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The financial performance of an innovative megaproject

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Abstract

The financial structure of megaprojects, known in the literature as project finance, is characterized by the creation of a legally independent project company financed with a concentrated equity ownership and a high level of non-recourse debt. Research in this field may yield new ideas and theories about the existing theoretical framework on capital structure, stakeholder management and risk management. A case-study is analyzed in this paper: the financial performance of the first metro line in Seville (Spain). In spite of previous cost overruns in the construction stage, the present operation stage is considered successful from the point of view of social and financial profitability, whereby the risks have been theoretically transferred to stakeholders, as defined by Value for Money considerations.

The objective of this study involves: first to determine whether this megaproject meets the expectations for which it was created in terms of hope of return of the shareholders, and the expectations of the economic and financial feasibility under a change of subsidy policies; and secondly to determine whether the conditions remain for not including the investment as public debt. This issue is crucial in a budgetary constraint context for the planning of future metro lines. By taking this first experience into account, this article also provides information for potential participants in the projects of the new metro lines, which are currently in the planning stage.

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1. Theoretical framework, goal and methodology

The criteria for classifying a project in the mega category still remain an issue in the literature. Esty (2002) sets the threshold at an investment higher than \$ 500 million. Nevertheless, other authors state that the characteristics that elevate a megaproject to mega-status are more complex. From a review of existing definitions, Fiori & Kovaka (2005) propose the following definition of a megaproject: "a construction project, or aggregate of such projects, characterized by: magnified cost, extreme complexity, increased risk, lofty ideals, and high visibility, in a

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combination that represents a significant challenge to the stakeholders, a significant impact to the community, and pushes to the limits of construction experience”.

In addition and from a financial point of view, megaprojects are characterized by a high level of leverage, and therefore a high level of financial risk, which may be managed as an independent entity. According to Esty (2004) project finance involves the creation of a legally independent project company financed with equity from one or more sponsoring firms (that is, a concentrated equity ownership), and with non-recourse debt for the purpose of investing in a capital asset.

Due to the complex nature of megaprojects, the literature covers a large range of disciplines, including construction and project management, legal aspects, public policy, accounting, leadership, and success factors, among others; being the case study the methodology most widely applied. Publications focused on the financial aspects of megaprojects are still scarce in high impact journals, being some of the studied financial issues: (a) Financial Risks, (b) Funding Structure and Cost of financing, and (c) Financial Performance. With regard to the last, just some of the case-studies give information about the return of the megaproject. There is no commonly agreed framework of performance measurement on megaprojects, Toor & Ongulana (2010) state that the “iron triangle” (on-time, under-budget, and according to specifications) should be substituted by a mix of both quantitative and qualitative indicators; de Palma, Picard, & Andrieu (2012) propose different approaches used in finance (Value at Risk, Conditional Value at Risk, Downside Risk Measures, and Efficiency Ratio) to model the impact of risk in project evaluation, comparing them on basic examples. Nevertheless, no criterion is a priori better than the others due to may lead to different conclusions. Other related research fields of interest such as Stakeholders Management or Public-Private Partnership Models, can be considered multidisciplinary .

Currently, there are very few published papers on project finance and megaprojects. Esty (2004) analyzes why project finance in general, and why large projects in particular, merit separate academic research and instruction. Megaprojects have unique structural attributes, which vividly illustrate why the financial structure matters and show that investment decisions cannot be separated from funding decisions, in contradiction with financial theory. Since Modigliani & Miller (1958) enunciated the proposition of “irrelevance”, that is, the idea that corporate funding decisions do not affect the firm’s value under certainty, there have been three main lines of research to determine the critical factors that define the capital structure (Palacin & Ramirez, 2011).

First, from a traditional perspective, there is an optimal balance between the benefits of debt, linked to the tax deductibility of interest, and the disadvantages of the increase in the probability of bankruptcy involved in the use of higher levels of debt. The Theory of Financial Optimum suggests that firms adjust their capital structure to a target debt ratio or optimum, and once reached, firms achieve their maximum value. Therefore, firms would no longer have an incentive to increase the proportion of debt, since one additional dollar of debt, would imply a net loss in the marginal value.

