Economic Appraisal - Expansion of the County Education Centres Project

For DFID South Sudan

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List of Abbreviations

BSF	Basic Services Fund
CEC	County Education Centre
CBR	Cost benefit ratio
ECS	Episcopal Church Sudan
EFA-FTI	Education for All – Fast Track Initiative (now Global Partnership for Education)
FTE	Full time equivalent
GBP	Great British Pound (Sterling)
GDP	Gross Domestic Product
GoSS	Government of South Sudan
GMR	Global Monitoring Report
INSET	In-service training
IRR	Internal rate of return
MDTF	Multi-donor trust fund
M&E	Monitoring and Evaluation
MOE	Ministry of Education
MoU	Memorandum of Understanding
NGO	Non-governmental organisation
NPV	Net present value
PRESET	Pre-service training
PTA	Parent-teacher association
SSP	South Sudanese Pound
TIMSS	Trends in International Mathematics and Science Study
TPDI	Teacher Professional Development and Infrastructure Program
TTI	Teacher training institute
UNHCR	(The Office of the) United Nations High Commissioner for Refugees
USAID	United States Agency for International Development
USD	United States Dollar

Summary and recommendations

- **Option 2 – USAID managing the project with UNOPS managing the construction – is the most cost-effective option for achieving the project's impact.**
- **This option has a positive net present value which is somewhat augmented by significant unquantifiable benefits which cannot be monetised. The economic case would be stronger if negotiations with UNOPS managed to lower construction costs, as strongly recommended by this appraisal's annex.**
- **Project benefits are threatened by many risks - particularly low CEC utilisation, high teacher attrition and low quality training. These risks will mostly need to be addressed by other projects, but a clear strategy for risk mitigation must be developed by this project, which should in turn inform the development of other DFID projects. This project must not be considered in isolation from other DFID and USAID interventions in South Sudan and should not go ahead if the ability to manage and mitigate risks is judged unrealistic.**
- **Possible options for risk mitigation by this project specifically include decreasing the number of CECs constructed and considering a cost-sharing arrangement with the government to ensure their commitment to the full utilisation of the centres.**
- **The sustainability of the project's benefits is dependent on increased GoSS expenditure to cover CEC operational costs and increased salaries for trained teachers. This is a major uncertainty for the project, particularly as rapid expansion of the education sector more generally will increasingly put government resources under strain. Realistically, development partner involvement in South Sudan may need to continue into the longer term to ensure this sustainability.**

1 Rationale for intervention

What is intervention?

The proposed intervention is to finalise construction of 14 County Education Centres (CECs) such that they become operational. The CECs will predominantly be used for the in-service training of teachers, although they will eventually also be used for

government training for other sectors, such as health and agriculture. They will also potentially be used by County Education Departments as resource hubs and examination centres.

Why is it needed?

Development Partners and the Government of South Sudan have together recognised that teacher training is an urgent priority for developing the education sector. The international consensus is that teachers are the most critical resource in education reconstruction and that strategies to improve quality should be considered from the outset. If quality is neglected early on as access expands, it is believed to become far more difficult to address at a later stage.[1]

More generally teachers are considered the fundamental factor in any education system's quality (Barber et al. 2007 – "The quality of an education system cannot exceed the quality of its teachers"). This is just as relevant to South Sudan as any other country since 77% of the education budget is spent on teacher salaries.[2] Furthermore a focus on quality rather than just access is vital since the presumed benefits from education are believed more dependent on what is actually learnt rather than simply the amount of schooling that is received.[3]

The quality of teachers in South Sudan is extremely low. In primary schools 46% of teachers have only primary school education themselves, 96% have no formal qualification and 63% have no teacher training at all.[4] This lack of quality is reflected in indicators for student learning. A Service Delivery Study conducting sampled and internationally comparable learning assessments in South Sudan found students in Grade 6 scoring an average of only 29% in mathematics and 35% in language.[5] By comparison, as the tests were multiple choice, a purely random selection of answers would score 25% and Grade 4 students in Singapore score above 80%. Poor learning is also demonstrated by very high repetition and drop-out rates (15% and 34% respectively).[6] The drop-out rate for girls is particularly alarming at 48%.[7]

Market and government failure

[1] Education and Post Conflict Reconstruction: Reshaping the Future (World Bank 2005). Sudan Multi-Donor Education Rehabilitation Project, Project Proposal (2006).
[2] Page 91, Education and Post Conflict Reconstruction: Reshaping the Future (World Bank 2005).
[3] Hanushek & Woessmann (2008), "The role of cognitive skills in economic development", Journal of Economic Literature, 46:3
[4] Education in South Sudan: Status and Challenges for a New System (World Bank 2011). The Status of Teacher Professional Development in Southern Sudan (USAID 2009).
[5] Education in South Sudan: Status and Challenges for a New System (World Bank 2011).
[6] National Baseline and Household Survey (2009). Social and Human Development Pillar (2011).
[7] Social and Human Development Pillar (2011).

There are many reasons why the private sector will not provide this intervention. Principally these are because of externalities from teacher training that they wouldn't be able to fully capture in fees (such as the social benefits from having better educated teachers – see later discussion) and an imperfect capital market that makes it difficult to invest in projects with high start-up costs and more distant long-term benefits.

The government will not construct these education centres as political realities mean its resources are prioritised on more immediate term issues away from investments with longer term benefits. In 2009, 97% of the government's education budget went on recurrent spending.[8] Without development partner support almost no capital investment would take place in the education sector.

The counterfactual to this project is that these 14 CECs would not be made operational within the foreseeable future, and as such no training would occur at these centres. It is not believed that any other development partner would construct these centres if DFID did not finance this intervention. In addition, given the very limited number of existing venues for teacher training, it is assumed that training at the CECs will not simply displace training that would have taken place anyway elsewhere.[9] In the counterfactual the teachers who would have been trained at the CECs will instead remain untrained and provide a poorer quality of education to their students.[10] There are also some planned linkages between USAID's Teacher Professional Development and Infrastructure Program and this project since USAID's project envisages DFID to construct the training centres while USAID provides the training. Since the TPDI project will likely commence before DFID finalises construction of the CECs, not all USAID funded training will be able to take place at these CECs.[11] Nevertheless, given the joint DFID-USAID planning of this program, failing to complete the CECs may lead to a breakdown in DFID-USAID coordination in South Sudan with further reaching consequences.

[8] From 2009 budget - Education in South Sudan: Status and Challenges for a New System (World Bank 2011).
[9] The 2009 USAID study on Teacher Professional Development in Southern Sudan found that only 9 of a possible 158 CECs were operational.
[10] The risk/sensitivity analysis explores the possibility of a different counterfactual such that some of the training at CECs in fact displaces training that would have taken place anyway. This may be the case if the true constraint to expanding teacher training is resources rather than venues.
[11] USAID planning for this is ongoing. As they have no budget for accommodation, one option being explored is that they will initially only train teachers in close vicinity of the CECs until DFID construction of dormitory facilities is finalised.

2 Options for intervention

1. DFID manage project through direct MoU with UNOPS who carry out construction
2. Money channelled to USAID who manage project with UNOPS carrying out construction
3. Money channelled to Government of South Sudan who organise construction
4. No intervention

The different options are about the modalities for carrying out the construction project. A further option of tendering the project to open competition was rejected since experience in South Sudan has shown that this would entail higher costs, higher risk (particularly in terms of timeframe and whether construction is even completed at all) and would exclude UNOPS from the process (since they are not allowed to bid for competitive tenders). The annex to this appraisal compares UNOPS construction costs to previous costs for education construction projects in South Sudan. This comparative analysis will be used to ensure that the UNOPS costs provide value for money.

Option 3 is also rejected due to weak government public financial management systems, and hence, there are high fiduciary risk and transparency and accountability concerns: the risk of money being spent ineffectively and construction being delayed is considered too high. The remainder of the appraisal will compare Options 1 and 2 against the counterfactual (Option 4).

3 Intervention logic and evidence

The key assumptions underpinning the intervention are:

- Project resources will be effective in completing construction at 14 CECs such that each becomes operational
- Once completed CECs will be used for teacher training
- Teacher training does not simply displace equivalent quality training that would have taken place anyway at alternative venues
- Teacher training will improve teacher quality, which in turn will improve education quality and as such boost students' welfare and entail benefits for South Sudan as a whole

The UNOPS track-record in South Sudan suggests that the first assumption will hold and construction of sufficient quality will be completed on time. UNOPS estimates

start-up, design and tendering to last for 5 months and construction to take between 9 and 14 months. As such the construction would be expected to be finalised within two years from the start of the project. The second assumption is ultimately dependent on the Government of South Sudan, since they will be responsible for running the CECs once completed – they will fund the ongoing recurrent costs. While the government seems committed to the importance of teacher training, the key risk is in terms of sufficient resources being made available for it. Nevertheless, in the short-term there is likely to be enough funding from development partners for full use of the CECs to be made.

