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Break-even point analysis of the Business Plan for a High-speed line in Egypt as a measure of financial sustainability

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Abstract

INECO developed between 2015 and 2017 a study for the Spanish Ministry of Economy and Competitiveness (MINECO) titled "Feasibility Study for a High-Speed Rail between Cairo, Luxor, Aswan and Hurghada in Egypt". In the framework of this study, a financial model was developed that has led to the identification of break-even points that guarantee the repayment of financial costs under different investment and demand scenarios.

This scenario analysis takes on special relevance in a macro economic, financial and situational context of the real economy such as of Egypt's during this period.

This paper presents the main conclusions obtained in the specific case of a High-Speed analysis in Egypt. It is a high-speed railway infrastructure to be developed in a middle-income country, in a corridor highly linked to tourism and in a context of economic uncertainty.

Several investment infrastructure alternatives have been evaluated, assessing the suitability or lack of suitability of making this investment in the country. From the point of view of the financial analysis, the report provides the level of demand, or income, from which the project has found its break-even point in the short and medium term, complemented by the environment conditions in which this circumstance has been estimated.

The Break-even point analysis in the short term of the Business Plan for a High-Speed line at which the system will function without an operating subsidy, as a measure of timing financial sustainability (EBITDA > 0). Additionally, the break-even point in the long term, or discounted payback, could be considered as a relevant indicator to choose among different options for the development of a high-speed network in competition with other transport modes. It can help either on how to schedule investment over time or to evaluate the financial sustainability of an investment. The views expressed in this paper are those of the consultant and do not present an official view of the Spanish Ministry of Economy and Competitiveness (MINECO).

Keywords: Transport planning, investor's return, financial risk, cost benefit analysis, new business plan, long-term economic sustainability

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1. Introduction

Commissioning a high-speed line benefits both the cities and the regions it passes through, as well as the rest of the regions within the country, thanks to its impact overall transport system and the potential intermodality benefits that it implies.

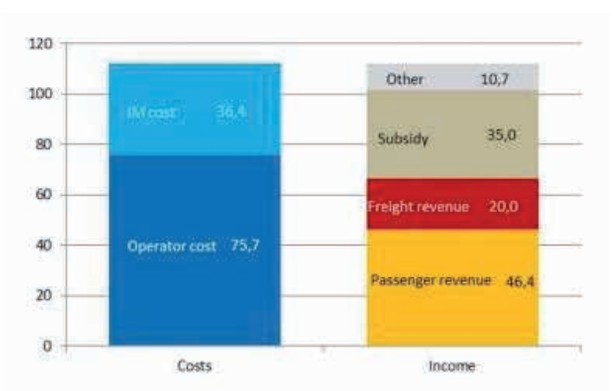
Transport services, along with their infrastructure requirements, occupy a relevant space in the agendas of policy makers. There are many economic methodologies used to evaluate transport infrastructures in general, and High Speed Railway Lines in particular, as a fundamental support in the decision-making processes on which investments and which transport systems are optimal for a country or region.

A commonly asked question among Public Services Senior Management decision makers is which break-even point in high-speed investment would meet financial profitability criteria? Thus, defining the break-even point as the ability to cope with the re-payment of initial investment plus financial return.

2. State of the art

The answer to the question stated above, on whether "to go" or "not to go" for a HSR project based on investors returns and breakeven point depends on numerous elements, profit project vector. As a first approach, they could be synthesized as the cut-off point between the expected revenues once it has started to function against the estimated operating costs. In a more detailed approach, the return required by the financial resources used to make the initial investment should be taken into consideration, as well as the subsequent investments in the expansion of the network capacity and replacement of the assets according to their useful life.

In average, operating costs of the railway system (conventional, freight and HSR lines) rely more on railway undertakings revenues and state subsidies than on the rest of the infrastructure manager's income.



Source: European Commission (2016)

Figure 1. Cost and contribution of the rail sector (billion EUR, 2012 in 2010 prices)

As a result, the break-even point is more precisely defined when complementing calculations with the asset amortization policy or the country's taxation in order to differentiate the effects of indebtedness on the profitability of the different profiles of investors, public of private, that have contributed capital to the project.

