Ex-post evaluation – India

Sector: Rail transport, CRS: 21030
Project: Modernisation of signalling system on Delhi-Kanpur journey route, BMZ no. 1997 65 223*
Implementing agency: Indian Railways (IR)

Ex-post evaluation report: 2017

		Project appraisal (Planned)	Ex-post evaluation (Actual)
Investment costs (total)	EUR million	122.85	62.10
Counterpart contribution	EUR million	28.26	17.69**
Financing	EUR million	94.59	44.41
of which BMZ budget funds	EUR million	94.59	44.41

*) Random sample 2016
**) Plus unknown amount of own contributions since end of disbursement (2014)

Summary: Within the scope of the project, a central control of traffic was set up; 38 train stations and sections of track were equipped with automatic block systems and accompanying signalling systems; six marshalling yards were modernised; safety of 150 level crossings was enhanced on the Ghaziabad-Kanpur section (415 km); and the communication system on the Ghaziabad-Kanpur-Mughalsarai section (760 km) was expanded, although only 180 km of this is presently ready for use. At the time of the ex-post evaluation, all the essential work was approx. 90% completed (communication and central control of traffic still in test phase). The original and important plan to equip the trains and signals with an automatic train control (ATC) device was cancelled as a project measure, as the Indian partners wished to test and introduce a nationally standardised solution. The ATC system has not yet been installed on the FC-financed section of track. However, it has been completed or approved on the adjoining sections.

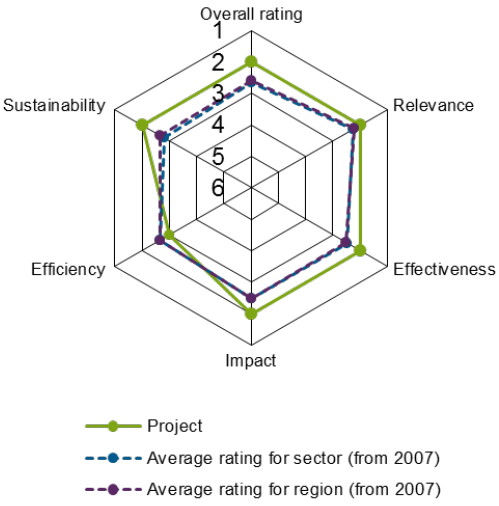
Development objectives: The project objective was to increase the transportation capacity and its utilisation, while also reducing the accident probability on the Delhi-Kanpur project route. The measures overall development objective was to contribute to India's economic development by supplying the increased demand for safe rail transport services.

Target group: (i) Passengers benefiting from more and safer passenger transport, who are generally deemed to be in lower-income social groups, as well as (ii) Major customers of the railway (e.g. fertiliser factories, coal-fired power plants).

Overall rating: 2

Rationale: The evaluation picture is ambiguous: on the one hand, this is a measure of national importance that was realised at lower cost than originally expected, it is highly profitable and it has large cross-project effects with good prospects for sustainability. On the other hand, it includes a delay of over eight years before physical activities started and an implementation time of eight years more.

Highlights: The FC commitment in the railway sector occurred at a time (1997) when bilateral and multilateral donors had withdrawn from the sector, primarily because of the pace of reform. The cost of the project fell significantly below budget, especially owing to the falling price of electronic components.



Rating according to DAC criteria

Overall rating: 2

In spite of intensive efforts, this ex-post evaluation could not be carried out locally. This stemmed from a lack of cooperation on meetings, approval to visit the project route and responses regarding requested information on the part of the project-executing agency, Indian Railways (IR). Instead, an office-based evaluation had to be performed. As a result, certain information was unobtainable or only partially obtainable, especially regarding the project-executing agency, the local physical situation, changes in the rail traffic volume and structure on the project route over time. Further data – especially on the progress of the project – could be extracted from the annual reports and final inspection report (2015) and complemented by details from the consultant.

Relevance

Decades of under-investment have resulted in an investment lag in the railway sector. This has hindered capacity expansion and modernisation of rail traffic, as it still does to this day: between 1950/51 and 2013/14, IR's freight traffic rose by 1,344% and its passenger traffic by 1,642%. Over the same period, the track length only grew by 27%. The share of public transport expenditure spent on rail traffic was 56% in the Seventh Five-Year Plan (1985-1990), but was only 30% by the time of the Eleventh Five-Year Plan (2007-2012). Given this state of affairs, the freight and passenger traffic demand was stretched to the limits of its physical capacity. Consequently, the average speed of trains slowed down and the reliability, punctuality and quality of service dropped. This resulted in a decreasing or shifting demand for freight and passenger transport - for which the rail traffic industry has a competitive advantage - from rail to road traffic .