For example, USAID's TPDI program plans to provide 4,000 teachers with In-Service Training, while DFID is also planning its own teacher training project. There are about 27,000 primary and secondary teachers in South Sudan, the vast majority of whom are untrained.[12] Current GoSS guidelines for in-service training are for four stages of three months each (completed over 4 years). Realistically each CEC could host two different cohorts of teachers each year. With a capacity for 100 teachers at any one time, this implies that the completed CECs could host at most 2,800 teachers over the next four years for the full INSET programme. As such, the evidence that CECs will actually be used in the short to medium term is strong.

The evidence for the third assumption is mixed. While it is clear that adequate facilities are not the only constraint to expanding teacher training, they appear to be very relevant given the serious lack of usable venues. The 2009 USAID study on Teacher Professional Development in Southern Sudan found that only 9 of a possible 158 CECs were operational. This would suggest that a lack of facilities is indeed a major constraint to the expansion of teacher training. Although some training could also potentially be hosted at other venues, such as schools during holidays, it seems unlikely that the scale of in-service training which is targeted in the near future would be able to be accommodated without operational CECs. As highlighted in the rationale for this intervention, 96% of primary teachers have no formal qualification and 63% have no training at all. There are about 25,000 primary and 1,700 secondary teachers in South Sudan.[13] Without a reasonable number of CECs it seems unlikely that anywhere near this number could be trained simply by finding alternative venues.

Nevertheless, until now some training has indeed been hosted at venues other than CECs, implying that a lack of CECs is not a complete constraint on expanding

[12] Education in South Sudan: Status and Challenges for a New System (World Bank 2011)
[13] Page 110, - Education in South Sudan: Status and Challenges for a New System (World Bank 2011)

teacher training. As such, it is certainly possible that some training at CECs will displace training that would have occurred anyway at other venues.

For this reason the risk/sensitivity analysis will consider an alternative counterfactual such that CEC training has displaced training that would have occurred elsewhere. The impact of this possibility is considered to be reduced since the quality of training relative to cost at CECs should be higher than for the counterfactual. Evidence explicitly capturing this difference is not available[14] - although it seems certain that a quality differential will exist, the extent of the differential can only be assumed.[15]The evidence for the fourth assumption is very strong. Many studies show that students with better trained teachers achieve higher test scores.[16] Furthermore this effect is both cumulative and residual, such that a student with a better teacher in one particular year still gets better test scores in later years.[17] Better test scores have been linked with greater returns to education. For example, Aslam et al. (2010) show that for India a one standard deviation gain in test scores results in an 18% improvement in annual earnings.[18] Strong evidence already referenced (Hanushek & Woessmann 2008) also suggests that all the private and social benefits of education are based on the quality of education received rather than simply the quantity. Better quality of education should also imply lower repetition rates, entailing major cost savings for both government and students.

There is also clear evidence showing that better teachers attract more students to go to school, and so increase enrolment and reduce drop-out. For example, Lloyd et al. (1998) find that the quality of teaching increases demand for education in Kenya, and the effect is stronger for girls than boys.[19] This is particularly relevant to South Sudan where the drop-out rate for girls is 48%.

Finally there is clear evidence that other investments in the education sector are dependent on teacher training. For example, for an improved curriculum to have any effect on students' results, alterations have to be followed by in-service training for

[14] But would be a worthy target for teacher training projects' M&E
[15] See Annex 10 of DFID Education Portfolio Review 2009. Assuming equivalent resources made available to facilities of different quality, the quality of learning will be higher in the better quality facility.
[16] Verspoor (2003), "Breaking the mold: Teacher development for pedagogical renewal", Ch7 from "The Challenge of Learning: Improving the quality of basic education in sub Saharan Africa", Discussion Paper for ADEA Biennial Meeting, Dec 2003
[17] Ibid
[18] Aslam, Kingdon, Kumar (2010), "Economic returns to schooling and skills – An analysis of India and Pakistan", RECOUP working paper no.38
[19] Lloyd et al. (1998) "The effects of primary school quality on the educational participation and attainment of Kenyan girls and boys", Population council working paper 116

teachers.[20] Similarly, a study by Woessmann based on TIMSS data shows that "increasing school resources will not succeed in raising student achievement unless these resources are used efficiently by teachers".[21]

4 Incremental costs and benefits

4.1 Cost-effectiveness analysis – Option 1 vs. Option 2

Options 1 and 2 are assumed to achieve the same outcome and so yield the same benefits. As such selection between the two options is on the basis of which is more cost-effective.

Option 1: The direct costs for Option 1 are principally the UNOPS costs, which incorporate design, actual construction, monitoring and evaluation, capacity building and a 7% management fee. In addition, DFID would incur its own management, monitoring and evaluation and auditing costs.

[20] Nilsson (2003: page 8) "Education for All: Teacher Demand and Supply in Africa", Education international working papers no12
[21] DFID Education Portfolio Review 2009, page 62

Table 4.1 Option 1 Summary of Costs (GBP)

Option 1	Year 1	Year 2	Year 3
UNOPS Contract	10,730,036	10,730,036	
Independent M&E and Audit	12,500	12,500	214,601
DFID Management Burden (FTE)	0.25 Advisor 0.3 Programme Assistant 0.2 Deputy Programme Manager	0.25 Advisor 0.3 Programme Assistant 0.2 Deputy Programme Manager	
Total (excluding FTE)	10,742,536	10,742,536	214,601
NPV (excluding FTE)	10,742,536	9,765,942	177,356
Total NPV (excluding FTE)	**20,685,833**		
Non-discounted total (excluding FTE)	21,699,672		

Note: USD-GBP exchange rate of 1.57 used. Independent M&E costs set as 1% of total direct project costs. Discount rate = 10%. There is no widely accepted discount rate for South Sudan. As such, the same discount rate as applied to other DFID South Sudan projects has been used (e.g. South Sudan Education Programme). This is in line with DFID guidance of a discount rate in the range of 8-12% for developing countries (p.24 of "Guide to Investment Appraisal for DFID Economists", 2005). An argument could be made for a higher discount rate since uncertain prospects in South Sudan may mean there is a higher premium on short-term returns. Equally a lower discount rate may be appropriate given a smaller range of alternative investment opportunities than for a rapidly developing country. A study would need to be undertaken to establish the most appropriate discount rate. Until then it is most appropriate to use an equivalent discount rate as used for other DFID South Sudan projects.

Option 2: By combining this project with another USAID project for constructing TTIs, there are synergies in the UNOPS contract. These reduce the direct costs compared to Option 1 by £973,721 or 4.5% of the total contract costs. DFID would no longer need its own independent monitoring and evaluation or auditing for the project, while its management costs would also be significantly reduced. Replacing these costs USAID would receive a management fee of 6%.

Table 4.2 Option 2 Summary of Costs (GBP)

Option 1	Year 1	Year 2	Year 3
UNOPS Contract	10,243,175	10,243,175	
Independent M&E and Audit	614,591	614,591	
DFID Management Burden (FTE)	0.2 Deputy Programme Manager	0.2 Deputy Programme Manager	
Total (excluding FTE)	10,857,766	10,857,766	
NPV (excluding FTE)	10,857,766	9,870,696	
Total NPV (excluding FTE)	**20,728,462**		
Non-discounted total (excluding FTE)	21,715,531		

Note: USD-GBP exchange rate of 1.57 used. Discount rate = 10%.

The total discounted costs for Option 2 are very marginally higher than for Option 1, £42,629. However, these do not include DFID's non-monetised management burden. The annual difference in FTE is 0.25 of an advisor's time and 0.3 of a programme assistant's time. When considering the overall costs to DFID of these staff members (total gross salary, living allowance, flights allowance, insurance and security etc.) this would probably be valued greater than the monetised discounted cost difference between the options.

In summary, Option 2 is likely to be marginally more cost-effective than Option 1. In addition, while the project's impact is assumed equivalent between the two options, Option 2 has a very large but unquantifiable broader benefit in terms of improving donor coordination and cooperation in South Sudan. Many studies have emphasised the value of donor coordination in terms of reduced transaction costs for government from dealing with multiple partners, avoiding duplication of donor efforts and most critically ensuring donor interventions are complementary to one another to maximise their overall impact.[22] South Sudan's donor community at present is considerably fragmented and so the benefits from fostering greater coordination between two of the principal donors is likely to be considerable. For this reason Option 2 is the preferred choice.

[22] OECD (2003) "Harmonising donor practices for effective aid delivery", A DAC reference document

The remainder of this section will discuss whether Option 2 is better value than the counter-factual of doing nothing (Option 4 – assumed to have zero costs and benefits, but frees up money to be used on other interventions), and as such whether the project should go ahead or not.

4.2 Cost-benefit analysis – Option 2 vs. Option 4

Option 2's Incremental Net Benefits

The benefits from making the CECs operational are in terms of how the CECs will be used. The plan is for in-service teacher training to be conducted at the centres. As such this section will focus on attempting to quantify the economic costs and benefits from the teacher training that will take place. These net benefits will be calculated from the perspective of the Government of South Sudan.

