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CONVERSION FACTORS IN THE COST-BENEFIT ANALYSIS OF INVESTMENT PROJECTS FINANCED FROM ERDF AND CF

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CONTENT

1. INTRODUCTION

The Cost - Benefit Analysis is a tool at the disposal of decision-makers, its goal being that of facilitating an efficient distribution of society's resources. It is an economic assessment which compares the costs and benefits of two or more alternatives to achieve an investment, both costs and benefits being transformed into monetary units. Costs[1] must include the price of acquiring the equipment and the operating costs (maintenance, operator's training courses, consumables etc.) and also the opportunity cost. Some benefits[2] are quantifiable (additional profit, loss decreases). Others, however, are harder to quantify. It is hard to transform into monetary units, for example: time savings, increases in employees' satisfaction or the growth of the population's living standard.

While the cost and benefits may relate to goods and services that have a simple and transparent measure in a convenient unit (e.g. their price in money), this is frequently not so, especially in the case of social infrastructure. It should therefore be emphasized that the costs and benefits considered for the `cost-benefit' analysis of the social infrastructure projects are not limited to easily quantifiable changes in material goods, but should be construed in their widest sense, measuring changes in individual `utility' and total `social welfare' (though economists frequently ex-press those measures in money-metric terms).

The use of conversion factors is due to the fact that entry and exit prices are not reflecting their social value, because of the market distortion (monopoly, trade barriers and others). Thus, in case of an energy-intensive project that depends upon the electricity supply under a regulated tariffs regime, when such rates are different from the long-term marginal costs, prices are distorted and it is necessary to use "shadow" prices that can better reflect the social opportunity costs of resources.

For this reason, conversion factors are used, either as standard conversion factor (SCF – for non-tradable items, with a low share in total, such as electricity, fuels, other forms of energy, local products and materials) or as specific conversion factor (CF - for non-tradable major items).

In this sense, the paper explores the general use of the applicable correction factors per cost item, the types of costs and their conversion factors.

The proposed methodology in this paper will be based on the identification of the typical planning parameters – shadow prices of labour and capital.

In the analysis it is distinguished between non-tradable goods (e.g. local transport services), which take into account the marginal cost, and tradable goods (energy services) valued at border prices (CIF for imports and FOB for exports).

Tradable goods are defined as goods that can be considered for international trade; CIF (import) or FOB prices (export) will be used. Non-tradable goods are items that cannot be exported or imported (e.g. local suppliers), non-skilled labour, land expropriations and maintenance costs.

[1] For more details on costs please consult WP 4

[2] For more details on benefits please consults WP 5

In terms of wage distortion, one should be careful and consistent in carrying out its assessment for the social costs of labour. For economic analysis, it is important to check if the project involves jobs reduction in other sectors, or those jobs that would otherwise disappear are still kept (e.g. renovation and modernization of an existing factory); at the same time, employment influence can vary depending on target groups.

To convert these prices, the Standard Conversion Factor (SCF) can be used, based on the average gap between domestic and international prices (e.g. FOB and CIF border prices) due to trade tariffs and barriers. But when considered that these costs have a small share in total project costs and that about 70% of Romania's trade is conducted within the EU and, by definition, is not subject to commercial rates, SCF=1, unless otherwise justified.

2. THE CASE

2.1 GENERAL USE OF THE APPLICABLE CORRECTION FACTORS PER COST ITEM

The objective of cost- benefit analysis is the evaluation of the "production activities'. The "social profitability' of public sector projects is calculated in a manner similar to the way a business enterprise would calculate the profitability of its activities, but the resources used and the outputs produced are valued differently. In a cost-benefit appraisal, "shadow prices', which reflect the social value of goods, replace the market prices that are used in the private calculation. In a perfectly competitive economy market prices and shadow prices will coincide, if we ignore complications introduced by issues of income distribution. Cost-benefit analysis and calculation of private profitability will yield the same result in this case.

The economic and social analysis implies the crossing through *3 stages*:

- Stage 1: Fiscal Corrections;
- Stage 2: Corrections of the externalities;
- Stage 3: The Conversion of the Market Prices into Accounting Prices.

Stage 1: Fiscal Corrections

This stage consists of the elimination of some fiscal distortions (taxes, subsidies) that affect the prices of the inputs and the outputs, respective:

- The elimination of the VAT and other indirect taxes of the inputs and outputs prices. The direct taxes included in the prices of the inputs will be maintained.
- The elimination of the transfer operations made towards natural persons (e.g. the payments for the social security).

