Ex post evaluation – Vietnam

Sector: Electric power transmission and distribution (CRS code: 23630)
Project: Improving Energy Efficiency in Rural Areas of Vietnam (BMZ No 2009 66 663)*
Implementing agency: Electricity of Vietnam (EVN)

Ex post evaluation report: 2020

		Project (Planned)	Project (Actual)
Investment costs (total)	EUR million	144.00	161.64
Counterpart contribution	EUR million	24.00	41.64
Funding	EUR million	120.00	120.00

*) Random sample 2018

Summary: The Improving Energy Efficiency in Rural Areas of Vietnam measure included rehabilitating, modernising and expanding the rural electricity grids in northern, central and southern Vietnam. The three regional energy suppliers were responsible for its implementation. As part of the measure, low-voltage grids, medium-voltage grids, substations and transformers were installed in northern, southern and central Vietnam. As a result, the measure played a role in strengthening the Vietnamese distribution network by ensuring that rural areas were better connected to the national electricity grid.

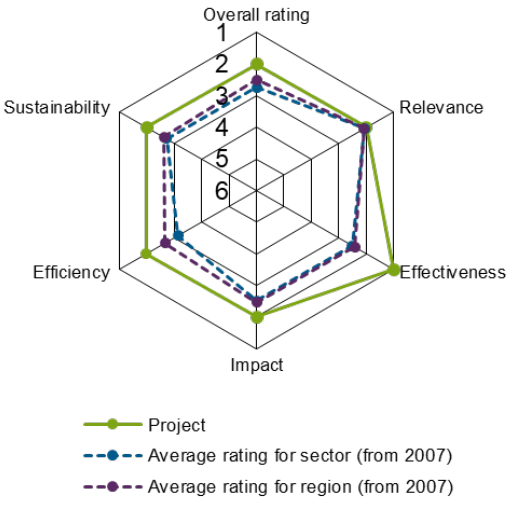
Development objectives: The project objective (outcome level) was to decrease electric power transmission and distribution losses (T&D losses) in the project regions and, in turn, deliver a reduction in the resulting CO_2 emissions. This goal was to be achieved by implementing the above-mentioned energy efficiency measures. Another aim was to provide a reliable and affordable electricity supply capable of meeting demand in rural areas. The developmental objective (impact level) was to support an environmentally sustainable development in Vietnam and combat climate change on a global level by reducing greenhouse gas emissions as well as strengthening local economic development.

Target group: The project's target group was all end-use consumers in the relevant regions, who were intended to benefit from having a reliable and affordable electricity supply.

Overall rating: 2

Rationale: Improving energy efficiency was an important measure at the time, as it accompanied the integration of former cooperatives into the national grid. However, as of the evaluation, the rationale behind using climate action funds to finance the activities has still not yet materialised. All the project indicators were surpassed, although the ultimate completion date was delayed by almost two years due to protracted tendering processes.

Highlights: The effective implementation is a particular highlight. Compared with the original plans, it was possible to build a number of extra lines and all the indicators were surpassed. At the same time, the results strongly improved the living conditions of the population in the rural regions, as gleaned from interviews on the ground.



Rating according to DAC criteria

Overall rating: 2

Ratings:

Relevance	2
Effectiveness	1
Efficiency	2
Impact	2
Sustainability	2

Relevance

Since the Dong Moi reforms, the Vietnamese economy has grown very strongly in recent decades – even by global standards. For instance, the country's average growth rate between 2000 and 2010 was 7% per year.[1] In addition, energy demand increased so sharply that it could not be met during peak periods. By 2009, the electrification rate was already 96%. As a result, the Vietnamese government focused primarily on improving the quality of the electricity supply. The high levels of transmission losses within the distribution networks posed a problem. It was only once EVN was founded as a central energy authority in the 1990s that these losses could be significantly reduced – from 26% in 1992 to a nationwide average of 9% in 2014.[2] [3] This was due in no small part to the integration of local cooperative energy companies at the final distribution level into the centralised structure, which began in 2009. This gradually helped to reconfigure the grid, facilitating better connections between medium and low voltage networks.

