The Economic Valuation of Social Aspects: A Multicriteria Approach based on Input-Output models

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ABSTRACT:
Decision making on the suitability of public investment projects has traditionally been based on the study of their economic feasibility**.** Since the end of 1970s, this has been complemented by a more holistic vision of reality in which social and environmental aspects are explicitly considered alongside economic factors. This paper proposes a new evaluation methodology which allows for the valuation of social and environmental factors in economic terms. The methodology is based on *use values* (direct, indirect and potential) and *non-use values* (bequest and existence) that are usually studied for an environmental evaluation. The resulting economic value is obtained by the utilisation of: i) input-output models to calculate the direct-use value in monetary terms; and, ii) multicriteria techniques (especially AHP) and comparative models to estimate the remaining use (indirect and potential) and non-use values (bequest and existence). The methodology is applied to a real-life problem in Aragon.

KEYWORDS: Public Investment, Integral Viability, Input-Output Model, Multicriteria Decision, Analytic Hierarchy Process (AHP).

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1. INTRODUCTION

Public administrations often make decisions on investment projects that are located in a specific place but generate high externalities. In these cases, traditional investment analysis techniques that focus on the economic viability of the project (especially payments and collections which are most relevant to the investor, e.g. Net Present Value and Internal Rate of Return), should be complemented by new valuation instruments which consider factors other than those that are simply economic.

Since the end of the seventies the dominant economic approach to public investment analysis has been complemented by a more holistic vision of reality which explicitly examines the social and environmental aspects that were not considered due to the difficulty of measuring them in economic terms (Moreno-Jiménez et al., 1999, 2001; Munda, 2004, 2007; van Beers et al., 2007). Conscious of the fact that "*not everything that counts can be counted, and not everything that can be counted counts*", efforts have been directed towards the development of new approaches and scientific tools for measuring the intangible and integrating this with the tangible to achieve more realistic and effective decisions[1].

This paper proposes a new methodology which allows the evaluation of public investment projects in a more realistic and effective manner than the exclusive consideration of economic factors (a holistic vision of reality). The methodology contemplates economic, social and environmental aspects (these are often intangible attributes) and employs the use values (direct, indirect and potential) and non-use values (bequest and existence) typically included in environmental evaluations (Barbier et al., 1997; Moreno-Jiménez et al., 2009)[2].

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[1] Effective decisions (doing the correct things) refer to decisions in which the relevant aspects of a problem are correctly considered (Moreno-Jiménez, 2003).

[2] The indirect economic valuation of intangibles (Gilboa, 2010) and social and environmental aspects covers the incorporation of future generations (Asheim, 2010) through bequest and existence values.

Of these five values, only the direct use can be evaluated in monetary terms. A monetary evaluation of the other values is obtained through the use of one of the most widespread multicriteria techniques (Saaty, 1980, 1994): the Analytical Hierarchical Process (AHP) combined with a comparative evaluation method[3]. This approach is inspired by Saaty and Vargas (1979), Steenge (1986) and Banai-Kashani (1990). Benjamin et al. (2015) and Aviso et al. (2018) have combined input-output analysis and multicriteria techniques for other purposes.

In the case study (Section 4), environmental aspects (the valuation would be obtained by the same method as used for the social values) are not considered relevant, so the analysis is based on the economic valuation of social aspects. The estimation of the social values of direct use in monetary terms uses two of the most common indicators in the empirical literature*:* work generation and turnover; both are calculated from the Input-Output Framework (IOF). The monetary evaluation of the economic, social and environmental aspects provides an integral evaluation of the public investment projects.

The methodology was applied to a real-life problem regarding a project that was put forward in the region of Aragon some years ago (‘*HistoPark*’). The results are included in this work. For reasons of confidentiality, the official name of the project is not given. The explicit consideration of social interactions in public decision making (Durlauf and Ioannides, 2010), follows a procedure that captures the context in which they are embedded (Dekel and Lipman, 2010).

[3] Wang and Lee (2011) propose a Fuzzy Multiple Criteria Decision-Making with fuzzy integral. Their approach relaxes the independence assumption among criteria for the evaluation of the Multiple Criteria Decision-Making problems which is often the basic assumption when applying hierarchical system for evaluating the strategies of selecting investment style. They also employ Triangular Fuzzy Numbers to represent the decision-makers’ subjective preferences on the criteria, as well as for the criteria measurements to evaluate mutual funds investment style.

The paper is structured as follows: Section 2 outlines the methodological background (input-output models and multicriteria decision-making techniques); Section 3 presents the new methodology for the integral evaluation of public investment projects; Section 4 applies the methodology to a real-life case study of a public investment project (*HistoPark*); and Section 5 discusses the most relevant conclusions.

2. BACKGROUND

2.1. Input-Output Framework (IOF)

The Input-Output Framework or Model (IOF) was developed by Wassily Leontief, Nobel Prize winner for Economic Sciences, in 1973. It is often known as the Leontief Model. Its main aim is to analyse interdependences between the sectors of an economy, showing that the outputs from one sector are the inputs of the other. Leontief designed a Table Model for the economy in the USA in 1919 and 1929, establishing the methodological structure. In the 1950s, Leontief revised his work and with advances in computation the method became popular; by the 1960s it was beginning to be used, in a generalised form, by a number of authors. The integration of the IOF into national accounting systems was carried out in 1968 by the United Nations. The system was developed by Richard Stone, who received the Nobel Prize for Economic Sciences in 1984.