Principally two types of in-service training will take place at the CECs. The first is the full four-stage INSET course proposed by the government, to be equivalent to the 2-year pre-service diploma. This will involve 400 hours of training per stage taking place over 12 weeks, as well as some follow-up of teachers in classrooms following the training (1-2 hours per day for five weeks). It is assumed that for the first four years following construction of the CECs two full cohorts of teachers will follow this INSET course. This means that this training will utilise the CECs for 6 months per year, and after four years 2,800 teachers will have become qualified.

The other type of in-service training will be continual upgrading of skills for teachers. Planned trainings include English language training, Maths and Science training, HIV/AIDS awareness training, head-teacher and school management training. Closely related will be other trainings at CECs such as PTA training, school inspector training, data and statistics training for regional officers. Indeed the government is planning to use the CECs for training for other sectors such as health and agriculture.

To capture the benefits from these trainings it is assumed that they will take place for two months a year for the first four years of the CEC and then 4 months a year from five years after the CEC is completed. Given the wide range of different trainings planned by both GoSS and development partners, this seems a conservative estimate. Indeed, it is likely that there will still need to be at least one cohort enrolling on the full 4-stage INSET course beyond year 5, given the vast number of untrained teachers who need to be trained and the lack of other facilities within which to train them. For simplicity this 4 months per year figure will be assumed to incorporate both training as part of the full 4-stage INSET course, and other training, with each assumed to have the same pro rata unit cost and returns.

There is significant scope for much greater than 4 months training per year. Nevertheless, since GoSS will be responsible for the costs of training in the longer term, and both its ability and commitment to this cannot be guaranteed, it seems sensible to make a relatively conservative projection of usage beyond five years after CEC construction.

Training costs:

The unit cost for in-service training is set as £900 for one teacher completing one stage of the full INSET course - this is based on what the Episcopal Church Sudan estimates such training presently costs in South Sudan. This is a conservatively high cost estimate. Average equivalent BSF training costs (from 7 different providers) is £669. In addition, this training cost should prove to be lower once the CECs become operational.[23] However, the £900 figure will be used as a conservative cost estimate which should ensure that all training costs are incorporated (including, for example, maintenance which may not have been factored into the ECS or BSF costs).[24]

In calculating the economic cost for in-service training it is also necessary to include the opportunity cost to teachers from training. Ideally training should occur during holidays, so term-time teaching is not disrupted. Even though training is initially targeted to take place 6 months per year, this should be possible since holiday dates are not uniform across schools and term dates could be adapted to allow for training. Nevertheless, by being at training teachers may also be foregoing other income that they could have earned outside of teaching. Additionally, being realistic, there may be some clash between training and term-time teaching, such that teaching is disrupted. The opportunity cost will be assumed to be equivalent to the teacher's salary for the period in which they attend training. 75% of this cost will be assumed to fall on teachers themselves, since almost all training will be targeted to take place outside of term-time. The remaining 25% opportunity cost will be assumed to fall on the government, given the possibility that some term-time teaching will be disrupted because of training.

[23] Presently the trainings are often at ad-hoc venues with consequent spending inefficiencies. For example, expenses for food are likely higher without kitchen facilities than they will be when training is hosted at CECs with kitchen facilities.

[24] If maintenance costs are set as 1.5% of construction costs (DFID Guideline from Bonner et al. 2010 "Delivering Cost Effective and Sustainable School Infrastructure", p.14), then per CEC the annual cost is £15,405 (1.5% of £14.4m divided by 14), which per teacher trained for three months is £39 (£15,405 divided by 100 divided by 4).

Other private costs to teachers are assumed to be zero, since their food, accommodation, transport and materials are provided free-of-charge. Their private cost could in fact be argued to be negative since if they were not at the training they would need to pay for food. So setting these costs to zero seems reasonable. The implicit rental value for the CECs is also assumed to be zero, since realistically they could not be used for any other marketable purpose in the foreseeable future.

Following completion of training there will be a cost to the government in terms of rewarding trained teachers with higher salaries. The extra salary that the government pays a teacher following completion of the 4-year INSET will be the same as the extra salary paid to a teacher with a 2-year PRESET diploma, since these two courses are supposed to be equivalent.

The average monthly salary for a non-trained teacher is SSP387. The monthly salary for a newly trained teacher is SSP913. These salaries are equivalent to £1,003 and £2,364 per year. These figures include cost of living allowances (which are higher for trained teachers), and pension contributions (8% of all income). They do not include income tax, which is 10% of income above SSP300 per month. Payment of this tax is not assumed to be a cost to the government.

Comparative data from other developing countries suggest that this salary increase may in fact be quite high. For example, Mulkeen (2010) compares qualified and unqualified teachers in 4 sub-Saharan African countries, showing that only in The Gambia is the salary increase comparable, while in Lesotho, Liberia and Uganda the increase is very significantly less.[25] Nevertheless, providing sufficiently higher salaries for trained teachers seems vital to prevent teachers simply leaving the profession after completing their training. As such the GoSS salary scale cost estimate will be used.

It should be noted that while increased salaries are a cost to the government they are also a benefit to teachers. The present cost-benefit analysis will be from the perspective of GoSS, in which sense they are treated as simply a cost. If the benefits for South Sudan as a whole were considered then the higher salaries would not be a net cost.

Training benefits:

Increased productivity of teachers

[25] Mulkeen (2010), page 141, "Teachers in Anglophone Africa: Issues in Teacher Supply, Training, and Management", World Bank

The principal benefits from training are in terms of increasing the marginal productivity of teachers. This is extremely difficult to quantify. No robust evidence yet exists that can be used to quantify how much teacher productivity increases (in monetisable terms) as a result of training. However, theoretically it could be measured, and this should be a goal for the monitoring and evaluation of the teacher training projects that follow this construction project. For example, it can be measured how much repetition and drop-out rates fall, how much test scores increase and how much enrolment increases at schools with more trained rather than untrained teachers. All of these gains can be monetised.[26]While evidence is not common for what this rate of return for teacher training should be, it can be compared to international evidence on the rate of return for general education. Psacharopoulos & Patrinos (2002) summarise a wide range of studies to show the average rate of return to investing in an extra year of general education in sub-Saharan Africa is 18.4% at the secondary level.[27] Bennell (1996) breaks down this information into lower and upper secondary, corrects some reporting errors and shows that (for those studies where a breakdown is possible) the average rate of return to lower secondary is 22.4%, while the average rate of return for upper secondary is 33.4%.[28] This breakdown is informative since the 4-stage INSET course is most closely equivalent to upper secondary education.

There are a number of reasons why the rate of return for teacher training should be higher than that for general education. First, teachers have guaranteed employment post-training, whereas general rate of return estimates are lowered by the proportion of students who do not find employment. Second, there is no lag between completing teacher training and then actually teaching in the classroom, so there is no delay to the realisation of productivity benefits (indeed teachers continue to teach while training is actually going on). In general education there is a delay between completing a particular year of school and then leaving school and eventually finding employment. Third, teacher training courses are focussed specifically on what skills the teacher needs for the classroom, whereas skills developed in general education will arguably only be partially relevant to the job that a student ends up doing.

[26] Decreasing repetition and drop-out reduces the costs for educating a child in a particular cycle of education by cutting the average number of years required to complete that cycle of education. Studies are starting to give estimates of the rate of return for increasing student test scores in terms of increased salaries in later life (see e.g. Aslam et al. (2010)). Attracting more children to actually attend school has an already commonly measured value in terms of the benefits these children then get from going to school.

[27] Psacharopoulos & Patrinos (2002), "Returns to investment in education: A further update", World Bank

[28] Bennell (1996) "Rates of return to education: Does the conventional pattern prevail in sub-Saharan Africa?", World Development, Vol24, No1

For these reasons the present analysis will assume that teacher productivity increases by 35% as a result of training, marginally higher than the average rate of return for general upper secondary education found by Bennell (33.4%). This return seems realistic and quite possibly underestimates the benefits from increasing teacher skills. Nevertheless a more accurate estimate will only be possible with robust monitoring and evaluation of any teacher training projects that follow this construction project.

Social returns from training teachers

There are also broader benefits from training teachers which are even harder to monetise, but to neglect them would imply significantly underestimating the overall returns from teacher training. The first of these are equivalent to the external benefits of general education, including benefits from better public health, lower crime rates, greater political stability and environmental benefits. McMahon (2004) brings together a number of studies to calculate that incorporating these broader social benefits from education would more than double conventional rate of return figures. For example, he shows that Psacharopoulos & Patrinos' rate of return figures for secondary education in sub-Saharan Africa would increase from 18.4% to 39.7%.[29] There is considerable uncertainty in estimating these benefits, meaning these estimates can only be applied cautiously. For this reason the present analysis will assume the social returns from teacher education to be 10%. This is equivalent to assuming that the teacher productivity return increases from 35% to 45% when incorporating the social returns. In addition the analysis will only calculate these returns for the time when teachers remain in the profession. This likely underestimates the returns since the social benefits from better educated teachers are likely to persist beyond their teaching career.