Alongside the strong economic growth and related increase in energy consumption, CO_2 emissions also rose from 17.3 million tonnes in 1990 to 106.1 million tonnes in 2007.[4] The results chain underpinning the project was intended to increase energy efficiency in rural areas. The measure involved rehabilitating existing power lines and replacing electricity pylons, transformers, and electricity meters in rural areas of northern, southern and central Vietnam. The intended outcome was for both T&D losses and CO_2 emissions to be reduced, resulting in a more reliable electricity supply for rural households. Subsequently, the productivity of rural regions was to be increased through cheaper electricity, which in turn would make a positive contribution to economic growth. Another assumption was that the increased use of electrical appliances would relieve women of household chores, increasing their labour market participation. Figure 1 shows the expected results.

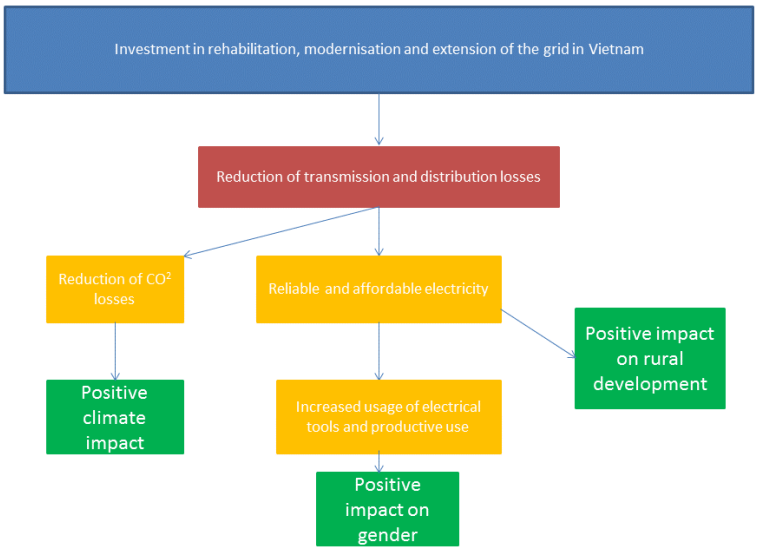
[1] Source: World Development Indicators.

[2] Source: World Development Indicators.

[3] The desire to reduce T&D losses to below 6% by 2030 was listed as a goal in the National Energy Efficiency Programme for 2019 to 2030, which was adopted in mid-2019.

[4] Danish Energy Agency (2017). Vietnam Energy Outlook Report (available online): https://ens.dk/sites/ens.dk/files/Globalcooperation/Official_docs/Vietnam/vietnam-energy-outlook-report-2017-eng.pdf

Figure 1: Results chain for the intervention



From today's perspective, the assumed results chain is only partially plausible and makes it apparent that there are problems at the final stage. While a reduction in T&D losses does directly result in more reliable and, potentially, cheaper electricity, the existing research studies do not provide confirmation of this having a causal effect on the desired outcomes – particularly in terms of positive gender effects and to some degree in terms of positive economic development in rural regions.[5] Nonetheless, it is worth noting that the Vietnamese evidence is generally positive. Potential positive effects on the climate are also only an indirect possible result of the project considering Vietnam's energy mix, which was already half comprised of fossil fuels in 2017, and which is due to be expanded by five new power plants, four of which are coal-fired power stations.

The rehabilitation of electricity lines and substations was one of the main priorities for the Vietnamese government and, in turn, for the state-owned electricity company (EVN) – as well as being part of the national energy development plan from 2010, which was in effect at the time. At the same time, the project was harmonised with similar programmes from the Asian Development Bank (ADB) and the World Bank. Both donors focused on rehabilitating and expanding rural electricity lines. These factors also confirm the relevance of the chosen approach. In interviews, both donors confirmed the high priority and high relevance of the approach adopted for the project-

At the time of the project appraisal, energy was not a priority practice area in development cooperation between the German Federal Ministry for Economic Cooperation and Development (BMZ) and Vietnam. This began to change in 2015, five years after the project under review was appraised. The project was financed via the international climate initiatives, although its relationship with climate issues should be called into question.

Overall, considering the rising energy demand accompanying a prospering economy, the project was highly relevant – especially for Vietnamese end-use consumers. However, the assumed impacts on economic development, gender and the climate (in the latter case, primarily due to funding levels) are clearly long-term in nature, with little supporting evidence available to date – especially considering the energy mix in Vietnam at the time.