A second theoretical approach is derived from the Theory of the Agency, proposed by Jensen & Meckling (1976) and Myers (1977), which states that agency costs arising from the conflict between shareholders and lenders, encourage the former to seek a capital structure that benefits them, even at the expense of the latter and of the loss of value of the company. Given this attitude, lenders react by demanding additional collateral and higher risk premiums. Moreover, agency problems may also arise between shareholders and the management team when defining the financial structure, since the managers may make the funding decisions.

Finally, a third approach to research is based on the costs generated by asymmetric information; this has led to two theories. On the one hand, the Theory of Signs, raised by Ross (1977) and Leland & Pyle (1977), which argues that managers with strong growth prospects send signals to the market about the quality of their projects through the increased level of debt, which reflects the ability of companies with new investments to meet the payment obligations of that debt. On the other hand, the Theory of Hierarchical Preferences, proposed by Myers (1984) and Myers & Majluf (1984), posits that companies do not seek to adjust to an optimal debt ratio but, due to asymmetric information problems associated with external financing, firms adjust their funding decisions to a hierarchy. First, firms prefer internal to external financing. Second, and only if internal funds are insufficient, firms resort to external funds. From among external resources, external financing is preferred (non-cost first, then long-term and ultimately convertible bonds), thereby leaving the issue of shares as a last resort in the quest for resources.

Research into project finance of megaprojects can shed new ideas and theories about the existing theoretical framework not only in terms of capital structure, but also in the field of stakeholder management and risk management. Along this line of thought are the contributions of Leland & Skarabot (2003), arguing that financial synergies can explain why firms prefer to finance separate projects against financing projects within the corporate structure. Another argument to support research in project finance this time from the stakeholder management perspective is the idea of using the megaproject organization as a tool of risk management. The challenge for successful project finance is competent management of exposure through: risk allocation, development of strategic alliances, and financial engineering. Allocating the various types of risk to those participants best able to manage them is thus a key ingredient for success (Beidleman, Fletcher, & Vesbosky, 1990). In this latter area of research, the financial theory and practice have been addressed from the perspective of analyzing financial instruments for the management of just specific risks, and not from the perspective of global risk management.

The aim of this paper is to analyze the economic and financial performance of a megaproject: the first metro line in Seville (Spain). Under the concession contract formula, an innovative public-private partnership model has been applied to this megaproject (Irimia-Diéguez & Oliver-Alfonso, 2012) and the main features are described. In spite of previous cost overruns in the construction stage, the present operation stage is considered successful from the point of view of social and financial profitability, whereby the risks have been theoretically transferred to stakeholders, as defined by Value for Money considerations.

The objective of this paper involves: first to determine whether this megaproject meets the expectations for which it was created in terms of hope of return of the shareholders, and the expectations of the economic and financial feasibility under a change of subsidy policies; and secondly to determine whether the conditions remain for not including the investment as public debt remain. This issue is crucial in a budgetary constraint context for the planning of future metro lines.

The return of the megaproject and that of shareholders are calculated here by using both Net Present Value (NPV) and Internal Rate of Return (IRR) based on the financial information published in the annual statements by the concessionaire Metro de Sevilla, SA since its establishment in 2003. These calculations are supplemented by interviews with financial officers of the entity and with information published on various official websites.

The contribution of this work is not only to determine the feasibility of the current running project, Line 1, but also the validity of the model for future megaprojects, lines 2 and 3, and other metrolines in Andalusia, which are now in a planning stage. To this end, an analysis of economic and financial alternatives which considers lower capital subsidies is also performed, whilst the treatment of operating subsidies is considered a social price.

The structure of the paper is as follows. After this introduction, the major economic and financial features of the megaproject are presented, the return of the project and that of shareholders are then included in the next section, whereby the results obtained are analyzed, and the paper ends with the drawing of conclusions and suggestions for future lines of research.

2. Economic and financial features

2.1. Introduction

The concessionaire of Metro Line 1 is a Limited Company created in 2003 for the construction and exploitation of this megaproject, whose main technical features are summarized in Table 1.