Spillover benefits to other teachers

The second broader benefit from teacher training is in terms of spillover benefits to other teachers through peer learning. Jackson & Bruegmann (2009) find that a teacher's students score better if the teacher has more effective colleagues, and this effect is strongest for the least experienced teachers.[30] They show that on average a one standard deviation increase in a teacher's quality is associated with a 0.04 standard deviation increase in maths scores and a 0.03 standard deviation increase

[29] McMahon (2004), "The Social and External Benefits of Education" from International Handbook on the Economics of Education

[30] Jackson & Bruegmann (2009), "Teaching students and teaching each other: The importance of peer learning for teachers", American Economic Journal: Applied Economics, Vol1, No4, 85-104

in reading scores for students taught by that teacher's colleague. Given that the average teacher has three peers, this implies that for a given increase in teacher quality, there is an additional collective increase in their colleagues' quality by 10.5% of that increase.

They also show that this effect is cumulative over time, such that a one-off increase in a teacher's quality results in a collective increase in colleagues' quality over three years by an additional third of the original teacher's quality increase. However, given that there are not many studies to counterbalance this evidence, to keep the present analysis conservative only the contemporaneous effect will be considered. As such, in the monetised analysis, in addition to the measured teacher productivity increase of 35%, an additional 10.5% of this increase will be calculated as the peer learning gains for fellow teachers.

Non-quantified benefits from training teachers:

Peace benefits: By providing residential teacher training that brings together teachers of different tribes into the same place, there are potential benefits in terms of encouraging unity between tribes. More generally there is also strong evidence emerging that the provision of decent quality education is an important investment in building peace in post-conflict states.[31]

Education as a human right: Many would argue that providing education of a reasonable quality is an unquantifiable human right. This would imply that even if an education project is not profitable for all the other factors outlined already, it might still be considered worthwhile simply in terms of the extra number of children who get access to a basic quality of education.

Other non-quantified benefits from constructing CECs

While it is clear that the principal goal of CECs is to be used as education centres, they will also be used for a number of reasons beyond training teachers, the benefits from which are necessarily excluded from the monetised analysis. First, the government also plans to use CECs for training in sectors outside of education such as health and agriculture. This training may well get similar returns to those for teacher training, but to be conservative they have been excluded from the analysis.

CECs will also be used as resource hubs and examination centres for schools. This would potentially entail significant benefits and would be unlikely to divert much time away from CEC usage for training. The CECs could as well be used by local

[31] GMR 2011

communities, for example, as a venue for meetings. This would only constitute a minor usage of CECs, the main purpose of which being to give the local community some kind of a stake in the centres such that they might support its maintenance and security.

Finally the utilisation of CECs could be significantly greater than what is assumed for the cost-benefit analysis. For example, CECs could be used as a venue for evening classes for training teachers from nearby schools at the same time as being used during the day for residential courses. Such evening classes are currently conducted in South Sudan by the Windle Trust for English language training.

Monetised Cost-Benefit Analysis

Full details on the calculations are presented in the annex. The following table gives the key summary figures.

Table 4.3 Summary Cost Benefit Analysis (GBP)

Total NPV project direct costs[32]	- 20,728,462
NPV from initial 2 cohorts completing full cycle of INSET (Years 3-6)	10,971,952
NPV from 2 months/year other INSET (Years 3-6)	5,348,275
NPV from training (Years 7-22)	14,969,780
Total Project NPV	**10,561,546**
CBR	**1.27**
IRR	**13.4%**

Notes: Discount rate of 10% used. Exchange rates of 2.95 for SSP-USD; 1.57 for USD-GBP; and 4.63 for SSP-GBP used.

The net present value for this project is £10.6mn. The cost-benefit ratio is 1.27. The internal rate of return is 13.4%. For a project with necessarily high start-up costs and long-term benefits that are strongly discounted, this is a satisfactory return and shows that simply in terms of what is monetisable the project is reasonable value for money.

When combining these calculated quantifiable benefits with the unquantified benefits outlined previously the economic case for this project is stronger. It would be stronger still if the UNOPS costs are negotiated down as recommended in the annex to this appraisal.

[32] Further details in the annex.

5 Risk/Sensitivity Analysis

Table 5.1 Sensitivity analysis

What if:	IRR (%)
Only 3 months utilisation per year	8.4
9 months utilisation per year	17.4
1-year delay in construction	12.4
2-year delay in construction	11.6
10% decrease in training rate of return	10.9
20% decrease in training rate of return	7.9
Teacher retention decreased to 6 years	10.6
Teacher retention increased to 20 years	15.3
CEC lifespan decreased to 10 years	11.8
CEC lifespan increased to 30 years	14.3
USD – GBP exchange rate 1.45	12.6
USD – GBP exchange rate 1.70	14.3

This table shows the impact on the internal rate of return by changing some of the assumptions underpinning the cost-benefit analysis:

Not full utilisation of resource

If CECs are only used for three months training per year then the IRR falls to 8.4%. This emphasises that the benefits from constructing CECs are completely dependent on the actual utilisation of CECs. In the short term this is not believed to be a major risk, since there seems sufficient donor interest alone in teacher training to make use of the CECs. For example, USAID's planned TPDI program aims to train a cohort of 4,000 teachers, while DFID is planning its own teacher training project. If each CEC was used to full capacity (100 students at a time) for two cohorts per year (i.e. across six months) then this would be a total of 2,800 teachers being trained over 4 years.

In the longer term this risk is more significant since ultimately it is the government who will be responsible for providing all training. Overall GoSS financing for education has been reasonable since 2005, with between 6% and 8% of the total budget allocated to education. However, there are significant concerns about the sustainability of GoSS's overall revenue (which is 98% from oil sources due to run out in 20-30 years). Furthermore, continuing expansion of the education sector requires significant, sustained resources to be allocated and disbursed to the education sector.[33] In addition, recent budget commitments to teacher training have not been honoured, with evidence from 2010 showing only 11% execution of the

[33] Enrolment quadrupled between 2006 and 2009, and is targetted to continue to expand rapidly (even in 2009 the Net Enrolment Rate was only 46%, implying that more than half the children of school age do not actually go to school) (Social & Human Development Pillar 2011).

allocated budget for teacher training.[34] While it should be recognised that this is only preliminary data and the reasons for this low execution rate might be justifiable (e.g. delayed disbursement rather than re-allocated resources), this is still significant cause for concern. It seems most likely that the risk of insufficient CEC utilisation in the longer term is the greatest risk to project benefits. The flip-side of this risk is that there is significant scope for CECs to be used much more intensively than the utilisation assumed for the cost-benefit analysis. If used for 9 months per year then the IRR climbs to 17.4%. If used for evening classes as well as day classes, then again project benefits would be even further increased.

Low quality training

The extent of the benefits from teacher training is dependent on the quality of training that is given in relation to the costs. If the quality of training is lower than assumed then the rate of return to training will be lower, which means project benefits will decrease. For example, if the rate of return (for both the productivity increase and social returns) is 10% lower than assumed, then the IRR falls to 10.9%. If the rate of return is 20% lower then the IRR falls to 7.9%. The rate of return assumed for the cost-benefit analysis has been estimated relatively conservatively and as argued previously in reality it may well be higher. Nevertheless, the monitoring and evaluation of development partner teacher training projects should be focussed on ensuring the returns to training are sufficiently high.

Another reason why the rate of return to teaching might be lower is if teachers are not provided with sufficient complementary resources (e.g. textbooks, adequate infrastructure etc.) once back in the classroom. This is a risk if GoSS does not provide sufficient financing for education inputs in general, which is quite possible given the general expansion of access to education putting ever greater pressure on limited government resources.

Construction delays

If there are delays in construction then CECs will not be operational until later than necessary and project benefits will be delayed. As benefits are discounted by 10% annually (reflecting both social time preference for benefits received sooner as well as the opportunity cost of capital) delays in construction reduce the project's NPV. If construction is delayed by one year then the IRR falls to 12.4%, if delayed by 2 years the IRR falls to 11.6%.

[34] Draft presentation, "South Sudan: Teacher Supply and Demand - Initial Analyses", Goldsmith (2011). Note the content of presentation is a work in progress at time of writing.

At the time of this appraisal only three of the CECs had been visited. From these visits it has been assumed that only minor touch-up work is required on the existing facilities. If in fact more than minor rehabilitation work is required at other CECs then this could delay the construction process. Nevertheless, UNOPS track record for completing construction projects on time would suggest this is not a major risk.

Decreased teacher retention

Project benefits are dependent on teachers staying on as teachers after training for an average of 10 years. If the average retention falls to 6 years then the IRR falls to 10.6%. Although, outside of the directly monetised benefits, not all the economic benefits of training will be lost if teachers become employed elsewhere since some of their extra skills will be equally relevant in other sectors. However, this is a major risk for the project's success in terms of addressing the need for intervention – a severe shortage of qualified teachers in South Sudan resulting in poor quality education for South Sudan's students.

There are two ways in which training may impact on teacher retention. The first is that by increasing teachers' skills they have greater alternative employment opportunities. This risk should be mitigated by ensuring that better trained teachers are given adequate remuneration by the government. The second impact of training, however, should in fact increase retention since studies show that teachers with proper training get more satisfaction from their work and as such are more likely to stay in the profession than those without training.[35] If teacher retention was in fact increased to 20 years then the IRR becomes an impressive 15.3%.