Relevance rating: 2

[5] For a summary of the literature, see Evaluation Update 7 from the FC Evaluation Department.

Effectiveness

The project objective at outcome level was to significantly reduce T&D losses and provide a reliable, eco-friendly, and affordable power supply.

Target achievement at the outcome level is summarised in the table below.

Indicator	Status PA, target PA	Ex post evaluation
(1) Technical T&D losses are 10% or lower	Baseline value: 5%–37%; 25% on average Target value: 10% maximum	Achieved NPC provinces: 6.1% CPC provinces: 5.1% SPC provinces: 5%
(2) Grid availability is at least 95% (2a) SAIDI (2b) SAIFI	N/A	Achieved (2a) SAIDI (2018) NPC: 6 SPC: 2.6 CPC: 6.5 (2b) SAIFI (2018) NPC: 964 SPC: 846 CPC: 485
(3) High-quality electricity supply in the project region	Baseline: N/A Target value: comply with Vietnam's distribution code/grid code, operate based on EN 51160 criteria	Achieved

NB: SAIDI stands for system average interruption duration index, and SAIFI stands for system average interruption frequency index.

Indicator 1: T&D losses should be less than 10%

The T&D loss indicator had already been achieved at the time of the final follow-up in 2017 in all three project regions in Vietnam, and the positive trends have continued since. It is not possible to obtain exact values for 2009 at every level. Data is only available from after the point at which the local cooperatives were integrated into the NPC, CPC and SPC. Previously, the cooperatives often only distributed electricity in the low-voltage range using diesel micro-grids, which makes it difficult to determine technical T&D losses. Figures from 2018 show that the T&D losses were 5.6% on average across all NPC provinces. Only the local authorities with FC investments had T&D losses of 6.1%. In the CPC province, the average T&D loss was 5.12% in 2018, while the same figure for the provinces supported by FC financing was 4.99%.

T&D losses have continued to fall in recent years. We can assume that this trend will persist, albeit potentially at a slower pace.

Indicator 2: grid availability is at least 95%

The average number of power cuts in NPC provinces fell from 57 per year in 2012 to 6 per year in 2018. The figures in the CPC provinces are similar, with 6.5 power cuts in 2018, while the numbers improved in the SPC provinces from 2.9 power cuts in 2013 to 2.6 in 2018. The figures in the FC-financed areas are slightly higher in some cases, with 14.3 power cuts in NPC areas and 13.9 in CPC areas. This is explained by the areas' different topographical conditions.

In terms of the SAIDI, the duration of the power cuts in the three regions has also fallen heavily. This dropped from 2,820 minutes in 2016 to 846 minutes in 2018 in the SPC areas, 5,246 minutes in 2013 to

485 minutes in 2018 in the CPC areas, and 10,300 minutes in 2012 to 964 minutes in 2018 in the NPC areas. The grid availability indicator comes to at least the 95% level with 525,600 minutes annually, meaning that it was comfortably achieved. However, it is worth considering that this only relates to grid availability at medium-voltage level (municipal distribution), as it would have been too complicated to measure at low-voltage level (household distribution). The impressions we gained on the ground generally confirmed that the rehabilitated electricity lines were also constructed with greater mechanical durability in the low-voltage range, enabling them to withstand tree growth or poor weather conditions. In interviews, affected households reaffirmed that the reliability of their electricity supply improved substantially. In particular, the larger conductor sizes led to greater use of electrical appliances and, in turn, increased capacity among small businesses in the villages.

Indicator 3: high-quality electricity supply in the project region

The grid codes applicable in the distribution network were already being adhered to during the final follow-up and continue to be adhered to. As a result, this indicator was achieved.

One of the distinctive characteristics in Vietnam is that many domestic electricity meters are located outside the home – generally, on the nearest pylon. In these cases, the homeowner themselves is responsible for connecting their home to this pylon, meaning that they will also bear the brunt of T&D losses in their local section. While T&D losses and voltage fluctuations on the “last metre” were a common problem before the rehabilitation work, these have now been significantly reduced thanks to the rehabilitation and targeted expansion of the grid. Despite not being represented in the indicators above, this nonetheless deserves a special mention.

In view of the excellent indicator achievement, we rate the project’s effectiveness as very good.