Different authors point out that the feasibility of a high-speed line should not be based on deterministic outputs, but on the profitability outcome. Therefore, uncertainty variables

should be explicitly considered as a range that would in turn depend on certain scenarios or key indicators or drivers, as it is set out in Article 101 (Information necessary for the approval of a major project), Regulation (EU) No 1303/2013, stating *"a risk assessment must be included in the Cost Benefit Analysis"*, EUROPEAN PARLIAMENT (2013). This is required to deal with the uncertainty that always permeates investment projects. These ranges would be obtained through modelling the profitability generated by the High-Speed project, whether it be socioeconomic or financial, EUROPEAN COMMISSION (2014).

Examples of these drivers or indicators that may have an impact on the break-even point identification, among others, could be the average cost per kilometre of the initial investment and replacements, the anticipated average maintenance costs, the feasible average cost of the ticket, the scheduling alternatives of the investment made and the scenarios of demand considered.

In the process of prioritizing and selecting public investments, the evaluation of a transport project, and particularly of the size of a new high-speed railway line, commonly includes a socioeconomic cost-benefit analysis, which compares the costs and benefits that the project contributes to the whole of society throughout its useful life. In addition, a financial profitability analysis is carried out, allowing the incorporation of the returns generated by the Business Plan of an investment into the decision-making process, regardless of the public or private ownership of its shareholders.

These practises are aligned with the different guidelines that EU Member Countries are setting, such as:

- To draft business plans by infrastructure managers,
- To manage transport companies according to commercial and profitability criteria,
- To implement ex-ante evaluations of investment projects as a support for the decisionmaking process in the public sector
- To identify the degree of financial sustainability, both in the short and long term, depending on the different profiles of investors.

INECO developed between 2015 and 2017 a study for the Spanish Ministry of Economy and Competitiveness (MINECO), titled *"Feasibility Study for a High-Speed Rail between Cairo, Luxor, Aswan and Hurghada in Egypt"*. In the framework of this study, a financial model was developed that has led to the identification of break-even points that guarantee the repayment of financial costs under different investment and demand scenarios. This scenario analysis takes on special relevance in a macro economic, financial and situational context of the real economy such as of Egypt's during this period.

Feasibility Studies are aimed at assessing on the practicality of a proposed project, exploring if it is technically and economically feasible. These studies used to be carried out at the first phase of projects' implementation to support decision-making processes.

The development of the study was entrusted to INECO, a leading transport engineering and consulting company dependent of the Spanish Ministry of Transport and Public Works. INECO has more than 45 years of consolidated experience, contracts in more than 40 countries and over 2.500 employees. It provides professional engineering, consulting and project management services for transport infrastructure projects, giving advice to central, regional and local government and companies around the world.

This paper presents the main conclusions drawn from the specific case of High Speed analysis in Egypt. It is a high-speed railway infrastructure to be developed in a middle-income country, in a corridor highly linked to tourism and in a context of economic uncertainty.

The government of Egypt is considering investing to construct a high-speed railway between Cairo-Luxor and Hurghada. A densely populated corridor in Egypt, with strong economic implications in the Egyptian tourist sector. Several studies have been developed before in Egypt by private and public sector regarding boosting High-speed railway services in the country. Based on Ali (2012) and Alí (2015) studies, it can be observed that the preconditions or success factors for reasonably getting started on a high-speed rail project in Cairo Luxor corridor are:

- Between 25 % and 60 % of the costs of high speed, tracks would in any case be required to build conventional railways with 160 km/h speeds. Therefore, project appraisal should then focus on the incremental costs to achieve this goal.
- The promising indicator of economic potential feasibility is a corridor of a high population density within large cities and high volume of demand with enough economic value to repay the high cost involved in the providing and maintaining the line. It is not only that the number of passengers must be large; however, a high willingness to pay for the new facility is required. Tourist and business passengers in the case of Egypt as law and middle-income country would cover this condition.
- High-speed rail service that can deliver competitive advantage over airlines for journeys of up to about four hours or 700 km, particularly between city pairs where airports are located far from city centers.
- A longer corridor that has a very large number of urban centers located on the line (eg: Cairo- Aswan, 879 km). On these corridors, high-speed rail has the ability to serve multiple cities in Egypt in one line.

3. HSR business case

3.1 Market sizing. Who is the high-speed train's real competition?

The Area of Study was determined by the corridors affected by the future HSR network under study, namely Cairo-Luxor, Luxor-Aswan and Luxor-Hurghada. Options for intermediate HSR stations location were analysed and discussed with MOT. Transport offer is mainly composed of:

- Road services: private car, shared taxi and bus.
- Rail services (ordinary, express and sleep cars).
- Air services.