Table 1: Main technical features of the megaproject

- Line length: 18.05 Km
- Number of stations: 22
- Surface stations: 7
- Underground stations: 15
- Travellers forecast: 14 million/year
- Population served: 227,974 inhabitants
- Frequency at peak time: 4 minutes

- Jobs created: 300
- Drivers: 50
- Number of trains: 17
- Track length: 39.2 Km
- Workshops and garages: 65,000 m²

Source: <http://www.juntadeandalucia.es/html/especiales/especialmetro-sevilla/inauguracion.html>

The company Metro de Sevilla was created with an initial equity equivalent to 20% of total investment. The public sector had an initial shareholding of 25%, and equity loans up to 5% of the investment could be granted. Several private companies such as Itinere, Iridium, and CAF were also shareholders of the Concessionaire. The European Investment Bank (E.I.B.) financed up to 25%, and the remaining amount was granted as subsidies from the public sector. The initial subsidy amounted 33% of the total investment (except mobile equipment and capitalized expenses), although it finally amounted to 47.94% of total investment. The financial structure of the megaproject, shown in Table 2, can be classified as Project Finance as was defined previously.

Table 2: Financial Structure

Financial Resources	Amount in euros	Percentage
Social Capital	126,820,000	21.69
Subsidies	191,572,984	32.76
E.I.B Loan	260,000,000	44.45
Equity Loan	6,428,160	1.10
TOTAL	584,821,144	100.00

Source: Financial Statements of the Company

The financial performance of this megaproject implies the determination of both the profitability of the investment-financing megaproject, and the profitability for shareholders. To this end, the following variables should be quantified:

- The volume and cost of the financing, by taking into account the use of privileged financing, in order to determine the Weighted Average Cost of Capital (WACC) of the megaproject.
- The initial investment, which includes all the necessary payments before the exploitation of the megaproject.
- The valuation horizon, which was predetermined to 35 years in the tender, although it was later modified to 37 years due to the delay in the construction stage.
- The expected cash flows, which can be estimated due to the established system for the demand forecast and the upper and lower limits of both fees and operating subsidies.
- The residual value which is equal to zero since the assets are transferred to the public sector at the end of the concession period.
- The impact of risk in the valuation of the financial performance.

2.2. Cost of the financing

The return of an investment-financing project is usually measured by the classic criteria NPV and IRR (Brealey & Myers, 2010). Consequently, a discount rate is required as a hurdle rate. A first possible value for the discount rate is the minimum return required by the investor, which can differ depending on the risk aversion of the decisor. A second option is to use the monetary cost of the financing, that is, the cost paid by the company to their suppliers of financing, usually known as WACC.

This first WACC has been calculated after taxes by using the long-term financial structure at the end of 2010, and the effective cost paid in the year 2011 is obtained from the annual financial statements of the company Metro de Sevilla.

Table 3: WACC without considering subsidies

SOURCE OF FINANCING	Volume	Dividends/Interests	Dividends/Interests	WACC without Subsidies
	in euros	before taxes	after taxes	
EQUITY	127,516,570	7,032,165	7,032,165	0.037
DEBT	264,791,255	10,490,905	7,343,634	

Source: Financial Statements of the Company

Notice that subsidies are not included in Table 3 as a source of financing. As proposed by Gómez-Bezares, Madariaga & Santibañez (2003), when a project is financed with “privileged” financial resources, that is, cheaper than those usually available for the company and linked to the investment, one of the options is to calculate the return of the project without subsidies and, then, add the negative cost or return of the subsidy.

The cost of the subsidy, k_s , is determined by applying the following IRR formula:

$$0 = S - \sum_{i=1}^n \frac{S/n \times t}{(1 + k_s)^i} \quad (1)$$

where S is the total amount of the subsidy; n , the number of years in which the subsidy is charged as income; and t , the tax rate. The capital subsidy obtained is allocated as income in the profit and loss accounts annually, starting in 2009 with an amount of € 6,561,577, continuing in 2010 and beyond with a constant amount of €10,364,229 until 2026. The remaining value of the subsidy is € 8,819,514, to be allocated in 2027. Therefore, the negative cost or return of the subsidy can be determined by applying (1) to these figures: the result is - 6.8%. Since the payments derived from the tax effect of the capital subsidy are lower than the amount obtained, then the result is a negative cost or return.

When NPV is applied to the stream of inflows and outflows derived from the capital subsidy and the cost of capital without subsidies is considered as the discount rate, then the net return of the capital subsidy referred to 2003 is obtained, which amounts to € 158,953,460.09. This return will be added to the return of the project calculated without considering the financing of subsidies.