Stage 2: Corrections of the externalities

This has as an objective the determination of the external benefits and of the external costs, which haven't been taken into consideration during the financial analysis[3]. Although these might be easily identified, they are hard to quantify and, in this situation, they have to be enumerated in order to offer to the decision maker additional elements to formulate the decision. As a general rule, every cost or social benefit that is spread abroad other subjects without compensation have to be book kept in this stage.

We must specify that these benefits may appear not only for the direct users of the project but also for third parties which haven't been taken into consideration from the very start.

[3] For more details on externalities, please consult WP 7

Stage 3: The Conversion of the Market Prices into Accounting Prices

This proceeding has to establish the conversion factors for the conversion of the market prices into accounting prices. It is necessary such a conversion because the prices in use of the inputs and outputs cannot express their social value because of the distortions on market (policy of exclusivity, barriers to entry etc.) and this changes the results of the analysis. The accounting prices come in order to solve out such a problem, because they eliminate such distortions and reflect the costs of social opportunity of the resources. They can be represented by the marginal cost of the goods that cannot be commercialized on an international market, specially the price in the custom for the goods that can be commercialized on the international market.

The conversion of the market prices into the accounting prices is made with the use of the conversion factor.

Appropriate conversion factors applied to the financial values of the operating revenues should already capture the most relevant non-market benefits a project may generate. However, if conversion factors have not been estimated or the project is non-revenue generating, alternative approaches can be used to assess non-market benefits. The most frequently used method is the willingness-to-pay (WTP) approach, which allows the estimation of a money value through users' revealed preferences or stated preferences.

In this stage we must point out also the distortions that may interfere in the level of the salaries because of the imperfections of the labour market. The supplementary staff employment is at the first sight a supplementary social cost because it implies the use of the labour power resources in the project which become unavailable for other alternative activities. At the same time, the new jobs will generate a supplementary input that must be taken into consideration for the estimation of the outputs. This is why, in order to estimate the social effects of the new jobs creation, we can resort to two modalities:

- either it is used an accounted salary that is inferior to the present salary paid by the project that is justified by the fact that in the conditions of a sub-utilization of the labour power, the paid salaries are bigger that the opportunity cost of the labour;
- either it can be tried in the estimation of the multiplier income of the output due to the positive external impact.

Market distortions, however, will cause shadow prices and market prices to differ. This makes cost benefit analysis difficult, since "shadow prices' or "social values' cannot be directly observed.

Computing shadow prices is part of a very sophisticated optimization problem. A shadow price is, in a way, an opportunity cost that would be lost by not adding an additional hour of capacity. To justify a decision in favour of a short-term capacity decision, the decision maker must be sure that the shadow price exceeds the actual price of that expansion.

In constrained optimization in economics, the **shadow price** is the change in the objective value of the optimal solution of an optimization problem obtained by relaxing the constraint by one unit it is the marginal utility of relaxing the constraint, or equivalently the marginal cost of strengthening the constraint.

The price which consumers pay for a good is one measure of social value of the good, as it measures what a consumer is willing to pay for an extra unit of the good. The price which producers face is an alternative measure of social value, since in a competitive market it is equal to the marginal cost of the resources used in producing the good. In the presence of a consumer tax or other distortion these two measures will not coincide.

The CBA literature offers different shadow wage formulae based on different hypotheses on labour market conditions, and sometimes on capital and product markets as well.

Lewis (1954) proposed a simple closed economy model based on output loss. Society maximizes aggregate output, and consumption of different workers is given equal social weight by the government.

Going back to shadow wage theory, a classical starting point in the context of project evaluation was the important work by Little and Mirrlees (1974). The authors justify the use of shadow prices because of the presence of real wage rigidity in the formal sector of the economy, which exaggerates the social cost of employment. Specifically, they identify five main sources of distortion. First, even if actual wages were equal to the value of the marginal product of labour at market prices, the former may be distorted by taxes and subsidies: hence consumption at shadow prices may be greater or less than that at market prices. Second, labour in the rural sector receives subsidies (one may think of the Common Agricultural Policy of the EU as a significant example). Third, in the public sector there are minimum wage requirements because of government regulation or unionization that may distort the market. Finally, in some sectors high wages may correspond to even higher productivity and consumption and transferring labour from the rural sector to the urban or formal sector may entail some costs.

There could be a problem with general equilibrium shadow wage rates due to the fact that models tend to be very complex, and the results sometimes surprising. An example is Roberts (1982), who shows a very complex model in which government may have a monetary policy, and public production can be financed either by money, indirect or lump taxes.