The Demand Study provided an O-D matrix for the travel relations between the different areas by transport mode. The analysis of this matrix enabled to extract the main features of current mobility patterns in the Area of study:

- Yearly travel demand along the corridor adds up to 38.5 million passengers (105,000 passengers per day).
- Private car and shared taxi are the most frequent transport modes, representing together a share of 57%. The image below shows the modal split of the different transport modes.

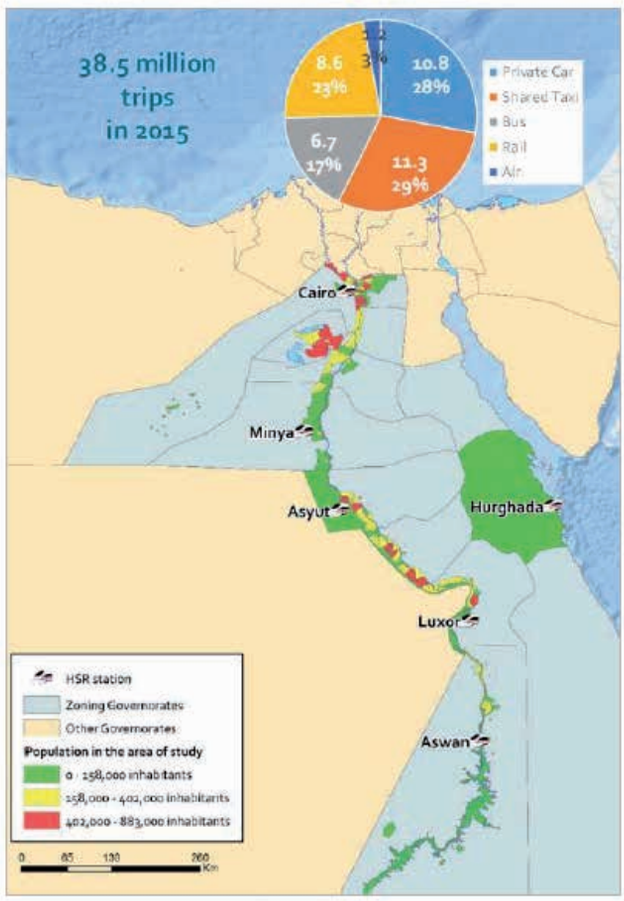


Figure 2. Travel market in the Area of Study (2015)

In terms of travel costs, total passenger demand in the Area of Study represents about 4,100 million yearly Egyptian Pounds. This market size has been estimated with the information obtained from available trip prices and from the consultants' experience in similar studies.

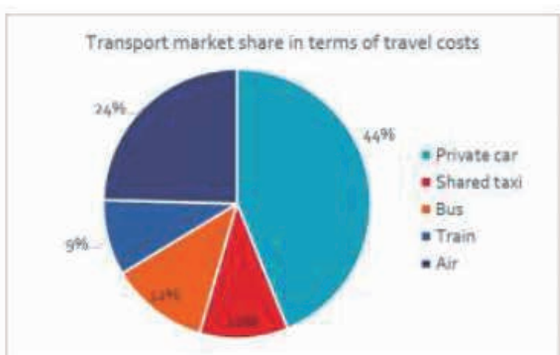


Figure 3. Transport market share in terms of travel costs.

Source: INECO

So, what is the high speed train's real competition?

- It takes around seven hours to reach Luxor by private car
- It takes more than ten hours to travel between Cairo and Luxor by regular railroad
- The flight time between Cairo and Luxor is three hours
- The high-speed train will take three and a half hours to reach Luxor from Cairo.

Therefore, the real competition for HSR comes from air travel, focusing in tourism travellers and business activity in the area of study.

3.3 Pricing. How much should be charged for high-speed train service?

Based on INECO's initial studies, the number of captured target customers depends on:

- Competitive door-to-door journey times
- Competitive fare structure
- Attractive services supply
- High comfort standards

However, not everyone will have the means or willingness to pay for a new high speed train service. How much should passengers be charged for high-speed train services? It was also found that they should not be charged more than 800 Egyptian pounds, as corporate and tourism clients are unlikely to be reimbursed a price higher than the flight fare. Therefore, demand studies were performed with a price discount of 35% below air traffic fares.