The following notation will be used to demonstrate the model: Let x_{ij} be the quantity registered in the cross square of row *i* and column *j* of the block of intermediate consumption of the IOF (the use that branch *j* makes of the products of branch *i*); X_i the production of branch *i* (the sum of all the intermediate consumption of the branch plus the gross value added); AV_i the gross value added of branch *i*, where AV_i = compensation of employees (W_i) + operating surplus/mixed income, gross salary and by gross operating surplus (GOS_i); *D*, the final demand, where *D* = domestic final consumption by households and by non-profit institution serving households (*CInd*) and final consumption expenditure by Public Administration (Ccol) + gross capital formation (*FBK*) + exports (*E*); *M* the inputs; *RES* the total supply of resources, where *RES* = Production (*X*) + imports

(M); TE the total number of jobs, output or destinations where TE = Intermediate Consumption (IC) + Final Demand (D).

Studies based on the IOF systematically calculate relationships whose usefulness is manifest: structural relations can be represented between the branches of an economy, calculating the proportion of each input in its production for each branch. The proportions are called 'input coefficients' and are shown in a table or matrix in which each element corresponds to that which occupies the same place in the original table. Technical coefficients are a special type of input coefficients that express the use that any branch makes of the products of another branch per product unit $a_{ij} = x_{ij} / X_j$.

The technical coefficients can be calculated by dividing each x_{ij} by the corresponding X_j (each element of the block of inter-industrial transactions by the production of the corresponding branch): $a_{12} = x_{12}/X_2$ is the use that branch *2* makes of the products of branch *1* per unit of production. In matrix form this would be $A = Z\hat{X}^{-1}$, where A is the matrix of technical coefficients resulting from multiplying the matrices of x_{ij} (Z) by the diagonal matrix of the reciprocals of the production of each branch $(\hat{X}^{-1})$. The sum of the columns of the elements of the matrix of technical coefficients (A), $\sum_i a_{ij}$, gives the total intermediate consumption that branch j requires in order to produce a unit.

Although the denomination of coefficients alludes to the expression of certain technological characteristics of the productive processes, in practice, the coefficients which are calculated are monetary, i.e., the IOF gives the value of the products a branch used in order to obtain a product unit of the product in the branch that uses them. The relationship is influenced by prices and their changes over time should be considered in order to draw appropriate conclusions regarding the use of inputs and their substitution or saving.

Given that the rows of the table represent the destinations of the production of each branch in relation to the rest of the branches and the final demand (branch by branch they coincide with their production value X_i), two rows of a table with two branches can be expressed as:

$$x_{11} + x_{12} + D_1 = X_1$$

$$x_{21} + x_{22} + D_2 = X_2 \qquad (1)$$

or as:

$$a_{11} X_1 + a_{12} X_2 + D_1 = X_1$$

$$a_{21} X_1 + a_{22} X_2 + D_2 = X_2 \qquad (2)$$

which, in a matrix expression can be represented as:

$$AX + D = X \qquad (3)$$

where $A = (a_{ij})$ is the matrix of the technical conditions; X is the vector column of the products at basic prices (X_i the production at basic prices of i); D is the vector column of the final demands (D_i is what i contributes to the final demand) and x_{ij} to the destinations from i to j (uses that j makes of the products of i). The branch i assigns $\sum_j x_{ij}$ to intermediate uses and D_i to final destinations.

Knowing that a_{ij} is a datum, and supposing that the final demand is determined exogenously, there are two equations and two unknown variables. The model of demand relates autonomous final demands to the production levels necessary to satisfy them.

If these alternatives are included with the final demand to be achieved, we can determine the production required by each branch to satisfy the demand. Logically, each branch has to produce this final demand objective plus the intermediate products which the other branches require in order to produce a unit.

When the number of unknowns is of a certain size, the problem can be resolved using an algorithm known as the Leontief inverse matrix method:

$$X = (1 - A)^{-1} D \qquad (4)$$

where X is the vector column of productions at basic prices of each branch (the unknowns of the problem), $(1- A)^{-1}$ is the Leontief inverse matrix $(1- A)$ and D, the vector column of the final demand. With the inverse that is obtained, we can simulate different situations:

a) Production of each branch so that a final demand unit can be produced (consumption, exports etc.)

b) Calculation of the employment that a specific level of demand (or of any of its components) will create or be generated by the consumption of intermediate products by other branches.

c) The needs of intermediate inputs.

The contribution of a branch to the creation of employment is determined by the importance of its products in the final demand and by the requirements that other branches make of their products as intermediate inputs. This estimate can be obtained by calculating the creation of employment in each branch when the final demand for all the branches increases by one unit. In matrix form, this would be:

$$L = \hat{l}(1 - A)^{-1} D \qquad (5)$$

where $\hat{l}$ is the diagonalised matrix of the direct coefficients of employment, D is the vector column of the final demands, and L is the employment requirements of each branch needed to satisfy the final demand for all the branches.

Generalising for any component of added value, different from work, naming the coefficients of gross value added F_V and, in particular, F_l the work coefficient per product unit (N_j/X_j) and F_k the coefficient of capital per product unit, the amount of employment generated by an increase in final demand is calculated by the formula:

$$L = \hat{F}_1(1 - A)^{-1} D_F \qquad (6)$$

where D_F is the final demand vector and $\hat{F}_1$ is the diagonal matrix of the direct work coefficients.

With employment calculated, the turnover figures generated due to the increase in final demand that an investment project originates can be approximated through the IOF itself or by introducing assumptions about the apparent productivity of the work factor of the employment created or maintained (or about the Gross Value Added or Gross Domestic Product that these employees will produce).

2.2. Multicriteria Decision Making - The Analytic Hierarchy Process (AHP)

Multicriteria Decision Making can be considered as the set of methodologies, models, techniques and tools that allow for a more realistic and effective resolution of highly complex problems, characterised by the existence of multiple scenarios, actors and criteria (tangible and intangible).

The main aim of multicriteria techniques (Moreno-Jiménez, 2003) is to improve integral quality and to increase the knowledge value of decision making processes followed by individuals and organisations in complex situations. In other words, to improve the effectiveness, efficacy and efficiency of decisional processes and to increase the knowledge derived from the scientific resolution process (Moreno-Jiménez, 2003).