Decreased lifespan of CECs

The expected lifespan of CECs should be more than 25 years. Conservatively the cost-benefit analysis calculated benefits for just the first 15 years. If the lifespan of CECs is reduced to 10 years then the project IRR will reduce to 11.8%. Conversely, if the lifespan of CECs increases to 30 years then the project's NPV becomes 14.3%.

Two key factors could reduce the lifespan of CECs. The first is if a return to conflict disrupts the use of CECs or destroys the facility itself. This is somewhat beyond the control of this project, although it does highlight the complementarity between this project and other DFID investments in South Sudan for peace and stability.

The second factor is if there is insufficient maintenance of CECs. Repeated studies have shown how incredibly cost-effective maintenance is compared to allowing a

[35] Nilsson (2003: page 10) "Education for All: Teacher demand and supply in Africa", Education International Working Papers no 12

building to decay completely and then need to be rebuilt.[36] The government has stated that an operational budget will be allocated to CECs that will include an allowance for maintenance. However, this may not be realistic, since until now the budget transferred by the Ministry to the states for schools' recurrent costs is almost exclusively reserved for salaries.[37] Despite rhetoric suggesting the arrangement will be different for CECs, it is not clear in reality why it will be.

An alternative approach to promote maintenance may be to encourage local communities to have a stake in the CECs. Part of the initial construction budget will be allocated to trying to promote this. In addition, by allowing local communities to make some use of the CECs (e.g. for meetings etc.) this may also increase their interest in ensuring the facilities are maintained. However, it is unlikely that they will ever consider themselves having as big an interest as they would with a primary school where they send their children, and so ultimately the responsibility for maintenance must fall on the government.

A third factor may also reduce the lifespan of CECs, which is if the quality of construction is low. Given UNOPS strong track record in ensuring decent quality construction this risk seems small.

Exchange rate volatility

UNOPS cost figures are in US dollars. A USD-GBP exchange rate of 1.57 has been used for the monetised analysis. If the pound depreciated relative to the dollar then construction costs would increase. If the exchange rate fell to 1.45 then the IRR falls to 12.6%. Conversely if the exchange rate appreciates to 1.70 then the IRR increases to 14.3%.

This suggests that project benefits are not excessively sensitive to the exchange rate, which in any case is out of the control of the project until negotiations with UNOPS are finalised. Nevertheless, this risk could be shifted to UNOPS once a contract agreement is reached by setting a fixed exchange rate for the duration of the contract.

CECs displace training that would have taken place anyway

If training that takes place at CECs simply displaces training that would have taken place anyway at different venues, then project benefits become less compared to the

[36] "Maintenance is the single most cost-effective investment a country can make. ... Of the estimated $6 billion annual price tag for EFA construction, $4 billion is to replace classrooms that are literally falling down." Education for All: Building the Schools (2003), Education Notes, World Bank.
[37] Page 92, Education in South Sudan: Status and Challenges for a New System (World Bank 2011)

counterfactual. For example, if half of the training that takes place at CECs would have been undertaken anyway in the counterfactual, and the training would have been of equivalent quality, then the project NPV becomes negative (-£5mn) and the IRR falls to 7.7%. Given the severe shortage of usable venues for teacher training and the very high amount of training required, as argued previously, this level of displacement seems unlikely.

Furthermore, any training displaced by the CECs would probably have been of a lower quality (or equivalently same quality for a higher cost) than what can be achieved in purpose-built training centres. If the counterfactual assumes that half the training at CECs would have taken place anyway, but the quality of the CEC training is 20% better than for the counterfactual (productivity gain falls from 35% to 28% and social returns from 10% to 8%), then the project NPV falls to £3mn but remains positive.

Evidence on how much this quality differential would be is not available. However, it seems implausible that the quality of training relative to cost will not be significantly greater at CECs than if hosted at venues with more limited and less appropriate facilities. Indeed if the quality differential is a little more than 20% then the project's NPV would actually increase compared to a counterfactual with half the training taking place at alternative venues, since the counterfactual would itself have a negative NPV.

Additionally the unquantified peace benefit from residential training courses bringing different tribes together would still be lost in the counterfactual where training would likely make use of disparate accommodation facilities rather than keeping all students together. Evidently, the unquantified benefits from other uses of CECs (e.g. as resource and examination centres) would also still be absent in the counterfactual.

Conclusions from risk and sensitivity analysis

Given the significant potential negative impact on project returns from all the above risks it is essential that a comprehensive risk mitigation strategy is adopted. Given that many of the risks to the project's benefits are outwith the scope of this construction project, they must be directly considered when developing other DFID projects. This project should not go ahead if the ability to manage and mitigate these risks is believed unrealistic.

One method to decrease project risk may be to construct fewer CECs and focus on ensuring that the CECs which are constructed are fully utilised with high quality training which does not displace training that would have taken

place anyway. In this regard it is worth noting that even the Government's very ambitious Social and Human Development Pillar only targets the construction of 10 CECs between 2011 and 2013.

An additional risk mitigation method worth exploring is to consider a cost-sharing arrangement with the government for constructing the CECs. This would be an effective means to increase the probability of full government buy-in and commitment to using the CECs once constructed.

6 Incidence of costs / benefits

The project construction costs will fall entirely on DFID. The direct costs of training will ultimately fall on GoSS. However, in the short term it is likely that a significant share of training costs will fall on development partners (including DFID). The majority of the indirect costs of training (in terms of the opportunity cost of teachers' time) will fall on teachers themselves (75%), although some of the training will potentially disrupt term-time teaching, implying a cost to GoSS and in turn the teachers' students (25%).

There is also a significant cost burden for GoSS from having to pay higher salaries for trained teachers. As shown below this cost will be partly if not fully offset by the increased effectiveness of teachers which reduces other education costs for government (see below).

The benefits from teacher training are enjoyed by:

- Students (who get better quality education)
- Society at large (which gets social benefits from both teachers' and students' education such as for health, environment, political stability etc.)
- GoSS (as teachers become more effective by lowering repetition, drop-out, making better use of complementary inputs such as textbooks, teaching bigger classes for same quality etc.; and as better quality teachers improve the effectiveness of other teachers)
- Teachers (who get higher salaries as teachers, increased earnings potential if leave teaching, and increased benefits outside of work)

It is extremely difficult to estimate the exact incidence of the benefits. However, the biggest beneficiaries ultimately are likely to be the children who get a better quality education from having better quality teachers.

6 Macroeconomic impact

The project would be expected to have a very positive macroeconomic impact. Much evidence shows the link between improving the quality of education and increasing economic growth. Indeed there is emerging evidence that the benefits of education for economic growth come entirely through education quality rather than education quantity. A recent cross-country study finds that a one standard deviation improvement in student test scores is associated with a 2% higher annual growth rate.[38]

In addition the potential project impact for peace and stability (through residential courses bringing different tribes together and through the provision of adequate quality education services more generally) would in turn be extremely beneficial to South Sudan's overall economic development.[39] This aspect may ultimately prove to be the project's greatest beneficial impact for the people of South Sudan.

7 Fiscal impact

Factors increasing GoSS spending:

- Operational costs of CECs, including conducting training (in short-term likely to be covered partly by development partners, in longer-term is the responsibility of GoSS)
- Increased salaries and pension contributions required to reward trained teachers[40]
- GoSS increased commitment to education relative to other sectors

Factors decreasing GoSS spending / increasing GoSS revenue:

- Decreased costs to GoSS from better quality teachers lowering repetition and drop-out rates; making better use of complementary inputs such as textbooks; teaching larger class sizes for the same quality etc.
- Decreased costs to GoSS from better quality teachers improving the quality of other teachers, which in turn further lowers repetition, drop-out rates etc.

[38] Hanushek & Woessmann (2008), "The role of cognitive skills in economic development", Journal of Economic Literature, 46:3

[39] Simply in economic terms Collier & Hoeffler (2007) estimate that the typical civil war (lasting 7 years) for a poor country costs (in discounted present value) $65 billion in terms of lost GDP, health costs, extra military expenditure and similar costs for neighbouring countries. This does not include the massive social and psychological costs of war, nor the global costs in terms of increased risk of terrorism etc. Pages 725-30 of "Civil War" (2007) in Handbook of Defense Economics, Volume 2, Sandler & Hartley (eds).

[40] Note that pension contributions are 8% of teacher salaries, and so are incorporated into salary costs

- Increased tax revenue, eventually, from more and better educated kids getting higher incomes
- Savings from other sectors through the broader social benefits of education, particularly in terms of better public health, decreased crime and reduced political instability

Overall it is likely in the short to medium term the fiscal burden on GoSS is significantly negative. In the longer term as the benefits of providing better quality education are experienced, the overall fiscal impact would most probably become significantly positive.

8 Financial sustainability

The long-term sustainability of this project's benefits is dependent on the government taking full responsibility for the running of CECs as well as paying teacher salaries such that teacher attrition does not increase.

This is a major risk for the project. GoSS contributions to education have fluctuated between 6% and 8% of the total government budget since 2006.[41] This is well below the EFA-FTI benchmark of 20% - of the total recurrent budget. However, given the post-conflict context demanding significant resources for defence and peace-building and the fact that the overall GoSS budget is actually relatively large compared to most post-conflict countries[42] the current contribution to education is not too discouraging.