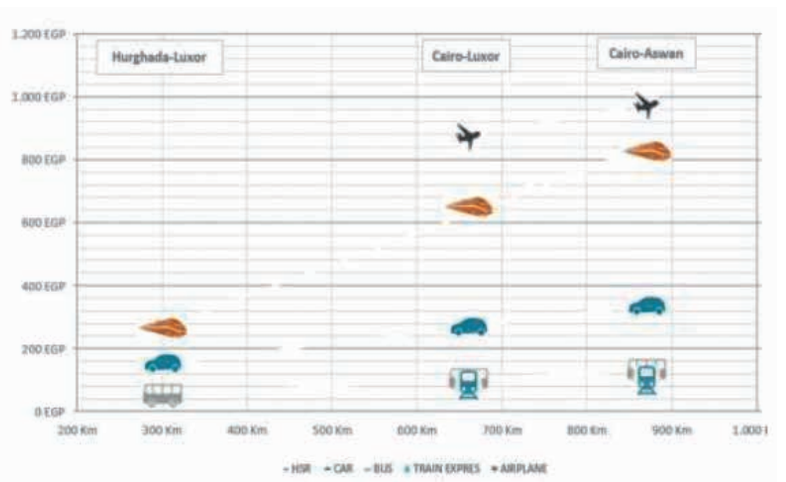


Figure 4. Fare comparison for the different transport modes.

Source: INECO

3.3 Future demand scenarios

Future transport demand scenarios were estimated considering different growth rate assumptions for each demand segment:

- Local mobility.
- International tourism mobility.

Egypt received approximately 10 million international tourists per year at 2015, almost 5 million less than the peak of 14.7 million foreign tourists reached in 2010. Although there is great uncertainty on the recovery of international tourism, it is expected to take place in the medium term.

Since tourism and its related activities are of great importance for the high-speed railway line under study, the analysis considered three different demand recovery scenarios:

- High demand scenario: This scenario foresees a high GDP and population growth with an optimistic tourism growth based on the Ministry of Tourism's objective of reaching 20 million tourists in Egypt by 2020. The annual growth rate obtained by this assumption for the period 2014-2026 is of 9%, which is highly above the expected GDP growth for the same period.
- Medium demand scenario: The foreign tourism levels of 2010 will be regained by 2026, which represents an annual growth rate of 3.4% for the period 2014-2026. The medium scenario growth rate obtained is very similar to the expected GDP growth for the same period.
- Low demand scenario: The foreign tourism levels of 2010 will be regained by 2036, which means an annual growth rate of 1.8% for the period 2014-2026. With regards to GDP, the low demand scenario growth rate obtained is lower than the expected GDP growth rate for the same period.

The following figure shows the forecasts of the HSR demand for the three different scenarios. Section A opening of the Cairo - Luxor section in 2026, Section B opening of the Luxor - Aswan section in 2031 and Section C opening of the Luxor - Hurghada section in 2036.

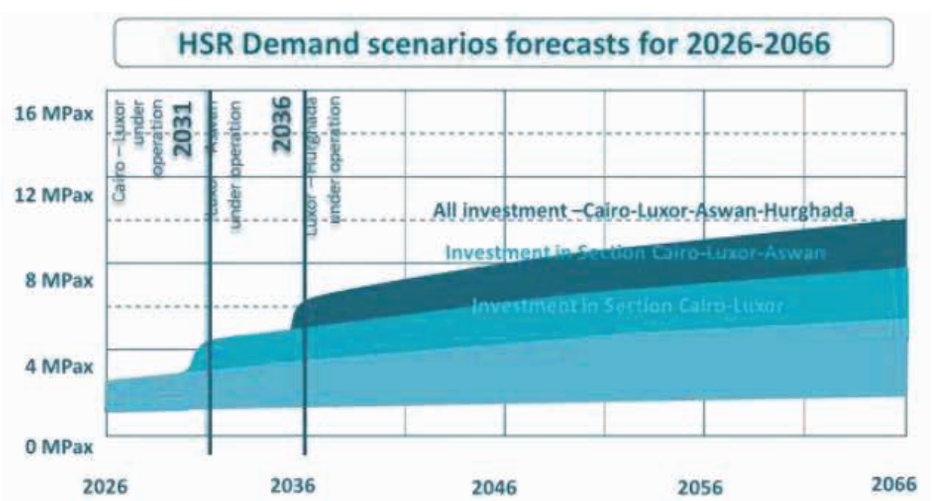


Figure 5. Future demand scenarios in Cairo-Luxor Aswan – Hurghada System

Source: INECO

4. Cost benefit analysis. Project profitability and economic sustainability

To make a "go" or "no-go" decision, it is essential to evaluate the anticipated profitability of the project this being measured by the internal rate of return required by project investors. As stated before, an additional financial project driver is the break-even point: this is considered as the ability to cope with the re-payment of initial investment plus financial return. Yield of this profit project vector will be determined by the profiles of the investors supporting the project.