Effectiveness rating: 1

Efficiency

The programme proposal envisaged the project being completed in early 2014. However, it ultimately only came to an end in late 2015. This was a consequence of the protracted tendering processes for the supply of products and services, as well as the disbursement of unearmarked funds in two additional phases. The products and services to be supplied were subject to nationwide competitive bidding under the FC procurement policy and Vietnamese tendering rules. The quotes received were significantly lower than expected in some cases, enabling the quantity structure to be increased substantially. However, this entailed two more rounds of bidding, which naturally caused further scheduling delays. This was the case for SPC, NPC and CPC. Ultimately, this resulted in 26,000 more electricity meters, 6,550 more kilometres of medium- and high-voltage line, and 1,130 more substsations being installed than had originally been planned. The rehabilitation work made it possible to deliver a more reliable electricity supply in all project regions. There were no alternative options for improving electrification, meaning that the measure is deemed successful – including in terms of production efficiency.

In Vietnam, households themselves bear the cost for connecting their home to an electricity meter. We can assume that the collection rate improved thanks to the installation of up-to-date meters, even though precise data is unavailable. At the same time, the electricity meters had a positive impact on billing efficiency according to interviews with local NPC and CPC staff. However, there is also a lack of reliable data to this effect. In broader terms, the World Bank states in a 2016 report that almost 100% of electricity in Vietnam is billed and paid for.[6]

The costs for one kilometre of electricity line are VND 550–680 million in the NPC region, VND 283–423 million in the CPC region and VNC 352 million in the SPC regions. The costs for a single substation were between VND 345–360 million in NPC and VND 266 million in SPC. The costs for a transformer were VND 150–220 million in NPC, around VND 244 million in CPC and roughly VND 118 million in SPC. The discrepancies primarily stem from the varying conditions across the different regions. However, we cannot preclude the possibility that the regional tendering processes also played a role in the cost struc-

[6] Maweni, J. and Bisbey, J. (2016). A financial recovery plan for Vietnam electricity (EVN). The World Bank Group: Washington, DC.

tures. Generally speaking, the costs under these circumstances are appropriate by international standards.

Despite the installation processes being delayed, the efficiency level can still be rated as good.

Efficiency rating: 2

Impact

The overarching developmental impact was defined as contributing to advance environmentally sustainable development in Vietnam and helping to protect the climate on a global scale by reducing greenhouse gas emissions as part of the programme proposal. The aim to strengthen the capacity of state and non-state actors in the energy sector to implement the Green Growth Strategy was later added. An annual reduction of 185,000 tonnes of CO_2 emissions was selected as the indicator in the programme proposal. However, this indicator was not monitored during the final follow-up and the project was defined as successful if it achieved the outcome-level indicators. Nonetheless, to provide a better evaluation, the impact section below is split into impacts on climate protection and impacts on the target group.

Contribution to advance environmentally sustainable development in Vietnam and reducing greenhouse gas emissions

The increased conductor diameters and replacement of old transformers brought about particularly significant reductions in T&D losses and, at least ostensibly, in lower CO_2 emissions. At the same time, many households that were previously served by cooperatives were also integrated. All these factors resulted in a more stable electricity supply. However, the more reliable electricity supply led, in turn, to increased demand for electricity. Since Vietnam mainly invested in fossil fuels to meet the growing energy demand, it ultimately was not possible to cut CO_2 emissions – and, indeed, there was an absolute increase in CO_2 emissions when assessed against a scenario where no rehabilitation work was undertaken. For instance, the percentage of energy from renewable sources fell from 53% to 24% between 2000 and 2015, while coal increased from 15% to 35% in the country's energy mix over the same timeframe.