More worrying is that 98% of government revenues come from oil.[43] This makes budgetary revenue both unpredictable (volatility in oil prices and external shocks can cause budgetary crises as in 2009) and unsustainable since oil reserves are predicted to be declining within 5 years and exhausted within 20-30 years.[44] Continuing expansion of the education sector requires significant, sustained resources to be allocated and disbursed to the education sector.[45]

Hence, development partner involvement in South Sudan's education sector will almost certainly need to continue into the longer term for the benefits from this project (and other initiatives) to be financially sustainable.

[41] Page 90, Education in South Sudan: Status and Challenges for a New System (World Bank 2011)
[42] Page 11, World Bank (2009), "Sudan: The road toward sustainable and broad based growth", Country Economic Memorandum
[43] Page 31, Education in South Sudan: Status and Challenges for a New System (World Bank 2011)
[44] Page 8, World Bank (2009), "Sudan: The road toward sustainable and broad based growth"
[45] Enrolment quadrupled between 2006 and 2009, and is targetted to continue to expand rapidly (even in 2009 the Net Enrolment Rate was only 46%, implying that more than half the children of school age do not actually go to school) (Social & Human Development Pillar 2011).

9 Attribution to DFID

The attribution of this project's benefits to DFID is assumed to be 56%. This is the pro rata share of total inputs which are funded by DFID. The direct inputs are the construction costs. The indirect inputs are the costs of running teacher training. If some of the teacher training ends up being funded by DFID this will be additionally attributable to DFID. It could be argued that this is a conservative estimate since without DFID completing the construction it is likely that no consequent training would take place at the CECs.

When considering only DFID's input costs and the percentage of benefits attributed to DFID, the Net Present Value becomes £5.9mnand the Internal Rate of Return 12.6%.

10 Annex A - Full methodology for cost-benefit analysis

To calculate the overall economic costs and benefits of the project a number of assumptions are required:

CEC utilisation:

- First four years following construction two separate cohorts enrolled on full INSET stages of three months each. This implies a total of 200 teachers being trained at each CEC, utilising CECs for 6 months each year
- In addition for first four years following construction two months of other training is conducted at CECs
- From years 5-15 following construction CECs are utilised 4 months each year for teacher (or equivalent) training

Teacher retention:

- Following completion of training teachers are assumed to continue as teachers for an average of 10 years. This average figure accounts for some who will leave sooner and others who will hopefully continue for more than 20 years.

Table 10.1 Benefits from first two cohorts of 100 teachers each completing full INSET 4-stage course from years 1-4 after construction of CECs (6 months / year) (GBP)

Project year	1	2	3	4	5	6	7	8	…	15	16
Productivity gain per teacher				404	842	1312	1815	1815	…	1815	1815
Social benefits per teacher				116	240	375	519	519	...	519	519
Spillover productivity gain				42	88	138	191	191	...	191	191
Extra salary cost per teacher							1362	1362	...	1362	1362
Overall training cost			1155	1249	1343	1437			...		
Of which direct cost of training			*900*	*900*	*900*	*900*			*...*		
Of which GoSS opportunity cost			*64*	*87*	*111*	*134*			*...*		
Of which teacher's opportunity cost			*191*	*262*	*333*	*403*			*...*		
Training cost - private OC excluded			964	987	1011	1034			...		
NPV for one teacher	3,919										
NPV per CEC (200 teachers)	783,711										
NPV across all CECs (2,800 teachers)	**10,971,952**										

Notes: Two separate cohorts of 100 teachers each enrolled for three months each year across four years. Direct training cost is £900. Opportunity cost of training set as teacher's gross salary and increases in line with teacher productivity gain. 25% of this cost is to GoSS, 75% to teachers (based on assumed term-time vs. holiday disruption for training). Average annual salary cost for an untrained teacher is £1,003 (between Grades 14 and 12 on GoSS salary scale, range is SSP 288 to SSP 440 per month plus SSP 30 per month cost of living allowance. Of this 10% of salary above SSP 300 per month is taken as income tax and not presumed a cost to GoSS). Average annual salary cost for a trained teacher is £2,364 (Grade 9 on GoSS salary scale is SSP 925 per month, plus SSP 50 cost of living allowance. 10% income tax again not presumed a cost to GoSS). Extra salary only paid on completion of training. Productivity gain per teacher is 35% of total training cost. Social benefits per teacher are 10% of total training cost. Spillover productivity gain is 10.5% of individual productivity gain. For simplicity returns from each stage of training are considered equivalent. Benefits received for 10 years following completion of training. Discount rate = 10%.

Calculation of NPV is from perspective of GoSS. Therefore extra salary for a trained teacher is considered only as a cost. Given that the teacher's private benefit from getting a higher salary is excluded, the teacher's private opportunity cost from attending training is also excluded from the NPV calculations. However, this private opportunity cost is still used for calculating rates of return in order to keep the analysis comparable with international estimates of education returns.

Table 10.2 Benefits from other INSET for already trained teachers from years 1-4 after construction of CECs (2 months/year) (GBP)

Project year	1	2	3	4	5	6	7	8	…	15	16
Productivity gain for Yr 1 teachers				357	357	357	357	357	…		
Social returns for Yr 1 teachers				102	102	102	102	102	…		
Spillover benefits for Yr 1 teachers				38	38	38	38	38	…		
Extra salary cost for Yr 1 teachers				166	166	166	166	166	...		
Total training cost for Yr 1 teachers			1021						…		
Training cost – private OC excluded			705						...		
...											
Productivity gain for Yr 4 teachers							357	357	...	357	357
Social returns for Yr 4 teachers							102	102	...	102	102
Spillover benefits for Yr 4 teachers							38	38	...	38	38
Extra salary cost for Yr 4 teachers							166	166	...	166	166
Total training cost for Yr 4 teachers						1021			...		
Training cost – private OC excluded						705			...		
NPV for one teacher equivalent (4 years of 2 mths INSET)	2,910										
NPV per CEC	291,024										
NPV across all CECs	**5,348,275**										

Notes: For simplicity costs and benefits calculated in terms of one teacher completing two months of training. This is considered equivalent to cumulative net benefits of, for example, four different individuals receiving 2 weeks training each. Direct cost of training per teacher per month is set as equal to pro rata cost of full 4-stage INSET training. Opportunity cost is set as gross basic salary for a new trained teacher – £211 per month. 75% of opportunity cost falls on teachers, 25% on GoSS. Rates of return on training are set as equivalent to that for full 4-stage INSET training (salary increase rate of return equivalent is 16%). Benefits received for 10 years following completion of training. Discount rate = 10%.

Table 10.3 Net benefits from INSET training from 5 years after CEC construction (GBP)

Project year	1	2	…	7	8	9	…	17	…	26	27
Productivity gain for Yr 5 teachers			…		715	715	…	715	…	0	0
Social returns for Yr 5 teachers			...		204	204	...	204	...	0	0
Spillover benefits for Yr 5 teachers			...		75	75	...	75	...	0	0
Extra salary cost for Yr 5 teachers			...		333	333	...	333	...	0	0
Total training cost for Yr 5 teachers			...	2,042			...		...		
Training cost – private OC excluded			...	1,411			...		...		
...											
Productivity gain for Yr 15 teachers			...				...	0	...	715	715
Social returns for Yr 15 teachers			...				...	0	...	204	204
Spillover benefits for Yr 15 teachers			...				...	0	...	75	75
Extra salary cost for Yr 15 teachers			...				...	0	...	333	333
Total training cost for Yr 15 teachers			...				...	2,042	...		
Training cost – private OC excluded			...				...	1,411	...		
NPV for one teacher equivalent trained (11 years for 6 months each year)	10,693										
NPV per CEC	1,069,270										
NPV across all CECs	**14,969,780**										

Notes: Training assumed to continue until 15 years after CEC construction for four months per year. For simplicity costs and benefits calculated in terms of one teacher completing four months of training. This is considered equivalent to cumulative net benefits of, for example, four different individuals receiving one month training each. Direct cost of training per teacher per month is set as equal to pro rata cost of full 4-stage INSET training. Opportunity cost is set as gross basic salary for a new trained teacher – £211 per month. 75% of opportunity cost falls on teachers, 25% on GoSS. Rates of return on training are set as equivalent to that for full 4-stage INSET training (salary increase rate of return equivalent is 16%). Benefits received for 10 years following completion of training. Discount rate = 10%.

Table 10.4 Summary Net Present Values (GBP Millions)

Summary NPVs	GBP Millions
DFID direct project costs	20.7
Teacher productivity gains	57.8
Social returns	16.5
Spillover benefits to other teachers	6.1
Extra salary cost	30.2
Direct training cost	16.5
GoSS training opportunity cost	2.4
Teacher private opportunity cost	7.2
Total project NPV (from GoSS perspective)	**10.6**
Total project NPV from South Sudan perspective	33.6

Notes: Net Present Value is calculated from perspective of GoSS. This means extra teacher salaries are simply a cost (and not a corresponding benefit to the teachers that receive them), while the private opportunity cost to teachers of attending training is not considered a cost. If the overall NPV was calculated such that teachers' private costs and benefits were taken into consideration then it would in fact be considerably higher at £33.6 million (and this figure still excludes private benefits to teachers who leave the teaching profession but have higher productivity in other sectors because part of the skills developed in training can equally be applied to other jobs).