Therefore, discounted cash flow method (DCF) was used by INECO financial analyst team to assess capital expenditure decisions for this HSR investment. The net present value (NPV) and internal return of return (IRR), widely used in discounted cash flow analysis, were established under different conditions of uncertainty/risk.

In any case, financial and macroeconomic indicators of Egypt will affect the risk appetite and pricing of risk takers under this investment analysis. The main indicators were:

- **2015 Real GDP** still close 4% yearly growth

- **Inflation rate**: Monthly inflation rose to 33 %, March 2017, from 10.35 % on 2015. Prices have been growing steadily from 2006 to 2014 at an average yearly rate of 9%. However, inflation considered was 9.27% according to the historical data from 1960 until nowadays.

- **Sovereign risk – treasury debt**: 10-year Treasury bond in Egyptian pound grew on March 2017 to 17.01 percent from 14.5 percent on 2015.

4.1 Measure of "go" or "no go" decision. Financial indicators

The discount rate to be used in DCF (discounted cash flow method) is the required rate of return based on the investor's weighted average cost of capital. The weighted average cost of capital (WACC) "may" be adjusted by the risk associated with the project and with risk investors perception. Expected rate of return on equity capital was calculated based on the capital asset pricing model (CAPM), which is the most widely used in risk-return models to calculate the shareholders' return, and on the Egyptian financial market analysis on a nominal base:

- Private investor profile. Capital market returns: 26.57 % in the case of private sector shareholding, and a priori of 21.74% in the event of a public sector shareholding of the SPV (Special Purpose Vehicle)
- Local institutional investor with Long-term view: 14.91%, which represents the estimation of remuneration of the Egyptian Treasury to the public debt holders in the form of sovereign 10 year bonds (Bonds issued for Suez Channel extension by Government Treasury paid a 12% interest rate)
- International institutional investor profile. Banks and Multilateral or bilateral Longterm debt returns. On this basis, and within the scope of the analysed projects from OCDE and WB databases, it has been assumed that the funding provided by the so-called commercial bank moves around 14.5%, while that provided by multilateral banks moves around 3.2%.

4.2 Project profitability. Financial indicators

A detailed financial model was developed to support the appraisal of the financial performance of the future HSR program as a commercial undertaking. The financial model presents the total financial picture of the future HSR program by compiling all costs and revenues for the evaluation period (construction & operation). An evaluation period of 50 years (from 2021 to 2070) was selected for the financial analysis so that all project cash flows from the project development stage until 2070 were incorporated to the analysis, in line with accepted financial analysis principles.