This paper concentrates on one of the most commonly applied multicriteria techniques, the Analytic Hierarchy Process (AHP). It was proposed by Thomas L. Saaty (1980) and combines tangible and intangible aspects to obtain, on a ratio scale, the priorities associated with the alternatives of the problem. The original version of AHP comprised three stages: (i) modelling, (ii) valuation and (iii) prioritisation and synthesis.

In the first stage, a hierarchical model is built and all pertinent aspects of the problem are included. Representational adequacy must be balanced against operational practicality. In the second stage, the actors involved in solving the problem incorporate their preferences using pairwise comparisons between the elements considered; these judgments are measured on Saaty's fundamental scale. The third stage involves the calculation of the local priorities (priorities of the elements that hang from a node with respect to the covering element) and the global priorities (the priority of each element in the hierarchy with respect to the goal). Finally, the total priorities of the alternatives are calculated by synthesising their global priorities.

The local priorities can be calculated with any of the existing prioritisation procedures; the most common are the *eigenvector method* (EGVM) and the *row geometric mean method* (RGMM). Global priorities are obtained by the hierarchical composition principle; the *total* are obtained by additive synthesis (some authors use multiplicative synthesis).

Finally, AHP can assess the inconsistency of the actors when eliciting the judgments. A reciprocal pairwise comparison matrix $A = (a_{ij})$ is said to be consistent if it verifies $a_{ij}\ a_{jk} = a_{ik}$, $\forall i,j,k=1,...,n$. There are several indicators for assessing inconsistency (Saaty, 1980; Aguarón and Moreno-Jiménez, 2003); Saaty's *Consistency Ratio* (CR) and the *Geometric Consistency Index* (GCI) are the most common for EGVM and RGMM. In the case of Saaty's Consistency Ratio (Saaty, 1994), inconsistencies of less than 10% are generally acceptable for matrices of rank n>4 (5% for n=3 and 8% for n=4). If this threshold is not satisfied, the judgments can be revised or the matrix can be abandoned.

AHP is recognised as one of the best multicriteria techniques in multi-actor decision making. The approach traditionally uses two procedures for group decision making (Saaty, 1980; Ramanatham and Ganesh, 1994; Forman and Peniwati, 1998; Escobar and Moreno-Jiménez, 2007): *Aggregation of Individual Judgments* (AIJ) and *Aggregation of Individual Priorities* (AIP). In the first (AIJ), a group judgment matrix is constructed from the individual judgments and each entry is determined by their weighted geometric mean. Based on this group judgment matrix, the priorities of the alternative being compared are identified by one of the prioritisation procedures. In the second procedure (AIP), individual priorities are deduced from the matrices of individual comparisons and the geometric mean is used to establish the group priorities.

3. INTEGRAL VIABILITY OF PUBLIC INVESTMENT PROJECTS

Decisions made on the suitability of public investment projects have traditionally been based on the study of their economic feasibility. Since the end of the 1970s, this economic perspective has been complemented by another, more holistic, vision of reality in which social and environmental aspects are explicitly considered, thereby filling the gap left by traditional models associated with measurement in purely monetary terms.

This paper proposes a new methodology based on use values (direct, indirect and potential) and non-use values (bequest and existence) usually studied for their environmental valuation (Barbier et al., 1997; Moreno-Jiménez et al., 2009) and this allows the evaluation of social and environmental aspects in economic terms (often considered as intangible).

3.1. The traditional focus: Economic Viability

Decisions on the suitability of public investment projects have been based almost exclusively on the study of their economic feasibility: the analysis of future cash flows associated with the inputs and costs most relevant to the project. Tools such as the Net Present Value (NPV) and the Internal Rate of Return (IRR) are used to evaluate the flows.

Net Present Value (NPV) –also known as Net Present Worth– is a classic procedure for financial evaluation of the net cash flows (the difference between inflows and outflows) which the investment produces, discounting a specified rate of interest. The main advantages of *NPV* are that it takes into account the value of money at each moment and that it is very flexible as it allows the introduction of any variable criterion that might affect the investment, for example, inflation, uncertainty or taxation. The formula is:

$$VAN = -A + \frac{Q_1}{(1+k_1)} + \frac{Q_2}{(1+k_1)(1+k_2)} + \ldots + \frac{Q_n}{(1+k_1)\ldots(1+k_n)} \qquad (7)$$

where *A* is the value of the initial investment; Q_i is the value of net annual cash flow (the difference between inflows and outflows) in the *i-th* period; *n* is the number of periods considered and k_i is the rate of discount.

If a project does not involve risk, the type of fixed income is usually taken as a reference. In this case, we can use the NPV in order to estimate whether is better to invest in the project or in something safer, with no specific risk. In other cases, the opportunity cost of the investment is used. In accordance with this criterion, when the NPV of a project is positive, the investment will produce profits above the required profitability (k_i), the project will add value and it can be approved. If the NPV is negative, the project should be rejected, if NPV is zero, the decision should be made in conjunction with other factors.

The two most important aspects of NPV criteria are fixing the time period to be studied and the interest rates that are used. In the present case study, the time horizon was fixed at 25 years and the interest rate was a nominal growth in inflows and outflows of 2% per annum (the same as the projected rate of inflation of the European Central Bank in the year of the study).

Another factor that influences the results is the rate of depreciation. The case study assumed a linear depreciation and two different scenarios based on a maximum and minimum repayment period. It should be noted that the calculation of the NPV only considered economic effects directly associated with the project, it did not contemplate the economic impact on the area or other social or environmental effects.

Previous work on public investment problems by the Zaragoza Multicriteria Decision Group (Moreno-Jiménez, 1997, 2005a, 2005b, 2006; Moreno-Jiménez et al., 1999), has demonstrated the growing interest in social and environmental aspects (in many situations, their relative importance is significantly superior the importance of economic aspects).