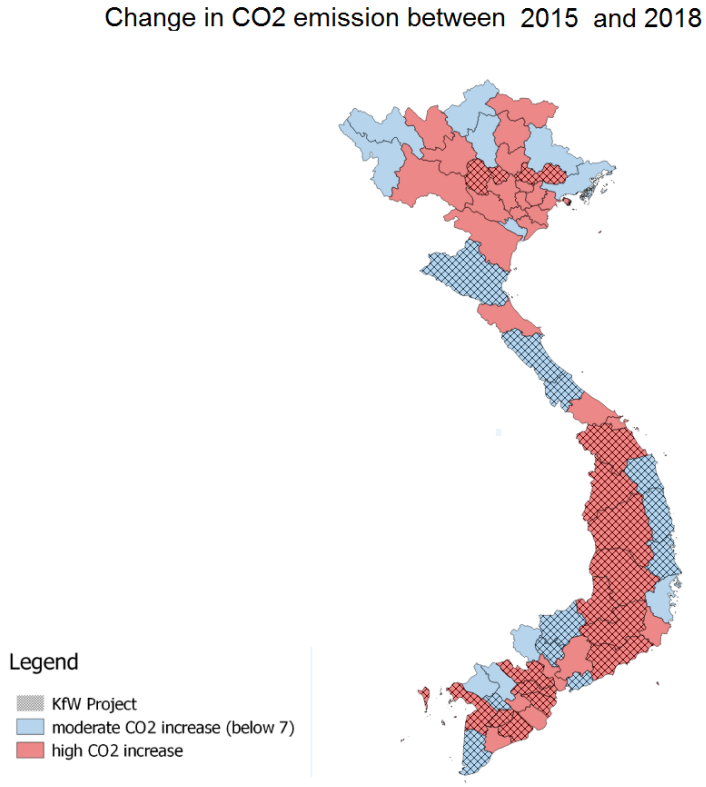
Nevertheless, efforts were made to reduce the share of CO2 emissions compared with a business-as-usual scenario. For instance:

a) By deliberately using transformers with low levels of T&D losses

b) By extending the transmission lines, enabling many more households to get connected and allowing existing households to significantly shorten their connection lines, which were heavily affected by T&D losses

In spite of these efforts, it was not possible to deliver an absolute reduction in CO_2 emissions, as had originally been planned in the financing proposal. Despite a one-time rise in greenhouse gas emissions, the now highly developed network provides the foundation for the Green Growth Strategy, which was launched by the Vietnamese government in 2014 and which aims to significantly increase in the share of renewables. Over the long term, this will be the cornerstone of a sustainable energy sector. The change in CO2 emissions between 2015 and 2018 could also indicate lower emissions in FC project regions than in other regions of Vietnam. CO_2 emissions did increase in the FC project regions from 2015 to 2018, albeit less sharply than in other Vietnamese regions. This is a significant result, amounting to a 10% gap. However, these outcomes cannot be directly linked to the FC project.

Fundamentally, delivering lower greenhouse gas emissions than would have existed in a business-as-usual scenario is the starting point for achieving future reductions. But these will only be able to materialise when the energy mix in Vietnam changes as planned. At this time, the impacts on the climate can only be considered more negative than positive.



Improving living conditions

In addition to the first goal of reducing greenhouse gas emissions, the second goal was to improve living conditions. To assess this, households and manufacturers in CPC and NPC areas were surveyed, and the academic literature was evaluated. All the households on the ground mentioned the high reliability of the electricity supply. Unlike the situation before the project was implemented, there are no more unannounced power cuts. Pre-announced outages are imposed when the power has to be cut (e.g. due to an approaching storm). Consumers are generally made aware of these on the television or via notifications on their mobile phone. Small, home-based businesses from all sectors are equally impressed by the substantially higher quality of the electricity supply. Nearly all business owners, especially heads of household enterprises, stated that the more reliable flow of electricity led to an improvement in their business income. These household enterprises could have an important role to play in Vietnam in terms of increasing incomes and preventing inequality.[7] A rice miller, for example, switched from a diesel-powered to an electric-powered mill, doubling his productivity in the process. One carpenter emphasised that the improved electricity quality meant that he could now buy new, electric-powered equipment. Since these require less physical strength, his wife can now help him to build new furniture in the shop.