2.3. Initial Investment

The Initial Investment of the megaproject includes all the payments throughout the construction stage, that is, from 2003 until the beginning of the exploitation stage in 2009. The concepts analyzed are:

- Cost of work, including the industrial benefit of the construction company.
- The financial costs assumed in the construction phase; when no operating revenues were generated (just financial income), and the Society capitalised the losses generated each year, as an increase in investment.
- The payment of taxes, especially the value-added tax, VAT. During the construction phase, VAT was registered on a cash basis, and the amount paid was recovered when the tax declaration was submitted. Nevertheless, over a period of three years, VAT of the subsidized assets was not deductible. This judgment was appealed by the Spanish concessionaire companies, and such amounts could then be deducted. Therefore, the effect of VAT is neutral, and is not considered as a higher initial investment.
- Net Working Capital used each year.

Using the SABI database, the Initial Investment is then determined incrementally for each period, in order to calculate the present value of such initial investment at the megaproject starting date, of 2003, which amounts to €627,544,680. The figures are detailed in the Appendix, Table 1.

2.4. Operating Cash Flows

The operating revenues of the concessionaire during the operational stage are composed of both the user fees and the operating subsidy granted by the government. This operating subsidy enables a feasible fee to be charged to the user, thereby preventing the transfer of the entire cost of the transport (which is known as the technical fee) to the user. The purpose of this subsidy is, on the one hand, to generate adequate levels of demand via the setting of a price similar to that of other means of public transport, and on the other hand, to limit the risk of the demand from being transferred to the public sector, since a minimum income is guaranteed. Both objectives are conditioned to the basis that the project does not affect the public budget, except for the expected annual subsidies (Nores & Jiménez, 2004).

The annual operating subsidy, P_i , is composed of the sum of two components, A and B, which must be calculated annually. The first component, A, is determined, for the first 30 years of operation, as the product of the expected demand defined for each year in the tender, N_p , and a parameter, called β , which is decreasing over time, as presented in Table 4. This first component represents the lower limit of the stream of revenues of the megaproject.

Table 4: Evolution of β value

YEARS	1-5	6-10	11-15	16-20	21-25	26-30
B	0.45	0.40	0.35	0.30	0.27	0.24

Source: Nores & Jiménez, 2004

The second component, B, is defined by the following expression (2), which determines the amount payable by the administration based on the actual annual demand, N_r , and takes into account the difference between the total cost (tt) and the price charged to the users, weighted with β , whenever this difference is positive.

$$B = [((1-\beta) \times tt) - tm] \times N_r \tag{2}$$

where:

tt, technical fare offered.

tm, perceived average fare per passenger using the service each year.

N_r , actual number of travellers.

In addition to the lower limit, the contribution of the public sector has a maximum value for each year, as shown in formula (3):

$$P_{max} = (tt-tr) \times N_p \tag{3}$$

A technical rate of € 3.6 (for the first year of the concession only) and an annual inflation rate (to be applied to future values) of 2.5% were defined by the public sector in the concession offer.

An innovative feature of this system is that both components, A and B, of the annual operating subsidy, P_i , are strippable and may be transferred to the financial markets by the concessionaire in order to secure certain financing transactions that can be arranged for the construction and exploitation of the megaproject. Additionally, the excess of revenues obtained, due to actual demand exceeding the expected demand, will be refunded to the public sector on a percentage as laid out in the tender.

The Operating Cash flows have been calculated by taking the information from the annual accounts of the years 2003-2011. In order to forecast cash flows for the years 2012-2040, a growth of 2.5% due to the inflation rate has been applied. In addition, the cash flows must be obtained after taxes; therefore, the effective tax rate has been

applied to the cash flows calculated before taxes (as sales minus operating expenses) and the tax savings due to the deductibility of the annual depreciation expenses have been added, as shown in the following formula:

$$CF_{i\text{at}} = CF_{i\text{bt}} \times (1-t) + \text{Dep}_i \times t \quad (4)$$

where CF_i is the operating cash flow of year i ; t is the tax rate, calculated as the effective tax rate from annual accounts (for years 2003 to 2011) and with a value of 30% from for forecasted exercises; and Dep_i is the annual depreciation of the non-current assets included in the initial investment. The forecasted Cash flows are included in the Appendix, Table 5.