The Internal Return Rate/Internal Profitability Rate (IPR) of an investment is not used in this study as it is not part of the objectives. It is defined as the rate of interest at which the NPV is equal to zero. It is a profitability indicator (the greater the IRR, the greater the profitability) used to decide whether to accept or reject an investment project. The IRR is compared to a minimum rate or cut-off rate which is the opportunity cost of the investment (if it is a no-risk investment, the opportunity cost used to compare with the IRR is the risk-free profitability rate or the cost of capital). If the output rate of the project (the IRR) is greater than the cut-off rate, the investment is accepted, if not, it is rejected.

3.2. A new approach: Integral Viability

In the Knowledge Society, the importance of social and environmental aspects in the study of the viability of public projects and the integration of a holistic perspective have led to the development of new evaluation methodologies which allow the consideration of multiple actors and all the relevant (tangible and intangible) factors.

This paper presents a new method for evaluating suitability which involves economic, social and environmental aspects (integral viability). The analysis of economic viability uses the tools described in the previous section. The study of social and environmental viability is undertaken with the proposed methodology which values the tangible and intangible aspects in monetary terms. The methodology involves the *use* and *non-use values* used in environmental evaluation (Barbier et al., 1997; Moreno-Jiménez et al., 2009). Of the five values, three are use values (*direct*, *indirect* and *potential*) and two are non-use values (*bequest* and *existence*), only *direct use values* are normally evaluated in monetary terms (in some cases, indirect aspects can be given a monetary value). The determination of a monetary value for the other factors (largely intangible) is by means of an indirect procedure based on the multicriteria decision-making technique that is most commonly employed in the world of business: the Analytical Hierarchy Process (AHP), proposed by Thomas L. Saaty in the mid 1970s (Saaty, 1980).

The new methodology has two stages: i) the direct use values for the social and environmental aspects are quantified in monetary terms; ii) from the monetary estimation of the direct use values, the relative priorities of the other four values (obtained using AHP) are converted into monetary values.

When the monetary values for the economic, social and environmental aspects have been obtained, the integral viability of a project is assessed in accordance with a holistic vision of reality. In the *HistoPark* case study (see Section 4) environmental aspects were not considered relevant so the methodology focuses on the economic evaluation of the social aspects[4]. The calculation of the monetary estimation of the direct use social values involved two of the indicators most commonly used in empirical economic studies: i) the number of jobs created; ii) the turnover (estimated by the Gross Value Added or Gross Domestic Product generated by the project). The estimates of these two indicators were calculated according to the Input-Output Framework of the regional Aragonese economy for 2005 (Pérez-Pérez and Parra, 2009).

There are a range of types of values that can be found in the literature on economic evaluation, they include: market value, probable market value, use value, substitution value and objective value; in all them, the definition of value refers to market activity. However, the purpose of the economic valuation of a public investment project of this kind is not, in general, to obtain a market value (it cannot be considered as a 'good'); the objective is to provide an indicator of the importance the 'product' for the wellbeing of society in terms of a value that can be compared with other assets.

Barbier et al. (1997) define five types of values that make up *Total Economic Value* (TEV): direct use, indirect use, option/quasi-option, existence and bequest. In the *HistoPark* project

[4] The methodology for evaluating environmental aspects is analogous to the methodology for the evaluation of social aspects.

for the restoration of historic/cultural heritage, the components of the TEV (Moreno Jiménez et al., 2009) were as follows:

- *Direct Use Value* (*DUV*)*:* the value of goods and services associated to the project in the satisfaction of human needs as quantified by the market (income or turnover)

- *Indirect Use Value* (*IUV*)*:* the value of goods and services that are not financially remunerated, they are often difficult to observe and quantify, the value is not directly decided by the market but is derived from their functions (the establishment and maintenance of the population, training potential, ability to develop a cultural heritage, the creation of an identifying landmark, the enjoyment of recreational areas, etc.).

- *Potential Use Value* (*PUV*) or Barbier's option/quasi-option: this reflects the value which a person gives to the possibility or guarantee of future use of goods and services whose direct and indirect effects are unknown or difficult to establish with current knowledge.

- *Existence Value* (*EV*)*:* the value of an asset due to the fact that it is an essential resource for the conservation and development of life in the environment, of different animal species, floral micro-habitats, unique natural systems, cultural values etc.

- *Bequest Value* (*BV*)*:* the value of the benefits of the assets to future generations, i.e. the value assigned on the basis of the use and enjoyment by future generations.

Of all the components of the TEV, the only one which can be valued directly in monetary terms is the DUV. For this reason, the DUV can be taken as a *pivotal* element from which monetary evaluations of the remaining components can be made. The use of this indirect route for considering the other values is necessary as there is no market for them.

There are a variety of methods for evaluating environmental assets whose framework is used as a reference to determine the monetary value of an asset the services that the asset produces. Table 1 shows the most commonly used methods and the value that they attempt to determine.

Insert Table 1. Values of goods

As the DUV is a value reflected by the market, any of the methods used for the valuation of economic goods will suffice. This choice is subordinate to the initial information. As the remaining values are not linked to the market, other methodologies are usually used: indirect methods (avoided costs, increase in productivity, etc.) for IUV, and methods based on the determination of the willingness of the citizens to pay or on the perception of the citizens affected, for the rest (PUV, EV and LV).

From an operative point of view, the viability study for projects with high externalities includes aspects corresponding to economic, social and environmental criteria, which, in turn, reflect (Frey, 2000; Moreno-Jiménez et al., 2009) the five previously mentioned values (DUV, IUV, PUV, EV and LV). When the economic, social and environmental, aspects included in each of the five values are identified, the relative importance assigned to them by the actors involved in the decision-making is calculated by means of the Analytic Hierarchy Process (Saaty, 1980).