11 Annex B – Is UNOPS good Value for Money?

Given the choice to contract UNOPS to manage the construction of the CECs, it is vital to ensure that they are providing good value for money. This section breaks down the significant cost components of the UNOPS construction budget to assess whether their estimates represent good value for money compared to other construction projects in South Sudan.

The CECs already have 4 classrooms, an administration block, and 8 latrines. This phase of construction is to build 2 dormitory blocks (for 50 students each); a kitchen, dining area and food store; 2 four-door pit-latrine blocks for the dormitories; a 2-bedroomed house for the CEC principal; an 8-bedroomed house for other CEC staff; 2 two-door pit-latrine blocks outdoors for the staff accommodation; fencing and gates around compound with small guard house; water supply and electricity generation.

The unit cost for completion of each CEC ranges from $1,363,860 to $2,073,690 depending on the location. The average unit cost is $1,612,376 or £1,026,991.

Table 11.1 Overall CEC Unit Cost (USD)

Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
$1,612,376	$1,486,290	$1,567,930	$2,073,690	$1,778,000	$1,363,860	$1,363,860	$1,653,000

1. Unit cost per square metre

Much of the construction can be broken down into a unit cost per square metre (this is true for the dormitories, kitchen, dining hall, store room, principal's, staff and guard houses). This varies from $710/m^2 in Western and Central Equatoria to $1,215 in Upper Nile. This cost is extremely

high when compared to DFID's international benchmarks for education construction projects. However, they are more reasonable when considered in line with the South Sudan context, which has extremely high costs of importing raw materials because of poor transport infrastructure.

Table 11.2 Unit costs per metre squared (USD)

USD/Metre squared	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Phase 2	**886**	**815**	**855**	**1215**	**1000**	**710**	**710**	**900**
Previous UNOPS in same states (2010-11)	787	677	712	1010	947	589	589	988
DFID community schools construction project (UNOPS 2011)[a]	629	580	-	665	644	-	-	627
BSF unit costs (2010-11)[b]	620	736[c]	587	628	379	970	393	648[d]
CEC Phase 1 2007[e]	600							
MDTF primary schools 2009[e]	450							
Regional Benchmarks[f]								
International competitive bidding	270							
National/local competitive bidding	180							
Community managed programmes	100							

a = These are unit costs for classroom construction. Unit costs for kitchen and store room were lower at $540 and $500 respectively.

b = BSF costs generally inflated by including office blocks as well as classrooms in total cost figure but only dividing by classroom size for unit cost.

c = Unit cost inflated by borehole and latrine not separated from costs.

d = Unit cost figure from 2009/10 because latest available. All other BSF figures from 2010/11.

e = Estimates from Ministry of Education.

f = From DFID Guidance Note July 2010, “Delivering cost effective and sustainable school infrastructure” by Bonner, Das, Kalra, Leathes and Wakeham

As can be seen in Table B2 the proposed unit costs for this construction project are at the top of the range. These costs are based on previous UNOPS experience in the same states in the past year (average unit cost $787). An increment of 20% has been added to these costs (for all states except Northern Bahr-El-Ghazal and Warrap), 8% of which for the more sophisticated design required (partition walls, tiling, electrical points etc.) and 12% for inflationary increases in construction materials.

These costs seem too high for two reasons. First, the UNOPS construction projects which are used as a baseline to which the increment is being added to are already more expensive than other comparable construction projects. The average unit cost for both DFID's community school construction project (also implemented by UNOPS) and for BSF's various school construction projects[46] are $629 and $620 respectively, considerably lower than the average UNOPS baseline cost of $787. Indeed the BSF unit costs are somewhat inflated as they fail to strip out non-classroom costs such as offices and in one case a borehole and latrines.

Ministry of Education estimates for construction from phase 1 of CEC construction (2007) and MDTF primary school construction (2009) are less up-to-date than the other comparator figures, but still give further weight to the evidence that the proposed CEC phase 2 construction costs are too high.

The second reason these costs seem too high is that the 20% increment is likely excessive. The necessity of a more sophisticated design (e.g. tiling) across all the CEC construction should be carefully considered. If deemed surplus to requirements a lower unit cost should be negotiated. In addition, different unit costs for different parts of the construction should be requested. For example, perhaps the more sophisticated design is more relevant to staff housing than for the kitchen, dining area and store room. In the DFID-funded UNOPS Community School Construction project, unit costs for kitchens and store rooms are notably lower than those for classrooms (an average of $520 rather than $629).

[46] The Basic Services Fund is a DFID project which has constructed a number of schools in South Sudan. Construction is generally implemented by a range of different NGOs.

Furthermore, the inflationary factors driving up unit costs are likely short-term, and should be closely monitored until negotiations are finalised. The North-South border will not be closed indefinitely, and equally the Government is starting to make strong efforts towards closing down illegal customs points. If progress is made while negotiations are ongoing with UNOPS, then lower costs should be negotiated.

Summary recommendations on $/m^2 unit costs:

- **Baseline unit costs from BSF experience should be targeted**
- **Different unit costs for different parts of the construction should be requested based on each part's relative need for more sophisticated design**
- **Short term cost factors driving up unit costs should be carefully monitored until contract is finalised**

2. Unit costs for latrines

Table 11.3 Unit costs per latrine (stanch)

USD / Latrine (stanch)	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Phase 2	5,036	4,250	5,000	6,250	5,750	4,250	4,250	5,500
Previous UNOPS (2010-11)	6,445	6,445	-	-	-	-	-	-
DFID community schools construction project (UNOPS 2011)	2,250	1,500	-	3,000	2,400	-	-	2,100
BSF (2009/10)a	1,426	1,471	-	2,206	1,426	1,904	823	724
MOE estimate	3,000							
DFID regional benchmark	1,250							

a = Overall average for BSF 2010/11 is $1,485, but state breakdown not available from data.

The average unit cost for latrines is $5,036. This compares to a unit cost of $2,250 per latrine for the UNOPS implemented DFID Community School Construction project and a cost of just $1,426 for BSF funded latrines. There is no apparent justification for the extra cost at CECs, so it seems clear this unit cost needs to be reduced.

A further recommendation would be for the latrines at one of the dormitories to be separated into two separate two door latrines, rather than one block of four. This would allow for girls' latrines to be located separately from boys' latrines. In the reasonable future the majority of teachers at the CECs will be male since only 12% of teachers are female.[47] As such it is impractical for one dormitory to be dedicated to women, and one to men (although this should be an eventual goal as gender equality in the teaching workforce is achieved). One of the dormitories will need to be used by both men and women, and to make the facility more attractive for female teachers, it would be appropriate to ensure they have separate sanitary facilities.

The unit cost for two two-door latrines will be marginally higher than for one four-door latrine. The present UNOPS estimates suggest an average increase of $300 per latrine. This would seem good value-for-money if it attracts more female teachers, which is a major goal of the overall Teacher Professional Development Initiative.

Summary recommendations on latrine unit costs:

- **Latrine unit costs must be reduced**
- **One dormitory should have separate latrines to allow for both boys and girls in same dormitory block**

[47] Page 110 of "Education in South Sudan: Status and Challenges for a New System (World Bank 2011)

3. Unit cost for water supply

Table 11.4 Water supply and unit costs

USD / Water source	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Water Supply 1 (borehole with hand pump)	16,000	13,000	15,000	23,000	18,000	13,000	13,000	17,000
CEC Water Supply 2 (borehole with electric pump)[a]	50,429	45,000	50,000	60,000	55,000	45,000	45,000	53,000
CEC Water Supply 3 (rainwater harvesting)[b]	10,429	8,000	10,000	15,000	12,000	8,000	8,000	12,000
Total CEC Water Supply Cost	76,857							
Regional benchmark for school water supply cost	7,500							

a = Borehole with submersible pump and 10,000 litre elevated steel water tank

b = Rainwater harvesting with 20,000 litre plastishell tank

The average unit cost for a borehole fitted with a hand pump is $16,000; for a borehole with electric submersible pump and elevated 10,000 litre water tank is $50,429; and for rainwater harvesting with 20,000 litre tank is $10,429. The overall unit cost for water supply to the CEC is $76,857.

The DFID international benchmark for providing a school with a water source is $7,500.[48] This is seemingly based on one source of water supply. As such the key question is whether all three sources with such a high storage capacity are necessary. The main water supply will be

[48] Bonner et al. (2010), "Delivering cost effective and sustainable school infrastructure", DFID Guidance Note

the borehole with electric pump. Rainwater harvesting cannot be relied on as a year-round water source, while the borehole with hand pump is designed as a backup for when the electric pump is not working.