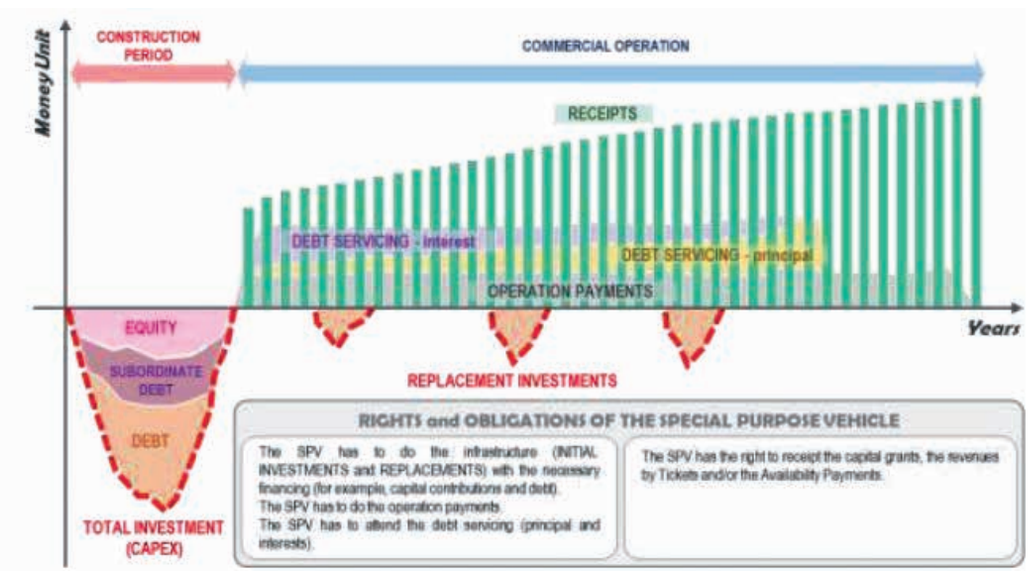


Figure 6. HSR project cash flow financial performance profile

Source: INECO

Mathematically, the **Project IRR** represents the discount rate that makes the net present value of all economic cash-flows of the project equal to zero. The higher the IRR, the greater the net economic returns achieved by a project relative to its capital resource costs and if IRR is greater than the discount rate, then the project delivers a positive net economic benefit (NPV).

Overall, the results of the financial analysis present:

- **A small** positive Project IRR for a medium-income country as Egypt ranging between **2.21% and 11.03%** depending on the infrastructure and demand scenario.
- A positive economic case (**positive Project NPV**) for the introduction of HSR only in the **high demand scenario. A project expected IRR of 7.46%** would be necessary for Capital Investors, without liquidity project constrains, considering a scenario of strong funding by multilateral agencies.

Considering the three different investment options, these being: 1: Cairo-Luxor, 2: Cairo-LuxorAswan, and 3: Cairo-Luxor-Hurghada, the main results derived of the financial assessment modelling, with incomes from HSR service tickets and an additional 5% from commercial activities are the following:

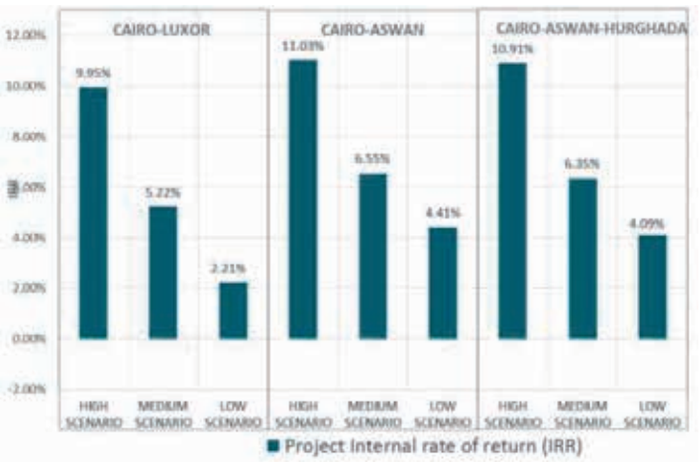


Figure 7. Financial assessment – Results

Source: INECO

Infrastructure yearly investment cash flow fluctuate from yearly 2016 € 0.65 billion in 2021 to 2016 € 1.1 billion in 2024 in Alternative 3 option (construction of all project phases):

HSR PHASE	Section	Total investment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
CONSTRUCTION PHASE	A: Cairo-Luxor	M€ 4,452															
	B: Luxor-Aswan	M€ 928															
	C: Luxor-Hurghada	M€ 1,114															
		M€ 6,494															
% of investment to total amount of the section			15%	15%	20%	25%	25%				45%	55%				45%	55%

This IRR objective would only be achieved on the basis of a "project finance" structure with low equity requirements.

For the case of No contribution from multilateral resources, none of the simulated scenarios would be financially sustainable, although the Cairo - Aswan corridor would be the strongest financial performing HSR program. In this case, the project IRR would be of 10.77%, below the commercial bank interest rate approach, and over the average inflation rate of the last decade. The last expansion of the Canal the Suez by Egyptian Government pays an interest of 12% for their corporates bonds. More than 80% of that total investment came from the Egyptian public's purchase of state-issued bonds.

If we were to compare this project's IRR with the one requested in the USA, the project would not be profitable enough to reach the 11.12% return on capital demanded by the United States Surface Transportation Board. The Railroad Cost of Capital 2012[1] found that the weighted average cost of capital for US railways in 2012 was fixed onto 11.12% (22.56% debt capital X 3.29% return on debt) + (77.44% equity capital x 13.40 return on equity) (Lawrence, Martha & Ollivier, Gerald, 2014). This rate was 8.8% for 2016, which would position the project under profitable standards in the high demand scenario (SURFACE TRANSPORTATION BOARD 2016). In

1 The cost of capital figure represents the Board's estimate of the average rate of return needed to persuade investors to provide capital to the freight rail industry. Calculated annually, it is an essential component in evaluating the adequacy of an individual railroad's revenues each year. US also uses the figure when determining the reasonableness of a challenged rail rate, considering a proposal to abandona rail line, or valuing a particular railroad operation.). In this paper, it is only used as analytical official reference, taking into account that our corridor initially is only for passenger services.

the case of the California HSR, the discount rates used in the 2016 Business Plan were 8%, 11% and 14%, depending on the range of risk transfer that will be finally allocated in the future contracts (California High-Speed Rail Authority 2016).