Nonetheless, the railway sector has shed little of its great importance for India. With a present track length of approx. 66,000 km (34% electrified), India has the second largest railway network in the world. Transport capacity has increased impressively in absolute numbers since the programme appraisal (PA). Freight traffic has increased from 255 billion net tonne kilometres at the time of the PA (1995/1996) to 682 billion ntkm; passenger traffic from 320 billion passenger kilometres to 1,147 billion pkm by 2014/15. With its large distances and without capacity restrictions, the Indian subcontinent has been and remains very well-suited for railway transport, especially of bulk goods such as coal, cement and iron ore. The latter constituted 70% of transport volume in 2014/15.

There were few bilateral or multilateral donors in the railway sector during the 1990s, and the small number of donors who were active had practically all withdrawn. The Asian Development Bank (ADB) refrained from new commitments for around 10 years up to 2002, due to a lack of progress with reform by IR and delays with their projects lasting for years. The World Bank remained uninvolved for 20 years and did not fundamentally re-commit to its support until 2011.

After decades of under-investment, recent years have seen high priority status restored to investments in IR as a pre-condition for economic growth and in particular for stimulating private-sector investment. Between 2011/12 and 2015/16, investment expenditure increased by 60% from $1.0 billion (US dollars) to $1.6 billion per year. However, the inflation rates were 4.91-9.94% per year during the same period, according to the IMF. 52.7% of the investment was funded from the national budget in 2014/15; the proportion financed by loans increased from 23.9% to 28.9%. A further increase to $1.8 billion is envisaged for 2016/17. In addition, investments three times the size of those in the last five years are planned for the next five years. The multiplier effect of the enormous investments planned in the railway sector on GDP was estimated to be 5.73% in 2015.

The most important IR routes form the "Golden Quadrilateral". These link Delhi, Mumbai, Chennai and Kolkata. The quadrilateral's edges and its diagonals of Delhi-Chennai and Mumbai-Kolkata have continued to form the backbone of the Indian railway network. Spanning around 10,100 km, they only constitute 16% of the route network, although they handle around 60% of all freight and 50% of passenger traffic. To date, the Delhi-Kolkata connection has been the most important of these routes. In particular, the project

route of Delhi-Kanpur, on which all the FC-financed measures were implemented, continues to be the most travelled route.

The target group comprised and still comprises the major customers for freight traffic and the passengers for passenger traffic; these benefited from the railways´ increasing capacity and improving safety.

In terms of safety, IR met European standards in 2014 with 0.10 accidents per billion train-kilometres; the number of fatalities the same year, however, was 25,000. At 21.8 per billion pkm, this exceeded the EU average (0.03) many times over. However, one must consider that the the vast majority of train victims fell down or were run over on the tracks, while approx. 10% of fatal accidents occurred at level crossings. Fatal casualties caused by the technical aspects of railway service (collision, derailing, fire) amounted to a relatively very low number of 190 victims. The choice of this project route and design (including the planned safety components) was substantially influenced by the Firozabad rail disaster of 1995, which involved more than 300 deaths.

Even from today's perspective, the identification of project route and design are reasonable and highly relevant considering the importance of the railway for India. The measure continues to be consistent with India's priorities.

Relevance sub-rating: 2

Effectiveness

The underlying project objective was to increase the transportation capacity and its utilisation, while also reducing the accident probability on the Delhi-Kanpur project route. The project's objectives are measured by the following indicators:

Indicator	PA status (1995/96) PA target value	EPE
Number of trains per day and direction, three years after project measures' completion	PA status: 62 trains Target value: 93 trains	105 trains [1)]
Number of signal-related accidents	PA status: N/A Target value: 0 accidents	0 accidents [2)]

[1)] Final inspection, 2015
[2)] Accidents attributable to technical failure on the hardware (signalling systems, rails, rolling stock, etc.)

