhoomphone	Savannakhet	-0.58	2	98.8	3.2	5.9	88.8	83.8
106	104	Khong	Champasack	-0.60	2	99.2	4.7	1.8	79.5	78.5
107	90	May	Phongsaly	-0.71	2	97.3	6.1	2.4	75.7	72.9
108	109	Xaysathan	Xayaboury	-0.80	2	97.9	2.7	14.2	89.2	83.7
109	102	Pha Oudom	Bokeo	-0.88	2	98.5	3.8	6.2	81.3	81.3

Ranking by Female PEPI	Ranking by Agg. PEPI	Area	Province	PEPI	PEPI Quintiles	Net enrollment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)
110	108	Tonpheung	Bokeo	-0.88	2	92.3	4.4	1.7	81.4	79.8
111	123	Sanasomboun	Champasack	-0.91	2	98.5	7.0	0.1	71.6	69.9
112	107	Lakhonepheng	Saravane	-0.96	2	99.9	5.0	4.4	81.3	76.6
113	74	Hom	Xaysomboune	-1.08	2	95.3	7.0	1.4	73.2	70.9
114	85	Xaychamphone	Borikhamxay	-1.10	2	93.9	5.2	2.6	80.8	76.1
115	115	Nambak	Luangprabang	-1.18	2	93.1	4.6	0.9	80.1	78.8
116	127	Paktha	Bokeo	-1.19	2	92.1	5.2	2.5	75.7	75.7
117	116	Phonthong	Luangprabang	-1.21	2	93.8	4.6	2.8	82.1	79.4
118	110	Huameuang	Huaphanh	-1.29	2	98.0	5.1	4.7	78.3	75.8
119	118	Quanh	Huaphanh	-1.32	1	92.5	5.0	1.7	80.1	77.4
120	122	Phouvong	Attapeu	-1.41	1	98.5	4.9	7.4	79.6	76.5
121	125	Nga	Oudomxay	-1.47	1	98.4	7.1	3.7	69.1	67.9
122	113	Sukuma	Champasack	-1.52	1	96.8	6.0	2.3	74.0	73.1
123	120	Samuoi	Saravane	-1.59	1	99.3	8.1	1.9	70.5	65.6
124	126	Pakbeng	Oudomxay	-1.89	1	98.0	6.3	10.2	74.0	70.7
125	128	Saravane	Saravane	-1.91	1	99.4	6.8	4.9	70.7	69.3
126	121	Hoon	Oudomxay	-1.97	1	97.7	5.5	7.6	75.4	73.8
127	134	Sanamxay	Attapeu	-1.98	1	98.1	3.8	11.8	83.3	80.1
128	136	Thateng	Sekong	-2.04	1	100.0	6.7	4.1	73.2	70.6
129	132	Nhommalat	Khammuane	-2.05	1	94.5	7.2	2.1	69.6	69.3
130	135	Paksong	Champasack	-2.37	1	97.8	7.0	6.2	70.8	69.8
131	117	Meung	Bokeo	-2.40	1	98.8	9.7	0.6	65.8	63.0
132	131	Sanxay	Attapeu	-2.41	1	96.5	5.9	9.1	74.3	71.7
133	129	Vilabuly	Savannakhet	-2.59	1	99.0	7.8	6.5	67.2	66.7
134	137	Bachiang	Champasack	-2.62	1	98.6	7.7	0.7	64.5	63.2
135	130	Thapangthong	Savannakhet	-2.65	1	99.2	8.9	4.2	66.6	60.2
136	139	Lao ngarm	Saravane	-2.68	1	99.8	8.0	5.4	67.7	65.0
137	140	Bualapha	Khammuane	-2.79	1	87.2	6.9	1.9	72.6	71.9
138	133	Samphanh	Phongsaly	-3.01	1	94.7	10.7	0.7	60.0	58.1
139	124	Toomlarn	Saravane	-3.03	1	98.2	6.7	11.0	72.7	68.4
140	138	Xonbuly	Savannakhet	-3.18	1	96.9	9.5	8.8	65.2	57.2
141	142	Nakai	Khammuane	-3.80	1	92.3	12.0	1.2	57.1	55.8
142	141	Phine	Savannakhet	-4.09	1	98.9	12.0	5.2	56.9	55.0
143	145	Phalanxay	Savannakhet	-5.21	1	99.4	14.7	6.2	47.4	45.4
144	147	Dakcheung	Sekong	-5.38	1	90.2	10.4	14.0	54.7	54.6
145	143	Kaleum	Sekong	-5.56	1	95.2	12.8	15.6	53.0	46.3
146	144	Sepone	Savannakhet	-6.09	1	96.0	16.3	9.2	46.7	44.1
147	146	Ta Oi	Saravane	-6.19	1	98.4	15.8	7.8	43.0	42.5

Ranking by Female PEPI	Ranking by Agg. PEPI	Area	Province	PEPI	PEPI Quintiles	Net enrollment ratio (%)	Dropout rate (%)	Repetition rate (%)	Survival rate (%)	Completion rate (%)
148	148	Nong	Savannakhet	-7.92	1	95.5	16.0	21.0	38.6	33.9

Source: Author's estimation.