If the project was to be delivered by a European government, the official reference of a minimum project IRR would be the European Commission general recommendations in an scenario of low inflation where the requested IRR would be ranged around 4% (EUROPEAN PARLIAMENT, 2013). In that case, the project would be profitable enough in the medium demand scenario too.

4.3 Measure of "go" or "no go" decision. Break-even point of Cairo-Luxor project (Without Hurghada phase)

INECO feasibility study drafted several investment infrastructure development alternatives that have been evaluated, in order to evaluate the suitability, or lack of suitability, of making this investment in the country. From a financial analysis point of view, the report provides the level of demand, or income, from which the project has found its break-even point in the short and medium term, complemented by the environment conditions in which this circumstance has been estimated.

The objective of setting a Break-even point is to ensure that the **HSR project** is **financially sustainable**, which means that the company will neither experience liquid assets problems nor temporary decapitalisation processes or bankruptcy.

Investors will have to carefully weigh the costs and benefits of the proposed high-speed railway project, and the expected future volatility or evolution (risk analysis).

A **"Profits = Revenues - Costs"** framework seems the right way to start with:

Profits = Revenues - Costs	
Revenues	**Costs**
• **Price**	• Fixed Costs
• **Volume**	• Variable Costs

The break-even point may be measured by a two-pronged approach:

- **Break-even in the short term as the point at which the system will function without an operating subsidy.** From a liquidity perspective, it is the point from which earnings before interests, taxes and amortization should start to be positive (EBITDA > 0). Whereas from an operational point of view, it quantifies the number of passengers or average annual income that would be necessary for the line to obtain operational profits in a given year. A yearly approach would show the turnover available to return and maximize margin on variable costs over which fixed costs will be charged. Based on the margins calculation in the short term, we can establish when sales are able to cover and ensure fix investments and fixed project costs, and when a HSR service or corridor is unsuitable and produces loss to the company.
- **Break-even in the long term**, from a solvency perspective, would be measured by the cumulative number of passengers or necessary income for the line to obtain a return on capital investment that considers the time value of money. This cash flow is commonly updated by the annual variation of the Consumer Price Index or the Gross Domestic Product

deflator, if this data is available in the country where the investment is being analysed. Therefore, the project is judged by its ability to cover non-distributed costs (fixed costs) in a long period of time (payback taking into account Price Index forecast, discounted payback).

For instance, given the **investment alternative** in the **Cairo-Luxor-Aswan** has fixed costs of EUR $5.4 billion for infrastructure, and the Egyptian HSR Railway company shall procure for either 9 or 24 trains depending of demand scenarios, the total variable yearly operation and maintenance costs will be around EUR 575,000 per day.

It would take 0 years to achieve the breakeven point in the short term for medium demand scenario (year 2026). The Gross margin will have yearly variations between 23% of 2026 revenues to 60% in 2070. This project's break-even point in the short term indicates that no operating subsidy will be required under the high or medium demand scenarios.

Based on financial considerations and taking into account yearly operation and maintenance costs as variable costs, this project will be eventually profitable, but it will need to take 40 years to breakeven in the long term for the medium demand scenario in the Cairo- Luxor Investment Alternative. This would be taking into consideration a discount rate of the average Inflation rate of 9.25 %. In the low demand scenario, the discounted payback or break-even point will not be achieved before 2070, the financial analysis period.