The number of trains per day and direction was exceeded, and the capacity fully utilised accordingly (refer to "Overarching development policy impacts"). At the time of the PA, the route was already meeting its capacity limit (62 trains per day and direction), and a substantial increase in capacity was no longer possible with the signalling system used at that time. In view of this situation, one can assume that the increase achieved in trains per day was principally attributable to the project sub-measure for renewal of signalling systems. Assuming the present mixture of trains and travel speeds, and supposing ideal management, the evaluator estimates an achievable track performance of approx. 140 trains per day and direction. In the World Bank's programme appraisal of a parallel effort, the Eastern Dedicated Freight Corridor (EDFC) project, it assumes a freight traffic volume alone of 100 trains per day and direction from 2020 onwards. If passengers and freight are separated following the completion of the EDFC parallel route, a reduction in the number of trains per day and direction on the project route can be expected, which in that case will then largely be dedicated to passenger traffic. Nonetheless, a high utilisation level amid falling excess demand is still assumed.

The targets have also been met in terms of increasing operational safety. Incorporating all the approx. 150 level crossings in the automotic line block system[1] technically eliminated a substantial risk (human error) from trains passing through while barriers were open, or from premature opening of the barriers after a

[1] It ensures that multiple trains can drive on the same section of track at a fixed distance from one another.

passing train. This increased the safety of the route. No accidents were reported. The automatic train control device was an important element originally planned within the scope of the project, and would have prevented passage at a signal indicating “Stop”. However, this was removed from the project measures, because IR wished to test and introduce a uniform system nationwide. Since then, introduction of the system has been planned nationwide, including on the FC project route, and is to be financed by IR’s own funds. The system is already in operation and approved for the sections of Delhi-Agra and Ghaziabad-Mughalsarai, respectively, which adjoin the FC financed section.

Effectiveness sub-rating: 2

Efficiency

The project’s implementation lasted an extraordinarily long time. The financing agreement was signed in 1997. The lengthy implementation time can be attributed to the massive delays in concluding the agreements and tenders, as well as in executing the physical work. The consultant was not contracted until 2003, following a five-year delay. Three more years passed before the supply and services agreements were concluded in 2006. The physical works, separate from the renewal of signalling systems, also progressed very slowly and required eight years up to the end of the disbursement period (December, 2014) instead of the 3.7 planned. These delays reflect the high level of inefficiency in project implementation and added a huge burden in project management and administration. At the time of the evaluation, the proportion of measures implemented, including measures pursued with IR’s own resources, was approx. 90%.

However, the delays had no negative effects on the cost of the project, in contrast with the expectation during the PA. Firstly, in large part the unit prices were kept stable despite the delays. Secondly, costs for hardware were considerably lower than foreseen (around 50%). Moreover, cost-saving technical design changes were made. In some cases during the lengthy implementation time, outdated technologies were replaced with newer and predominantly more economical alternatives. IR initially concentrated its work on the component it regarded as the largest and most immediately profitable, the renewal of signalling systems. The production efficiency is considered to be high and the results were achieved at minimal cost.

As expected in the programme appraisal report (PAR), the measure has led to a significant rise in income for IR because of the increasing train frequency. IR’s system of tariffs, as in the PA, is based on freight traffic cross-subsidising heavily loss-making passenger traffic. Until 2016, the revenues provided moderate excess coverage of the operating costs nationwide; since then, IR has generated losses. Considering the halving of investment costs and the significant increase in train frequency at the present system of tariffs of that time, it can be assumed that the investments in the project route are highly profitable. The delays in the project implementation have a negative impact on the measure’s high internal rate of return (36%), which was noted in the PAR. However, this may well have been more than offset by the investment costs being halved. It is not possible to recalculate, as there is a lack of information, especially about operating costs, division of the trains between freight and passenger vehicles, the proportion of different freight types and average distances.

In evaluating the allocation efficiency, the benefits to the national economy must be considered alongside the microeconomic effects. Given the intensive utilisation of this section of track over an accident-free period, it can be assumed that the measure’s anticipated substantial benefit to the national economy has been provided. Namely, this benefit was economic development from the reduction of the excess demand, as well as reduction of pollutant emissions and the risk of accident in comparison with road transport.

The measure is rated as satisfactory, considering the extreme inefficiency in project implementation, which was nevertheless accompanied by high allocation efficiency.