AHP incorporates the preferences of the actors involved in the resolution of the problem through the opinions expressed in accordance with Saaty's fundamental scale (Saaty, 1980) after completing the reciprocal matrices of paired comparisons. Unlike other multicriteria techniques, AHP can assess the decision maker's inconsistency when eliciting opinions. As measures of inconsistency, Saaty's Consistency Ratio (CR) (Saaty, 1980) is used for the prioritisation of the principal auto-vector on the right, and the Geometric Consistency Index (GCI) (Crawford and Williams, 1985; Aguarón and Moreno-Jiménez, 2003) is used for the prioritisation of the geometric mean by rows.

A questionnaire with the necessary comparisons can be sent to the different actors or political representatives. The priorities of each interviewee can be added together to obtain the group priorities for each of the five values. The Weighted Geometric Mean method (Saaty, 1980) was used in the case study. The group priorities are taken as a starting point when translating the economic evaluation obtained for the *DUV* to the other values considered for the project.

In the process of obtaining the monetary values associated with the five components of the TEV, a series of conditions must be guaranteed and fulfilled. Specifically, the decision makers cannot be inconsistent; this is achieved by the multicriteria technique employed (AHP), and its behaviour can be considered as homogenous. If this were not the case, the existing clusters would have to be identified and evaluations for each of the clusters or conglomerates would have to be determined (Gargallo et al., 2008; Altuzarra et al., 2019).

The *DUV* is obtained through thee monetary values associated with the project: investment, turnover and employment generated. Obviously, it is important to know if the project is economically viable and that future income stream can guarantee the progress of the business. However, it is possible that the indirect, potential use and non-use values suggest an investment that would not be economically profitable but would be socially and environmentally beneficial.

4. THE INTEGRAL VIABILITY OF THE *"HISTOPARK"* PROJECT

4.1. The *HistoPark* project

The study took place in the regional community of Aragon in the second quarter of 2008. For reasons of confidentiality, neither the real name of the project nor its exact location can be reported. The authors were also asked to wait for a number of years before publishing the results.

The estimated investment the *HistoPark* project was €24 million; this included the technical draft, technical work and the acquisition and urbanisation of 100,000m^2 of land for the development of a tourist complex. It was envisaged that the park would receive 65,000 stays per year, starting from the period *t+3*, with another 65,000 *express* visits (of shorter duration).

4.2. The Integral Viability of *HistoPark*

The evaluation of the integral viability of a public investment project usually looks at its economic, social and environmental viability. Due to the particular characteristics of the *HistoPark* project environmental aspects were not relevant. The integral viability of the project exclusively focused on the economic and social aspects captured by the five values (DUV, IUV, PUV, VE and LV) used in the study.

4.2.1. Economic-Financial Validity of the *HistoPark* project

The application of the *NPV* began with the investment figures, the income and expenditure transformed into cash flows and projected over a time horizon of 25 years, assuming a nominal increase in inflows and outflows of 2% annually. The calculations were made for two different scenarios (Tables 2 and 3), depending on whether depreciation was minimum or maximum[5].

Applying the linear coefficients established in the officially approved tables, and assuming that the investments are repaid and that this circumstance does not lead to the repositioning of the fixed assets, the accumulated cash flow is always negative in the two scenarios although the magnitude in the second is noticeably smaller than the first.

For any reasonable discount rate k_i (for example, the Spanish fixed interest rate), the NPV of the investment is negative and the project should be rejected. Table 9 gives the results of the NPV based on other annual growth rates of the inflows and outflows. Note that accumulated cash

[5] Technical installations and equipment would be renovated or updated every 20 years; machinery every 18 years; patents and brands would last 20 years; tooling, information-processing equipment and other fixed assets 8 years; and IT applications 6 years.

flow in year t + 25 is only positive when cumulative annual average growth rates of the flows are equal to, or higher than, 6% and amortization periods are maximum.

It should be noted that the calculation of the NPV only considers economic effects directly associated with the project, it does not take into account the impact of the investment on the area, i.e., the social effects quantified by the number of jobs created and the Gross Value Added (GVA) or Gross Domestic Product (GDP) that could be generated (they approximate the associated business figures).

Insert Table 2. *NPV* of investment in *HistoPark* (minimum depreciation period)

Insert Table 3. *NPV* of investment in *HistoPark* (maximum depreciation period)

4.2.2. Social Viability of the *HistoPark* project

As already mentioned, the analysis of the social viability used two of the most commonly employed indicators in the scientific literature: employment and turnover, estimated by means of the IOF of the Aragonese economy. The IOF can be used both to evaluate the employment generated by the investment of the project in the short term and to approximate the long term possibilities.

The evaluation of the effects of the investment was based on projected investment and predicted development over the years *t*, *t+1* and *t+2*. After the quantification of the investment and the temporary development of the project, the investment was assigned to different branches and the percentage of these branches to be satisfied with regional production was established.

The first question was relatively simple, the branches that received the initial investment were: machinery and mechanical equipment; manufacture of office machinery and computers; manufacture of electrical machinery and apparatus; manufacture of motor vehicles; manufacture of furniture; construction; computer and related activities; and, other business activities.

The second question was more complex: regional companies may benefit by being designated as contractors, taking part in temporary business associations (TBA) with businesses that are awarded tenders by acting as subcontractors or simply by supplying intermediary inputs and/or productive factors to the preceding businesses.

As there is a lack of precise information, it was decided to use the percentages given for the gross fixed capital formation of the Symmetric Table of the IOF of the Aragonese economy (72.58%), a criterion which is coherent with similar studies such as the Instituto *Valenciano de Investigaciones Económicas* (2005). Finally, it should be specified that in order to apply the demand model of the IOF, expenditure at acquisition cost was converted into basic prices.