When the shadow wage is simply seen as the marginal productivity of labour, as in earlier theories, it can be directly estimated using a production function. Cobb-Douglas specifications are often used in models estimating the labour supply of members of agricultural households, especially in developing economies.

From all the contributions reviewed, it is clear that highly project-specific micro data were often needed to compute shadow wages and corresponding conversion factors.

Therefore, several countries have developed National Guidelines and recommendations for applied CBA which include considerations on the social cost of labour.

2.2 TYPES OF COST AND THEIR CONVERSION FACTORS

In CBA the objective is to appraise the social value of the investment. Observed prices, as set by markets or by governments, sometimes do not provide a good measure of the social opportunity cost of inputs and outputs. This happens when:

- Real prices of inputs and outputs are distorted because of inefficient markets;

- Government sets non cost-reflective tariffs of public services.

These distortions are frequent in some less developed countries, where market opening is limited, and Government tariff policy is constrained by managerial and political issues. Some observed prices, however, can be far from social opportunity costs in any EU country.

The shadow wage and shadow income are the key variables in estimating the labour supply function. Thus, having an appropriate measurement of these variables is crucial to the estimation process. Under a perfect market assumption, the observed market wage is identical to the shadow wage, so it can be used as an appropriate measure of the shadow wage. However, this assumption is usually violated and any failure (or imperfection) in the labour, farm input, or credit market can make the shadow wage deviate from the market wage (Singh, Squire, and Strauss 1986; Thorbecke 1993). As a result of market failures, the market wage is no longer an appropriate measure of the shadow wage.

The corrections on the externalities hint the part of benefits generated by the project.

The external benefits generated by this objective are extremely diverse, and some of them are difficult to estimate.

In CBA guides elaborated by EC[4], there are established the values for correction factors to be used by member states.

These recommended conversion factors are grouped on six categories, as follow:

Cost category (cost item)	**Conversion factor**
Tradable goods	1
Non-tradable goods	1 (if not otherwise required)
Qualified workers	1
Non-qualified workers	Formula use SWRF (1-u) x (1-t)
Land acquisition	1
Financial intermediaries	0

The last correction is made through the calculation of opportune conversion factors which, multiplied by the market price, give the value of the shadow prices. This correction is necessary because the markets are imperfect and market prices don't always reflect the opportunity cost of a good. If prices are distorted they are not a suitable indicator of welfare.

EXAMPLE: PRICE DISTORTIONS

A land intensive project, e.g. an industrial site, where land is made available free of charge by a public body, while it may otherwise earn a rent.

[4] Guide to Cost Benefit Analysis of Investment Projects, European Commission, July 2008

An agricultural project that depends upon water supply at a very low tariff, heavily subsidized by the public sector and where output prices are affected by special policy regimes (e.g. under some provisions of the EU Common Agricultural Policy).

An energy intensive project which depends upon the supply of electricity under a regime of regulated tariffs, when these tariffs are below long run marginal costs.

A power plant under a collusive oligopoly regime, which determines a substantial price divergence of electricity prices from long-term marginal.

Whenever some inputs are affected by strong price distortions, the proposer should address the issue in the project appraisal and use accounting ('shadow') prices to better reflect the social opportunity cost of the resources (see Figure 2.4). We discuss below some shadow prices that may be needed in practice.

For some key national CBA parameters, the calculations should, in principle, be done by a planning office of the Member State and certainly not project-by-project, because of its macroeconomic nature.

- In some cases, when there is no full convertibility of the currency, one parameter for economic analysis is the shadow exchange rate (SER). This is the economic price of foreign currency, which may diverge from the official exchange rate (OER). In general, the greater the divergence between the OER and the SER, the more likely will depreciation or appreciation occur and affect project performance.

While all accounts for project analysis under the EU Funds should be in Euros, including those for countries which are not in the EMU (European Monetary Union), the use of a SER for the Member States is not suggested because of free currency convertibility and lack of controls on capital flows. The issue can, however, be considered for some candidate countries under IPA assistance (Instrument for Pre-Accession Assistance) if there is a need to add realism to project analysis when there are binding constraints on international capital flows.

- In general, the use of a standard conversion factor (SCF) for some project cash flows is preferred to the SER because in principle it captures the same distortions as the SER while being more consistent with the use of other (sector-specific) conversion factors. The value of the SCF is estimated on the basis of the values of exports and imports (see example below). If the planning authority does not offer its own estimates, SCF=1 should be the default rule.