3. Financial Performance

3.1. Return on the megaproject

The profitability of the megaproject is calculated by applying both criteria: Net Present Value (NPV) and Internal Rate of Return (IRR). The former is first applied to the variables of the project without considering the effect of capital subsidies (NPV_{inv}), and the net return of subsidies (NPV_{sub}) is then, added. The results included in (5) referring to euros of 2003 show a negative value in spite of the capital subsidies received.

$$\text{TOTAL NPV} = \text{NPV}_{\text{inv}} + \text{NPV}_{\text{sub}} = -178,518,223 \text{ €} + 158,953,460 \text{ €} = -19,564.763 \text{ €} \quad (5)$$

The latter does not have an additive property since the return is calculated over different initial investmentes. Therefore, the IRR of the whole project, that is, the rate of return including the effect of capital subsidies, should be determined and then, compared with WACC without subsidies. The IRR of the whole project is 2.98%; lower than WACC at 3.7%, showing therefore a negative net return of -0.72%. These results are consequent with those of NPV since both criteria set the same cut-off point.

Nevertheless, the evaluation of the financial performance of a megaproject must include an adequate trade-off between return and risk. Gómez-Bezares&Gómez-Bezares (2012) revisit three classic performance indexes, Sharpe, Treynor, and Jensen, which were developed in the 1960s, and propose an equivalent index, called Penalized Internal Rate of Return, PIRR, which can be used to measure the performance of a megaproject. The formulation of this index applies a linear penalization for risk, and varies depending on the type of risk considered: total or systematic risk. The formulation is as follows:

$$\text{PIRR} = \mu - \left[\frac{(\mu_m - R_f)}{\beta_m} \right] \beta = \mu - (\mu_m - R_f) \beta \quad (7)$$

where μ is the average return of the investment; R_f is the return of a risk-free asset; β is the systematic risk; μ_m is the average return of the market portfolio; and β_m its systematic risk in the period of analysis. If we apply the values of these parameters, referring to the construction sector in Spain, the PIRR obtained is also negative.

3.2. Return on equity

The profitability of shareholders is also calculated since this is one of the key criteria in megaproject decision-making. By considering that the NPV of the megaproject gives the value creation for shareholders referring to the initial moment, then the stream of dividends (properly updated to their required minimum return) has been added up in order to obtain the total return for shareholders by applying the equation (8).

$$R_s = \text{NPV}_{\text{project}} + \sum_{i=7}^{40} \frac{\text{div.}}{(1+k_e)^i} \quad (8)$$

The first dividend amounted to € 7,032,165 and was paid in 2009. The stream of dividends forecasted is considered constant in the valuation horizon; the cost of equity, k_e , is equal to 5.54%, and therefore, the return for shareholders is positive and equal to € 51,105,381 referring to year 2003.

4. Conclusions and future lines of research

The degree of fulfillment of the basic objectives of the public sector in the design stage of the model enables the following conclusions to be attained.

1.-The project must be attractive to potential investors; this factor is quantified via the profitability for shareholders.

The shareholder returns calculated in monetary units are € 51,105,381, which, compared with the capital invested of € 126,820,000, gives a profitability of 40%. Therefore, the megaproject is very attractive to potential investors, including the public sector, which is one of the shareholders. This constitutes a major innovation in the design of this model of public-private partnerships due to the alignment of the interests of both the public and private sectors. From the perspective of the theory of agency, this approach prevents potential conflicts between stakeholders.

2.-The economic and financial balance of the megaproject must be for both the public sector (in the sense of existing budget for contributions made) and for the concessionaire (the financial viability of the project considering the contribution of public funds).

The verification of the existence of sufficient budgetary provisions falls beyond the scope of this work. Nevertheless, the social return of the megaproject remains a key issue. From this point of view, the cohesion achieved between certain aspects, such as work, family, environment and sustainability, is excluded from this discussion.

With respect to the financial feasibility of the project, as discussed previously, the profitability of the megaproject is negative, with a present value for 2003 of -19 million euros, equivalent to an IRR of -0.729%. Such performance is calculated as the sum of two components, obtained by the project without subsidies, and the return on capital grants, which clearly shows that the profitability of the project depends heavily on the grants received.

3.- The lowest cost to the Government of Andalusia.