The IOF of Aragon (Pérez-Perez and Parra, 2009) was applied. The results are shown in Table 4. Note that 158 fulltime jobs could be created and maintained between t and t+2. This would be both direct and indirect employment in the years *t* y *t+1*, with the creation of 86 and 66 jobs, respectively (Table 4).

Insert Table 4. Potential impact on employment of *HistoPark* investments

The building sector would gain the most (91 jobs), followed by service industries (38), manufacturing (25), the primary sector (3) and the energy sector (1). This impact of this employment would disappear when construction finished so (for the purposes of this work) it is more interesting to quantify the effects associated with the running of the business, as they would be longer lasting.

The project could have a significant effect on economic activity in Aragon: there would be greater national recognition; more outside investment; an increase in tourism; locations for conferences and congresses; registered trademarks etc. *A priori,* all of these are difficult to quantify.

The study therefore decided to only evaluate the effects of tourism. By year *t+3*, the park would be fully functioning; the admission charges for the projected 65,000 visitors would generate €650,000. The predicted 65,000 *express* visitors would pay an admission fee of €3, whilst €195,000 is forecast for sales of food and drinks from vending machines

It is envisaged that the tourists would buy locally made goods to a value of €226,200 and gifts worth €1,043,900, the goods would be bought from shops sublet to third parties by the company that runs the project for a total of €208,650. On-site shops would take €575,250 from ordinary tourists and €260,000 from *express* visitors. It is expected that 15,000 tourists would eat in the restaurants/cafeterias to the value of €180,000 and that 8,000 vehicles would generate €320,000 in sales of petrol from local service stations.

To apply the IOF it is necessary to assign tourist spending to the different branches or sectors*:* sales of motor vehicles; petrol; vehicle repairs; retail; hotels and restaurants; and, recreational, cultural and sporting activities. It could reasonably be assumed that the tourist requirements would be satisfied by local businesses. With these assumptions, the IOF concluded that in year *t+3*, 194 jobs would be created or maintained as a consequence of the tourist demand and a GVA of €9,335,609 would be generated. If the (estimated) net taxes on products were added to the GVA figures, the Gross Domestic Product (GDP) generated by the project would be €10,365,353. According to the Spanish Government Internal Audit Office (2010), in year *t*, tax revenue in Spain was 37.1% of GDP; 12.9% of the non-financial resources of the Spanish Public Administration came from taxes on income and wealth (7.48% personal income tax, 4.73% corporation tax, 0.67% other); 12.16% from social security contributions; 11.7% from taxes on products (6% VAT and other taxes on products and production); and 0.51% from taxes on capital.

In the municipality where the *HistoPark* is located, an investment of less than €24 million would create 15 jobs and would generate around €2.23 million (evaluated as the business income figure).

Alongside these two indicators (part of the direct use value), other more intangible factors associated with indirect use (IUV), potential (PUV), existence (EV), and bequest (LV) values can be utilised to provide a monetary estimate using indirect procedures

The new values help to calculate a value indicator given to the project by the institutions (institutional value), this is a particularly relevant point if we want to determine the commitment (financial support) which the institutions should maintain for the future of the project.

To evaluate the (DUV, IUV, PUV, EV, LV) a questionnaire was sent to the spokespersons of the three political parties (PSOE, PP and PAR)[6] that govern the municipality where the project would be located. The reciprocal matrices of paired comparisons submitted by the three parties are as follows (Table 5):

The three matrices are consistent as the inconsistency indicator known as the Consistency Ratio (Saaty, 1980) is less than 10% (CR = 0.10): [CR(PSOE) = 0.04; CR(PP) = 0.09 and CR(PAR) = 0.08].

Insert Table 5. Evaluations of the political parties

The priorities for the three parties with their weightings and the priorities for the municipality obtained as the weighted geometric mean of the priorities of the political parties (Aczel and Saaty, 1983) are given in Table 6.

Insert Table 6. Evaluations of the political parties

The PAR gives more relative importance to the DUV and less to the IUV, the PP gives the least value to the PUV and the PSOE is the party that gives the least value to the LV.

The relative importance (priority) given by the municipality to the annual turnover figures (€2,230,000) for the DUV is 52.95%. Based on these relative priorities, the monetary expression associated with each of the remaining values can be estimated. These values are shown in Table 7.

[6] PAR: *Partido Aragonés*; PP: *Partido Popular*; PSOE: *Partido Socialista Obrero Español*.

Insert Table 7. Normalized priorities and monetary values for the municipality where *HistoPark* would be located (constant 2008 euros)

The institutional value of the project is obtained as the sum of the four values: IUV (€925,456); PUV (€378,524); EV (€154,154); and, LV (€523,088), is €1,981,221. This is the value that the institution associates with the functions of the project which are and are not evaluated in economic terms by the market. This is a guide to knowing what an administration is able to finance in order to achieve the other functions.

In Aragon, the IOF concluded that the 65,000 tourists visiting *HistoPark* could generate in year *t+3* a GVA of €9,335,609 and a GDP of €10,365,353. Considering the same normalised priorities and monetary values given in Table 7, the institutional value of the project would be €9,208,580. Table 8 shows the institutional value of the project assuming different numbers of visitors.

Insert Table 8. Normalised priorities and monetary values for Aragon (constant 2008 euros)

Taking into account that tax revenue in *t+3* could be around 37.1% of the GDP generated, the project would be socially and economically profitable. The Public Administration should support the project and finance maintenance, repairs or any necessary refurbishments. However, from the point of view of economic profitability, the project evaluated by the NPV in Tables 3 and 4, might not be seen as feasible.

5. CONCLUSIONS

The analysis of the economic return on a public project has proved to be one of the greatest justifications for investment in heritage promotion. The value of the economic returns produced by tourism can be calculated by means of a set of indicators, such as the number of visitors, employment or turnover.

The number of visitors is very significant, though susceptible to numerous variables that do not depend solely on development (purchasing power, cost of transport, security problems) but on the task of galvanizing the project and the operation of the marketing plan.