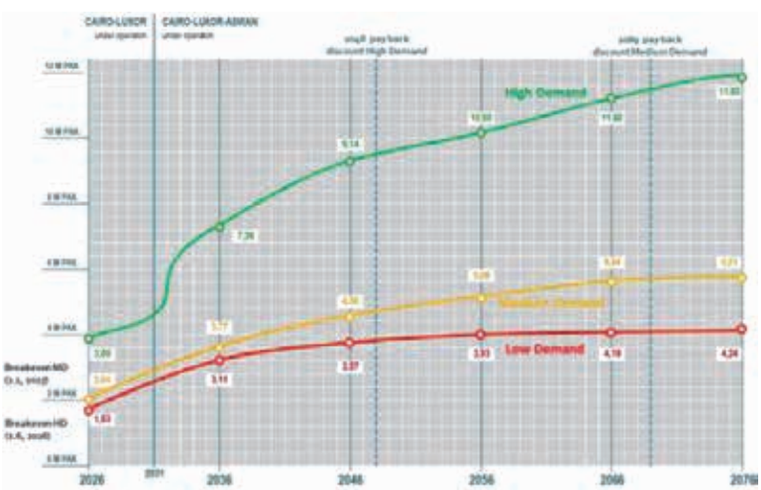


Figure 8. Investment option 2: Cairo-Luxor-Aswan Breakeven points (payback discount)

This is consistent with the results of other high-speed rail projects across the world, like the California HSR project, where the discounted payback period for the total invested capital is 36 years from operations commencement and 45 years from the start of construction. In this case, payback means the break-even point in the long term, and it is expected that collected net cash will equal total expended cash for capital in 2057 (California High-Speed Rail Authority 2012).

Whether this is a "go" or "no-go" decision is totally up to the decision makers. This gross margin has been proved not to be enough to cover all fixed costs including the recovery of capital investment in the long term for medium demand in the Cairo Luxor Aswan infrastructure investment alternative.

5. Conclusions

The Feasibility Study for a High-Speed Rail between Cairo, Luxor, Aswan and Hurghada in Egypt evaluated the operational viability, cash flows, profitability and breakeven for the project.

The analysis has been developed for three different investment scopes. For each of these options, and before any consideration of financing or any particular source of funding, various indicators for the project have been obtained: an internal rate of return, NPV and breakeven points for different periods, in the short and long term. The IRR for the project has been estimated to fluctuate between 4% and 12% depending on the selected investment alternative and demand scenario.

This total project return would be insufficient to attract private capital to pay for the entire project. These results illustrate that the project can generate a positive net cash flow from operations but that it would require government or multilateral funding for construction.

Whether this is a "go" or "no-go" decision is totally up to the decision makers. The breakeven point of the investment alternative Cairo Luxor Aswan proves that yearly gross margin will not be enough to cover all fixed cost including the recovery of capital investment in the long term in the case of such a long contract as that of 50 years.

The project profit vector (IRR; NPV, Breakeven in the short-term, breakeven in the long-term) will provide decision makers with additional approaches to set up "timing strategies" in the HSR Business Plan under different risk scenarios. This would allow to escalate and prioritize investment alternatives and sources of capital for the funding of each section of the project.

This analysis approach is similar to the one followed for the funding and financing analysis of the California HSR project. In this case, the timing strategy of the expansion system was correlated with the finance transactions / indicators. Prioritized investments according to their capacity to generate revenues was expected to attract private sector participation and extend the system beyond the initial line, so that additional segments can be constructed as new funding becomes available (California High-Speed Rail Authority 2016).

Breakeven indicators highlight how the project profitability changes if it is delivered earlier or later. This will help decision makers to consider the edge between an impressive infrastructure project and a possible white elephant project if it was to be deliver too early. The timing indicator for high fixed costs in public investments can be presented by the breakeven point as a way to check how relevant variables can affect the profitability of a project (ie: interest and inflation rates, investment overruns and delays, demand shortcuts).

It is worth noting that this analysis focuses in the purely financial aspects, leaving aside the fact that marketing strategies in competitive markets can always shift the balance of a business plan with actions such as lowering the prices to increase sales volume, direct marketing to educate clients or heavy promotion to increase market penetration.

Finally, from the decision-making point of view, other interesting technical points suggested to be considered for future discussion would be:

- Could it have any effect on the final profitability of the project to add a project profit vector analysis (IRR; NPV, Breakeven in the short-term, breakeven in the long-term) to the decision-making process?
- Should public investors follow either a proactive or a reactive timing strategy and are there any financial indicators that will allow them to create, monitor and react to a predictable rhythm for expansions?

- How could it be avoided that a failure of a big infrastructure project damaged the national budget rating and therefore the country image because of the irreversibility of the public investment?

- Future growth options are often the main argument for undertaking unprofitable investments or speeding up projects. In circumstances when the uncertainty is high, could the right timing save from some bad outcomes?

- Are decision-makers considering the use of a dynamic investment approach based on the monitoring and control of the project profit vector? Is the Business Plan consequently updated regularly in order to assure social and financial profitability considering unexpected events along the different stages of the project?

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