The operating subsidies are not disaggregated in the annual accounts of the concessionaire company, and therefore the NPV of these contributions cannot be calculated. In the future, this data will be useful in determining under which cost conditions the public sector is willing to support new megaprojects. It is important to notice that the economic return for the public sector must include not only the subsidies paid but also the value of the infrastructure at the end of the concession period, and the social return of the services provided.

4.-The project should not be computed as debt in the public sector.

Since the megaproject is an administrative concession, operated at the risk of private sector, the investment is recorded in the balance of the private sector and not in the public budget. Therefore, by excluding the investment portion subsidized during the construction stage, this megaproject does not generate a major deficit since the debt that finances the investment is included in the concessionaire balance sheet. Who bears the risk of demand? Answering this question is key to examining the feasibility of future lines. The existence of a minimum (based on forecasted demand) and a maximum of annual public contribution, truly makes us rethink whether there is a transfer of this risk to the contractor.

In line with the financial theories previously stated, the questioning of some financial principles when managing megaprojects is a relevant issue.

The Optimal Financial Theory suggests that firms adjust their capital structure to a target debt ratio or optimum, and once this is reached, then firms maximize their value and no longer have an incentive to increase the proportion of debt. In the case of complex projects related to public-private partnerships, the financial structure of the megaproject may challenge this theory, by linking the debt ratio to the negotiation of the different interests of the parties involved, rather than to the value maximization of the megaproject.

Regarding the Theory of Hierarchical Preferences, these asymmetric information problems associated with external financing are not detected. The financial structure of a megaproject is designed as a whole and adapted to the economic characteristics of the project and the possibilities and needs of all parties involved in the financing.

The analyzed megaproject design can also put into question the agency theory in relation to disputes arising from the relationship among shareholders and lenders, or between shareholders and the management team. The reasoning is similar to the discussion in the preceding paragraphs. The design of the economic and financial structure of the megaproject is derived from a previous negotiation process where agency problems are identified a priori, thus avoiding the feared costs thereof. However, due to the exploitation of the megaproject by the private sector, conflicts may arise between the interests of the public and private sector. Hence, the public sector establishes a series of covenants or control mechanisms to periodically detect the possibility that private interest holds greater priority over the public interest.

It is interesting to note that the high leverage of the project has generated a return for shareholders far superior to that of the project. Additionally, the low cost of the debt is possible due to the participation of the public sector as shareholder of the concessionaire. Consequently, we believe that, in the current climate of budget constraints, the design of public-private projects should include the innovations of this Andalusian model, where the Administration is part of the capital which enables benefit from these synergies.

Appendix

Table 1: Initial Investment in euros

Year	Incremental Initial Investment	Present Value
2003	147,827,708	147,827,708.00
2004	52,330,781	50,480,948.06
2005	82,299,238	76,583,707.41
2006	72,863,501	65,406,497.52
2007	227,978,724	197,412,870.60
2008	82,415,181	68,842,819.39
2009	26,049,140	20,990,128.99
TOTAL	691,764,273	627,544,679.97

Source: Authors' own based on Financial Statements of the Company

Table 5: Operating Cash Flow in years 2003 to 2040

YEAR	EUROS	YEAR	EUROS	YEAR	EUROS
2003	51,052.00	2017	32,106,610.26	2031	34,120,443.87
2004	72,963.00	2018	32,909,275.51	2032	34,973,454.97
2005	1,003,194.00	2019	33,732,007.40	2033	35,847,791.34

2006	4,134,762.00	2020	34,575,307.58	2034	36,743,986.13
2007	8,322,234.00	2021	35,439,690.27	2035	37,662,585.78
2008	11,194,631.00	2022	36,325,682.53	2036	38,604,150.42
2009	45,673,031.00	2023	37,233,824.59	2037	39,569,254.19
2010	38,289,119.87	2024	38,164,670.21	2038	40,558,485.54
2011	27,685,429.40	2025	39,118,786.96	2039	41,572,447.68
2012	28,377,565.14	2026	40,096,756.64	2040	42,611,758.87
2013	29,087,004.26	2027	39,515,842.03		
2014	29,814,179.37	2028	32,476,329.68		
2015	30,559,533.85	2029	33,288,237.92		
2016	31,323,522.20	2030	34,120,443.87		

Source: Authors' own based on Financial Statements of the Company

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