The employment indicator allows the measurement of the local impact, especially in deprived areas or those strongly affected by unemployment, though there are several matrices which demand caution when drawing conclusions. In the specific case of *HistoPark*, the IOF of the Aragonese economy estimated that more than 190 jobs could be created as consequence of increased tourism.

As for the third indicator for the evaluation of economic returns from a tourist venture: the turnover, it should be stated that this is based fundamentally on the income from admission tickets and associated services. In most heritage sites, the ticket income does not always represent the cost of services and operation.

According to the data, *HistoPark* would receive 65,000 visitors a year together along with 65,000 express visitors. The annual turnover in the municipality where the *HistoPark* is located (estimated income) would be very close to 10% of the investment (about €2.23 million) and the results of the operation would vary, depending on the repayment period.

If the IOF is used to estimate the economic impact on Aragon, a turnover figure (GDP) is reached which includes all the concepts, not only those of visitor spending, which would be €10,365,353 in *t+3*.

To complete the viability study undertaken for *HistoPark*, a social value was estimated using the Analytic Hierarchy Process (AHP). This figure includes values of indirect and potential use, as well as non-use values (existence and bequest). The social value was obtained both in the local area (annual turnover figures associated with the project) and in the region (turnover figures of the regional economy). The estimated local social value was €1,981,221, the sum of the four values:

IUV (€925,456), PUV (€378,524), EV (€154,154) and LV (€523,088). The regional social value was €9,208,580 for 65,000 visitors (the sum of IUV €4,301,621; PUV €1,759,000; EV €716,246 and LV €2,431,712).

This leads to the conclusion that the Public Administration should support a product whose social value represents 47% of direct use value (turnover). This support should be shown by taking responsibility for the renewal of equipment, if needed. It would seem reasonable for the administration, both for economic interests in the region and for the project's social interest, to try to offer some specific services, this last point being a key to ensuring the success of this project in the medium and long terms. It should also provide the marketing strategies necessary for dissemination.

Despite the fact that the project cannot be economically profitable with the projected number of visitors, *HistoPark* is viable from an integral perspective if the social values are considered with the economic impact in the region and the number of jobs that would be created. The project would contribute to the economic diversification of the area, reducing socioeconomic risks derived from adjustments in traditional productive activities, and would also pave the way for new small and medium sized businesses connected to the natural, historic and cultural resources of the surroundings.

It should be clarified that although many of the assumptions can be questioned, alterations would lead to the same conclusions: only part of the disbursements made would be recovered, the NPV of the investment is negative and, according to this criterion, the project should not be undertaken. However, when integral viability is examined the project should be approved.

The analysis of the integral viability of public investment projects with extended versions of the IOF (such as the social accounting matrix) and other multicriteria techniques is a future line of research of particular interest.

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Table 1. Values of goods
Source: Moreno-Jiménez et al. (2009) and Barbier et al. (1997)

TOTAL ECONOMIC VALUE		Method
Use values	Direct use value (DUV)	Market price Cash flows Factor income Replacement cost Travel costs
	Indirect use value (IUV)	Avoided costs Factor income Hedonic price
		Travel costs
	Potential use value (PUV)	Contingent valuation Hedonic price
Non-use values	Existence value (EV)	Contingent valuation
	Bequest value (BV)	Contingent valuation

Table 2. *NPV* of investment in *HistoPark* (minimum depreciation period)

Year	HistoPark investment payment	Payments for the renovation of HistoPark assets	Running costs	Set up costs	Operating income	VAT rebate	Cash flows	Accumulated cash flows
t	628,160			6,300			-634,460	-634,460
t+1	11,801,376			120,000			-11,921,376	-12,555,836
t+2	11,248,288		921,300	96,000	1,239,190	3,206,458	-7,819,940	-20,375,776
t+3			1,748,640		2,478,380	-68,837	660,903	-19,714,873
t+4		45,685	1,783,613		2,527,947	-63,912	634,737	-19,080,135
t+5		193,052	1,819,285		2,578,506	-44,990	521,179	-18,558,956
t+6		1,216,921	1,855,671		2,630,076	94,801	-347,715	-18,906,670
t+7			1,892,784		2,682,678	-74,511	715,383	-18,191,288
t+8		479,391	1,930,640		2,736,332	-9,879	316,422	-17,874,866
t+9		50,440	1,969,253		2,791,058	-70,564	700,801	-17,174,065
t+10		4,062,539	2,008,638		2,846,879	481,278	-2,743,019	-19,917,084
t+11		1,563,790	2,048,810		2,903,817	135,042	-573,741	-20,490,825
t+12		2,756,375	2,089,787		2,961,893	297,923	-1,586,345	-22,077,170
t+13			2,131,582		3,021,131	-83,912	805,637	-21,271,533
t+14		2,021,379	2,174,214		3,081,554	193,221	-920,819	-22,192,352
t+15			2,217,698		3,143,185	-87,302	838,185	-21,354,168
t+16			2,262,052		3,206,049	-89,048	854,948	-20,499,219
t+17		244,836	2,307,293		3,270,170	-57,058	660,982	-19,838,238
t+18		4,759,912	2,353,439		3,335,573	563,894	-3,213,884	-23,052,122
t+19		61,486	2,400,508		3,402,284	-86,018	854,273	-22,197,849
t+20		607,984	2,448,518		3,470,330	-12,529	401,299	-21,796,549
t+21			2,497,488		3,539,737	-98,316	943,932	-20,852,617
t+22		4,193,550	2,547,438		3,610,531	478,138	-2,652,319	-23,504,936
t+23		342,280	2,598,387		3,682,742	-55,077	686,998	-22,817,938
t+24			2,650,355		3,756,397	-104,334	1,001,708	-21,816,230
t+25			2,703,362		3,831,525	-106,421	1,021,742	-20,794,487