A recommendation would be to explore the possibility of putting both the hand pump and electric pump at the same borehole, rather than needing to construct two separate boreholes. This is possible as long as the casing is large enough to accommodate both pumps. However, in South Sudan the standard casing is only 4-inch, which is not large enough. As such it seems important to investigate how feasible it would be to source a different casing size.

Table 11.5 Unit costs for boreholes with hand pump

USD / Borehole with hand pump	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Water Supply 1 (borehole with hand pump)	16,000	13,000	15,000	23,000	18,000	13,000	13,000	17,000
Previous UNOPS (2010/11)	10,500	10,500						
DFID Community Schools Construction Project (UNOPS 2011)	20,500	12,000	-	30,000	20,000	-	-	20,000
BSF (2009/10)[a]	14,210	14,475	12,560	13,345	12,993	12,414	19,383	14,301
BSF Boreholes in Sediment	13,208[b]							
BSF Boreholes in Basement	15,548[b]							

a = BSF cost data for 2010/11 not yet finalised, as costs may increase due to possibility of dry boreholes.

b = Average across all BSF states, not only the 7 states considered here.

Comparing the individual water source unit costs, the borehole with hand pump cost is actually lower than DFID's Community Schools Construction Project, but higher than the previous UNOPS experience example given from one of the same states, and higher than costs from

BSF experience. BSF have also usefully broken down their unit costs to show that boreholes are more expensive when drilled in basement rather than sediment ($15,548 vs. $13,208). It is recommended that the CEC borehole unit costs are differed based on the soil type that will be drilled into.

Table 11.6 Unit cost for boreholes with electric pump

USD / Borehole with electric pump	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Water Supply 2 (borehole with electric pump)[a]	50,429	45,000	50,000	60,000	55,000	45,000	45,000	53,000
Previous UNOPS (2010/11)[b]	31,968[c]	28,900				36,300		

a = With 10,000 litre elevated tank

b = With 2,000 litre elevated tank

c = Average also includes unit costs from Unity and Jonglei states ($37,400 and $25,270 respectively)

Table 11.7 Unit cost for rainwater harvesting

USD / Rainwater harvesting	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CEC Water Supply 3 (rainwater harvesting)[a]	10,429	8,000	10,000	15,000	12,000	8,000	8,000	12,000
Previous UNOPS (2010/11)[b]	3,100	3,100						
DFID Community Schools Construction project (UNOPS 2011)[c]	2,200	1,500	-	2,800	2,000	-	-	2,500
Unit cost per litre								
CECs	0.52	0.40	0.50	0.75	0.60	0.40	0.40	0.60
Previous UNOPS	1.55	1.55						
DFID Community Schools Construction Project	2.20	1.50		2.80	2.00			2.50

a = With 20,000 litre capacity

b = With 2,000 litre capacity

c = With 1,000 litre capacity

The unit cost of the borehole with electric pump is higher than other UNOPS experience, although this is likely partly explained by having a 10,000 litre tank rather than a 2,000 litre tank. The unit cost for rainwater harvesting is most appropriately considered in unit cost per litre capacity. Previous UNOPS projects have installed rainwater harvesting with a capacity of just 1,000 or 2,000 litres. The CECs will have a capacity of 20,000 litres and as such they have a considerably lower unit cost per litre.

Summary recommendations on water supply unit costs:

- **Feasibility of combining both hand and electric pumps at same borehole should be investigated**
- **Borehole with hand pump unit cost should be reduced in line with BSF costs**
- **Borehole unit costs should be differentiated based on soil types**

4. Electricity generation

The principal power source for the CECs will be solar panels. In South Sudan there have not been many construction projects of an equivalent scale that have involved solar panels, so it has not been possible to get a benchmark cost figure.[49] The average cost of solar panels per CEC is $135,429. In terms of solar panels per metre squared the average unit cost is $128. If more information becomes available on the costs of solar panels in South Sudan, these unit costs will be useful benchmark comparators.

There will also be a back-up 25kVA generator at each CEC. The unit cost of the generator in terms of its Juba price is $19,000.[50] This is in line with the unit cost from a private sector quote from Ezentus for a 20kVA generator of $14,935 and for a 30kVA generator of $24,650.

It has been possible to compare the lifecycle costs of having solar panels rather than a generator. This analysis strongly supports the choice of solar panels as the principal power source for CECs.

[49] ESP International, a private construction company with experience of installing solar panels in Juba was contacted. They offered to provide a quote but needed full design specifications for the CECs including projected power usage. This could be taken further as design negotiations continue, but was beyond the scope of the present economic appraisal.

[50] This cost is then marked up for each state to include a 30-40% delivery cost and $11,500 for housing, cabling and connection.

Table 11.8 Lifecycle costs of solar panels vs. diesel 25kVA generator

	Solar Panels	25kVA Generator
Installation cost per CEC	$135,429	(incurred anyway for back-up)
Fuel Cost & Maintenance per year	$2,000	$23,200
Saving per year	$21,200	
Time to pay off investment	6.4 years	
Savings if 25 year life cycle	$394,571	
Life cycle savings for 14 CECs	$5.5 million	

A 25kVA generator would cost about $23,200 per year to run in terms of fuel costs and maintenance.[51] Solar panels would require significantly less maintenance costs and no fuel costs. The unit cost for solar panels per CEC is $135,429. Assuming 50% maintenance costs for solar panels compared to a generator, it would take less than 6 and a half years for the solar panels to justify their extra investment. Assuming a minimum 25-year lifespan for the CECs, this would imply a saving of $394,571 for each CEC compared to using a generator. This is a saving of $5.5million across all 14 CECs.

As such the investment in solar panels rather than reliance on a generator would seem excellent value for money. There are also significant benefits to the environment from using solar panels rather than high-carbon producing generators which should be added to the direct monetary savings. Together these present a very strong justification for the choice of solar panels.

[51] Assuming consumption of 4.5 litres per hour, 8 hours per day, 22 days per month and 12 months per year. Maintenance is estimated at $4,000 per year.

A risk that will have to be carefully monitored, however, is that there is not sufficient technical capacity within South Sudan to repair solar panels should there be any troubles. This could mean that should the solar panels have any problems, CECs may simply use their back-up generators instead anyway.

Summary recommendations on electricity generation unit costs:

- **Installation of solar panels is sensible based on lifecycle cost comparison vs. generators**
- **Technical capacity within South Sudan for repairing solar panels should be investigated**
- **Appropriate cost of solar panels should be independently verified by an engineer or through a full private sector quote**

5. Furniture

Table 11.9 Unit costs for furniture

USD / unit cost per classroom	Average	Eastern Equatoria	Lakes	Upper Nile	Northern Bahr-El-Ghazal	Central Equatoria	Western Equatoria	Warrap
CECs[a]	9,036	7,500	8,750	11,250	10,000	7,500	7,500	10,750
DFID Community School Construction project Primary Schools[b]	2,500							
DFID Community School Construction project Secondary Schools[b]	6,250							
UNHCR - TTIs[c]	?							
Regional benchmark[d]	2,000							

a = Total cost is for furnishing four classrooms as well as offices. Unit cost calculated by dividing by 4, so likely overestimating costs per classroom since also includes furnishing for offices

b = Current guidelines are for $20,000 per primary school and $50,000 per secondary school (with 8 classrooms per school). Furnishing has not yet been done, so these are indicative costs only

c = Data not yet made available by UNHCR

d = Cost for furnishing a classroom for 60 students. Bonner et al. (2010), "Delivering cost effective and sustainable school infrastructure"

The average unit cost for furnishing a CEC's classrooms and offices is set at $36,143. This is equivalent to a unit cost per classroom of $9,036 (although note that this figure is inflated by furnishing the offices). This unit cost per classroom is higher than the amount budgeted for by the DFID Community School Construction project ($2,500 and $6,250 for a primary and secondary classroom respectively) and more than 4 times

higher than DFID's regional benchmark cost for furnishing a classroom. As such there would seem to be clear scope for cost reductions, although this should be based on a careful analysis of exactly what is planned to be included in the furnishings.

The Japanese government funded the furnishing of a TTI, which was implemented by UNHCR. They have not yet made cost figures available; however, this would also be a useful cost comparison if the data could be found.

The cost of furnishing the rest of the CECs is on average $115,429. This is to cover all furniture and appliances for the two dormitory blocks, two staff houses, the kitchen and dining hall. Given this high cost, it will be necessary to investigate the inventory item by item to see if everything included is necessary and whether the cost is justifiable.

Summary recommendations on furniture unit costs:

- **Costs per classroom seem high and should probably be reduced**
- **Costs for furnishing the rest of CECs are very high and need to be investigated in close detail item by item to see if any cost reductions are appropriate**

Overall summary and recommendations on UNOPS costs

In general the costings presented by UNOPS are not completely unreasonable but they do seem higher than necessary. DFID and/or USAID should push hard to lower these costs as negotiations move forward. The possibility of contracting other management agents should not be dismissed, since without this risk of losing business UNOPS do not have any major incentive to lower their costs.

If another management agent were to be contracted then the cost-savings from combining this project with USAID's TTI construction project would be lost. However, the savings from lowering unit costs (e.g. to BSF levels) could potentially outweigh this, implying that this option should not be completely ruled out.

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