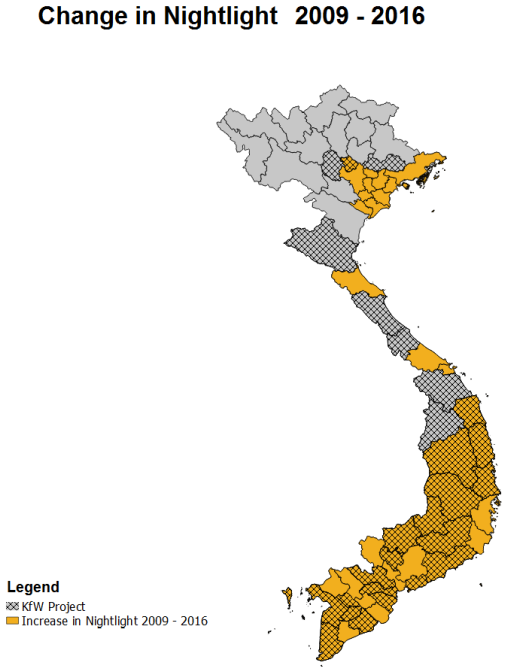
These results paint a highly positive picture of the local living conditions stemming from the grid rehabilitation. Although no large-scale quantitative household surveys have been conducted, there are studies on Vietnam that support this view. For instance, Khandker et al. (2013)[8] report that increased household incomes and an improved educational landscape have been the result of power grid connectivity in Vietnam. Min and Gaba (2014)[9] were able to demonstrate longer-term economic activity from a combination

[7] Oostendorp, R.H., Trung, T.Q., and Tung, N.T. (2009). The Changing Role of Non-Farm Household Enterprises in Vietnam, World Development (37) 3: 632-644.

[8] Khandker, S., Barnes, D.F. and Samad, H. (2013). Welfare Impacts of Rural Electrification: A Panel Data Analysis from Vietnam, Economic Development and Cultural Change, 61(3): 659-692.

[9] Min, B. and Gaba, K.M. (2014). Tracking Electrification Using Nighttime Lights, Remote Sensing (6): 9511-9529.

of satellite data and household surveys, confirming the results of Khandker et al. (2013) over a more extended period. Our own comparison between the FC project regions at the time of the project appraisal in 2009 and in the year of the final inspection in 2016 shows that there was an increase in economic activity in the regions where the FC project was carried out, as measured by the night-time light intensity. However, there are also increases in other regions and no increases in regions with FC-financed projects. This does not answer the causal question of what impact the FC project had in this context. Nonetheless, on average, there are signs of a positive trend in the FC project regions. Overall, we rate the developmental impact on the target group and its economic development as very positive.



Although there was not an absolute reduction in greenhouse gas emissions due to the changing energy mix in Vietnam, the target group benefits significantly from the improved energy supply.

Impact rating: 2

Sustainability

Fundamentally, the energy supplier (EVN) and all the sub-organisations (SPC, NPC and CPC) are technically and financially capable of operating the systems sustainably. Since the project was completed, operation and maintenance have been handled by the respective network operators. Regular maintenance is carried out, and the relevant local points of contact are at a high technical level. Random sample-style visits undertaken as part of the evaluation confirmed the generally positive prior impression.

At the same time, some minor technical issues were discovered and discussed with the local partner responsible. Specifically, there were low-quality junction boxes, the electricity pylons were too far apart, and most of the pylons consisted of two parts. The partner promised to correct the problems.

Electricity rates are politically determined in Vietnam and do not cover the costs, especially in rural areas. The trend among the indicators at outcome level shows a constant improvement on the relevant indicators – including after the final follow-up was conducted. We can assume that this trend will continue. In the same vein, it is likely that the impacts will continue to improve over a longer period of time.

Sustainability rating: 2

Notes on the methods used to evaluate project success (project rating)

Projects are evaluated on a six-point scale, the criteria being **relevance, effectiveness, efficiency** and **overarching developmental impact**. The ratings are also used to arrive at a **final assessment** of a project's overall developmental efficacy. The scale is as follows:

Level 1	Very good result that clearly exceeds expectations
Level 2	Good result, fully in line with expectations and without any significant shortcomings
Level 3	Satisfactory result – project falls short of expectations but the positive results dominate
Level 4	Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results
Level 5	Clearly inadequate result – despite some positive partial results, the negative results clearly dominate
Level 6	The project has no impact or the situation has actually deteriorated

Rating levels 1-3 denote a positive assessment or successful project while rating levels 4-6 denote a negative assessment.

Sustainability is evaluated according to the following four-point scale:

Sustainability level 1 (very good sustainability): The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected).

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and is very unlikely to improve. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The **overall rating** on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a "successful" project while rating levels 4-6 denote an "unsuccessful" project. It should be noted that a project can generally be considered developmentally "successful" only if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are rated at least "satisfactory" (level 3).