Efficiency sub-rating: 3

Overarching development policy impacts

The measure’s overall objective was to make a contribution to India’s economic development by supplying the increased demand for safe rail transport services. The PAR determined that the indicator for this would be a comparison between net tonne kilometres and passenger kilometres (on the whole network)

that were travelled against those forecasted. Even if this indicator is indeed suitable for measuring effectiveness, and the distance-based data allowed target achievement to be stated more precisely, the data on a national level provide an indication as a proxy.

Indicator	PA status (1995/1996)	Target value/forecast (2011/2012)	EPE (2014/2015)
Net tonne kilometres (ntkm)	255 bn	500-700 bn	682 bn
Passenger kilometres (pkm)	320 bn	600-780 bn	1,147 bn

For freight traffic, the kilometres travelled are at the upper end of the range predicted. The passenger traffic figure surpassed the forecast significantly. Considering the significantly increased number of trains (see “Effectiveness”) on the measure’s section of track (which is important for the entire network; see “Relevance”), and the resulting reductionl in excess rail traffic demand a similar development in terms of kilometres travelled on the project route can be assumed. Even in the event of a downturn in railway transport performance on the whole network, an increase in the net tonne kilometres and passenger kilometres on the route would be plausible, considering the significant increase in the number of trains and the importance of the project route. The resulting contribution to the country’s economic development appears obvious (see “Relevance”): power plant coal, cement and fertiliser are generally in India transported by freight traffic. The same applies for the project route. Value creation is increasing in these industries due to rail transport being inexpensive and more reliable in comparison with roads. The main route of Delhi-Kolkata, on which the project route is located, leads through and to the relatively poor states of Uttar Pradesh und Bihar, respectively. In terms of their development, these states have benefited particularly from improved connection to railway freight traffic. Furthermore, it is plausible that the measure also contributes to social development, as the increased passenger traffic improves the population’s access to employment opportunities, health and education infrastructure and social services in the neighbouring municipalities.

Beyond the aforementioned overarching development policy impacts, rail transport has high potential to reduce greenhouse gases in comparison with road transport. According to calculations by the India Green House Gas Program, in terms of passenger traffic, the CO_2 emission factor of railway transport is 7.9g/pkm as opposed to 15.1 g/pkm for buses. In terms of freight traffic, the CO_2 emissions in railway transport is 9.5 g/ntkm as opposed to 59 g/ntkm for road transport (medium-sized lorry). It can also be assumed that the significantly reduced greenhouse gas emissions from the induced traffic assisted the measure in contributing towards India’s ambitious climate policy goals, although these emissions cannot be precisely quantified because of the lack of data.

Overarching development policy impacts sub-rating: 2

Sustainability

The Golden Quadrilateral mentioned above is of national importance. The Delhi-Kolkata connection is the most important; in particular, the project route of Delhi-Kanpur, which is the most travelled route. One can therefore assume IR’s interest in further expansion and proper upkeep beyond the scope of the project. Qualified personnel are available for operational maintenance of the systems, and were were briefed by the consultant for a number of years. The maintenance is financed from IR’s central upkeep budget, which is adequate in size. The financial situation in autumn 2016, which had deteriorated as stated, may create a risk that could also adversely affect maintenance. However, this is deemed as a small risk, since the systems installed require low-maintenance in the medium term. Additionally, it seems unlikely that IR would disregard one of the most profitable segments of the route network.

Since 2012, the World Bank has financed the construction of a twin-track section reserved for freight transport, which runs parallel to the project route. The World Bank expects that around 100 freight trains per day and direction will travel on this route following completion in 2020. As a result of this, freight traffic may be shifted away from the project route to a significant degree. The functional separation of the low-speed freight traffic from the high-speed passenger traffic offers considerable operational advantages.

Moreover, the World Bank's forecasts indicate that even the expanded project route would not be able to manage the strongly growing traffic volume in the medium term.

Due to the lack of data and IR forecasts, it is impossible to state whether passenger traffic alone completely fulfilled the project objective indicator of "increase in capacity utilised", as a result of parallel route construction. Taking the strongly growing volume of traffic into account, however, little to no risk to the measure's efficiency, effectiveness and overarching development policy impacts are expected.

Sustainability sub-rating: 2

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

Projects (and programmes) 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).