Annex 5 - Classification of BEQUAL Districts

No.	District	Province	BEQUAL	
			Broad (67)	Narrow (29)
1	Phouvong	Attapeu	Yes	No
2	Sanamxay	Attapeu	Yes	No
3	Sanxay	Attapeu	Yes	No
4	Xaysetha	Attapeu	Yes	No
5	Meung	Bokeo	Yes	No
6	Paktha	Bokeo	Yes	No
7	Pha Oudom	Bokeo	Yes	No
8	Tonpheung	Bokeo	Yes	No
9	Xaychamphone	Borikhamxay	Yes	No
10	Bachiangchaleunsook	Champasack	Yes	No
11	Paksong	Champasack	Yes	No
12	Pathoomphone	Champasack	Yes	No
13	Sanasomboun	Champasack	Yes	No
14	Sukuma	Champasack	Yes	No
15	Add	Huaphanh	Yes	No
16	Huameuang	Huaphanh	Yes	No
17	Quanh	Huaphanh	Yes	No
18	Sone	Huaphanh	Yes	No
19	Sopbao	Huaphanh	Yes	No
20	Viengxay	Huaphanh	Yes	No
21	Xamneua	Huaphanh	Yes	No
22	Xamtay	Huaphanh	Yes	No
23	Bualapha	Khammuane	Yes	Yes
24	Mahaxay	Khammuane	Yes	Yes
25	Nakai	Khammuane	Yes	Yes
26	Nhommalat	Khammuane	Yes	Yes
27	Xaybouathong	Khammuane	Yes	Yes
28	Xebangfay	Khammuane	Yes	Yes
29	Long	Luangnamtha	Yes	Yes
30	Nalae	Luangnamtha	Yes	Yes
31	Sing	Luangnamtha	Yes	Yes
32	Viengphouka	Luangnamtha	Yes	Yes
33	Nambak	Luangprabang	Yes	No
34	Ngoi	Luangprabang	Yes	No
35	Phonthong	Luangprabang	Yes	No
36	Beng	Oudomxay	Yes	No
37	Hoon	Oudomxay	Yes	No
38	La	Oudomxay	Yes	No
39	Namor	Oudomxay	Yes	No
40	Nga	Oudomxay	Yes	No
41	Pakbeng	Oudomxay	Yes	No
42	Khoua	Phongsaly	Yes	Yes
43	May	Phongsaly	Yes	Yes
44	Nhot Ou	Phongsaly	Yes	Yes
45	Phongsaly	Phongsaly	Yes	Yes
46	Samphanh	Phongsaly	Yes	Yes
47	Lao ngarm	Saravane	Yes	Yes
48	Samuoi	Saravane	Yes	Yes
49	Saravane	Saravane	Yes	Yes
50	Ta Oi	Saravane	Yes	Yes

No.	District	Province	BEQUAL	
			Broad (67)	Narrow (29)
51	Toomlarn	Saravane	Yes	Yes
52	Atsaphone	Savanakhet	Yes	Yes
53	Nong	Savanakhet	Yes	Yes
54	Outhoomphone	Savanakhet	Yes	Yes
55	Phalanxay	Savanakhet	Yes	Yes
56	Phine	Savanakhet	Yes	Yes
57	Sepone	Savanakhet	Yes	Yes
58	Thapangthong	Savanakhet	Yes	Yes
59	Vilabuly	Savanakhet	Yes	Yes
60	Xonbuly	Savanakhet	Yes	Yes
61	Dakcheung	Sekong	Yes	No
62	Kaleum	Sekong	Yes	No
63	Thateng	Sekong	Yes	No
64	Meun	Vientiane Province	Yes	No
65	Xaysathan	Xayaboury	Yes	No
66	Khoune	Xienkhuang	Yes	No
67	Morkmay	Xienkhuang	Yes	No

Source: Author's compilation.

Annex 6 - Reliability of Female PEPI

Table A6.1: Means of variables used to compute the first principal component, by quintiles of female PEPI

Variable	Lowest (20%)		Low (20%)		Middle (20%)		High (20%)		Highest (20%)	
	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean	No. of districts	Mean
Net enrolment ratio	30	96.86	30	97.17	29	98.13	30	99.02	29	99.25
Dropout rate	30	8.87	30	4.77	29	3.68	30	2.68	29	1.24
Repetition rate	30	6.43	30	3.78	29	2.56	30	2.07	29	1.53
Survival rate	30	65.48	30	80.24	29	84.89	30	88.53	29	94.79
Completion rate	30	62.90	30	77.86	29	82.74	30	87.13	29	93.84
Pupil-teacher ratio	30	28.94	30	23.59	29	21.48	30	20.50	29	16.93
Pupil-class ratio	30	28.67	30	24.55	29	22.90	30	21.96	29	18.49

Source: Author's calculation.

Table A6.2: Mean of poverty rate, by quintiles of female PEPI

Education performance of districts	Mean of poverty rate (%)
Lowest	37.27
Low	30.16
Middle	25.16
High	22.29
Highest	19.00
Spearman rank correlation coefficient, ranking of districts	0.54

Source: Author's calculation.

Table A6.3: Classification differences of the lowest and low education performance districts (40%) using female PEPI

Quantiles	Base case: all variables	All variables except school resources	Only indicators of primary education quality	Only indicators of access to primary education
Lowest and low (40%)	100.00	88.33	86.67	75.00
Middle (20%)	0.00	11.67	11.67	23.33
High (20%)	0.00	0.00	1.67	1.67
Highest (20%)	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00
Spearman rank correlation coefficient, ranking of districts	1.00	0.76	0.82	0.39

Source: Author's calculation.

Acknowledgement

We are grateful to Dr. Michael Epprecht, Head of Country Office of the Centre for Development and Environment for providing poverty data for the analyses in this report. The views expressed in this report are those of the authors' and do not necessarily reflect the views and policies of the Australian Department for Foreign Affairs and Trade and the government it represents. All errors are the authors' sole responsibility.

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