Table 3. ***NPV*** **of investment in** ***HistoPark*** **(maximum depreciation period)**

Year	HistoPark investment costs	Payments for the renovation of HistoPark assets	Running costs	Set up costs	Operating income	VAT rebate	Cash flows	Accumulated cash flows
t	628,160			6,300			-634,460	-634,460
t+1	11,801,376			120,000			- 11,921,376	-12,555,836
t+2	11,248,288		921,300	96,000	1,239,190	3,206,458	-7,819,940	-20,375,776
t+3			1,748,640		2,478,380	-90,891	638,849	-19,736,927
t+4			1,783,613		2,527,947	-92,709	651,626	-19,085,301
t+5			1,819,285		2,578,506	-94,563	664,658	-18,420,643
t+6			1,855,671		2,630,076	-96,454	677,951	-17,742,692
t+7			1,892,784		2,682,678	-98,384	691,510	-17,051,181
t+8		204,868	1,930,640		2,736,332	-72,094	528,730	-16,522,451
t+9			1,969,253		2,791,058	-102,358	719,447	-15,803,004
t+10		2,385,232	2,008,638		2,846,879	224,592	-1,322,398	-17,125,402
t+11			2,048,810		2,903,817	-106,494	748,513	-16,376,889
t+12			2,089,787		2,961,893	-108,623	763,483	-15,613,406
t+13			2,131,582		3,021,131	-110,796	778,753	-14,834,653
t+14		230,715	2,174,214		3,081,554	-81,189	595,436	-14,239,217
t+15			2,217,698		3,143,185	-115,272	810,215	-13,429,002
t+16		321,648	2,262,052		3,206,049	-73,212	549,136	-12,879,866
t+17			2,307,293		3,270,170	-119,929	842,947	-12,036,918
t+18		1,543,350	2,353,439		3,335,573	90,548	-470,668	-12,507,587
t+19			2,400,508		3,402,284	-124,774	877,002	-11,630,584
t+20		4,792,174	2,448,518		3,470,330	533,720	-3,236,642	-14,867,226
t+21			2,497,488		3,539,737	-129,815	912,433	-13,954,793
t+22		1,674,057	2,547,438		3,610,531	98,493	-512,470	-14,467,263
t+23		853,768	2,598,387		3,682,742	-17,298	213,289	-14,253,975
t+24			2,650,355		3,756,397	-137,761	968,281	-13,285,693
t+25			2,703,362		3,831,525	-140,516	987,647	-12,298,046

Table 4. Potential impact on employment of ***HistoPark*** **investments**

Generation of employment	*t*	*t+1*	*t+2*	Total
Investments. Initial impact (constant 2008 euros)	368,641	7,136,559	6,480,528	13,985,729
Investments. Total impact (constant 2008 euros)	478,902	10,195,762	8,799,726	19,474,390
Potential employment (full time jobs)	**6**	**86**	**66**	**158**

Table 5. Evaluations of the political parties

PSOE	*DUV*	*IVU*	*PUV*	*EV*	*BV*
DUV	1	3	5	8	6
IVU		1	3	5	4
PUV			1	3	2
EV				1	1/3
BV					1

PP	*DUV*	*IUV*	*PUV*	*EV*	*BV*
DUV	1	3	7	9	5
IUV		1	3	7	1
OUV			1	5	1/5
EV				1	1/5
BV					1

PAR	*DUV*	*IUV*	*PUV*	*EV*	*BV*
DUV	1	5	7	7	5
IUV		1	1	5	1
PUV			1	5	1/3
EV				1	1/5
BV					1

Table 6. Evaluations of the political parties

	DUV	*IUV*	*PUV*	*EV*	*BV*	Weight
PSOE	0.5132	0.2506	0.1146	0.0424	0.0791	5/11
PP	0.5077	0.2255	0.0592	0.0296	0.1780	4/11
PAR	0.5603	0.1351	0.1014	0.0349	0.1683	2/11
Municipality	0.5295	0.2198	0.0899	0.0366	0.1242	

Table 7. Normalized priorities and monetary values in the municipality where *HistoPark* is located (constant 2008 euros)

	DUV	*IUV*	*PUV*	*EV*	*BV*
Norm.Prior.	1	0.4150	0.1697	0.0691	0.2346
Turnover	2,230,000	925,456	378,524	154,154	523,088

Table 8. Normalized priorities and monetary values in Aragon (constant 2008 euros)

	DUV	*IUV*	*PUV*	*EV*	*BV*
Norm. Prior.	1	0.4150	0.1697	0.0691	0.2346
Turnover for 65,000 visitors	10,365,353	4,301,621	1,759,000	716,246	2,431,712
Turnover for 100,000 visitors	14,604,339	6,060,801	2,478,356	1,009,160	3,426,178
Turnover for 115,000 visitors	16,421,047	6,814,735	2,786,652	1,134,694	3,852,378
Turnover for 130,000 visitors	18,237,755	7,568,668	3,094,947	1,260,229	4,278,577

Table 9. Accumulated cash flow in year t + 25 (euros)

Annual growth rate of the inflows and outflows	**Depreciation period**	
	Minimum	**Maximum**
0.0%	-25,059,790	-16,563,349
0.5%	-24,103,537	-15,607,096
1.0%	-23,077,596	-14,581,155
1.5%	-21,976,534	-13,480,093
2.0%	-20,794,487	-12,298,046
2.5%	-19,525,131	-11,028,690
3.0%	-18,161,644	-9,665,203
3.5%	-16,696,669	-8,200,228
4.0%	-15,122,273	-6,625,832
4.5%	-13,429,903	-4,933,462
5.0%	-11,610,337	-3,113,896
5.5%	-9,653,633	-1,157,192
6.0%	-7,549,077	947,364
6.5%	-5,285,121	3,211,320