EXAMPLE: CALCULATION OF THE STANDARD CONVERSION FACTOR

This is an example of data for the estimate of the standard conversion factor (Millions of Euros):

1) total imports (M) M = 2000

2) total exports (X) X = 1500

3) import taxes (Tm) Tm = 900

4) export taxes (Tx) Tx = 25

The formula to be used for the calculation of the Standard Conversion Factor is (SCF):

SCF = (M + X) / [(M + Tm) + (X - Tx)]

SCF = 0.8.

In practice, calculations may be more complex, because of non-tariff barriers and other sources of international trade distortions, for example in the foreign trade restrictions between EU and non EU countries; because of special regulations for the service sector; because of different tax patterns across countries and sectors.

The project examiner needs to carefully assess and consider how the social costs are affected by departures of observed prices from the following reference values:

♦ marginal costs for internationally non-tradable goods, such as local transport services;

♦ border prices for internationally tradable goods, such as agricultural crops or some energy services or manufactured goods.

For every traded item, border prices are easily available: they are international prices, CIF for imports and FOB for exports, expressed in the same currency. Where the relevant economic border lies is a matter to be ascertained on a case-by-case basis. For example the external border of the EU may be relevant for some sectors but not for others. The key empirical indicator for assessing whether border prices should be used is the dispersion of prices across countries for the same tradable good or service. Table 2.9, showing that there is a difference up to 250% across countries for prices paid by EU consumers of electricity, provides an example.

Table 2.9 Electricity price dispersion for industry and households in the EU, year 2005, €

Electricity		**2005**
Industry (annual consumption: 2000 MWh)	Average	6.74
	Median price	6.46
	Coeff. of variation	18.1%
	Max/min. ratio	2.20
Household (annual consumption: 3500 kWh)	Average	10.65
	Median price	9.00
	Coeff. of variation	23.5%
	Max/min. ratio	2.50

Source: European Commission, DG ECFIN (2007).

For non-traded items: the standard conversion factor is used for minor non-traded items or the items without a specific conversion factor, while for major non-traded items sector-specific conversion factors are used, based on long run marginal cost or willingness-to-pay. See the example below:

To remove the market distortions in financial prices of goods and services and to arrive at the economic prices, a set of ratios between the economic price value and the financial price value for project inputs and outputs is used to convert the constant price financial values of project benefits and costs into their corresponding economic values. The general equation is as follows:

CFi = EPi / FPi, where

CFi = conversion factor for i

EPi = economic value of i

FPi = financial value of i

Conversion factors can be used for groups of similar items like engineering, construction, transport, energy and water resources used in a particular project, or for the economy as a whole as in the SCF or SERF (Shadow Exchange Rate Factor). The former are referred to as project specific conversion factors for inputs while the latter refer to national parameters.

EXAMPLE: SPECIFIC CONVERSION FACTORS BY SECTOR

Land. Assume the SCF is 0.8. Government provides the land at a price reduced by 50% compared with market prices. So the market price is double the current one. The selling price should be doubled to reflect the domestic market and, as there is no specific conversion factor, the conversion factor to turn market price into border price is the standard conversion factor.

Conversion factor for land is: CF = 2 * 0.8 = 1.60.

Building. The total cost consists of 30% of non-skilled workforce (CF of non-skilled workforce is 0.48), 40% of imported material cost with import tariffs of 23% and sales of 10% (FC 0.75), 20% of local materials (SCF=0.8), 10% of profits (CF=0).

Conversion factor is: (0.3*0.48)+(0.4*0.75)+(0.2*0.8)+(0.1*0) = 0.60.

Machinery. Imported without taxes and tariffs (CF=1).

Stock of raw material. Only one traded material is supposed to be used; the item is not subject to taxes and the market price is equal to the FOB price. CF=1.

Output. The project produces two outputs: A, imported and B, a non-traded intermediate item. To protect domestic firms, the government has imposed an import tax of 33% on item A. The CF for A is 100/133 = 0.75. For item B, as there is no specific conversion factor, SCF=0.8.

Raw materials. No significant distortions. CF=1.

Intermediate inputs imported without tariffs and taxes. CF=1.

Electricity. There is a tariff that covers only 40% of the marginal supply cost of electricity. There is no disaggregation of cost components and it assumed that the difference between international and domestic prices for each cost component used to produce a marginal unit of electricity is equal to the difference between all traded items considered in the SCF.

CF = 1/0.4 * 0.8 = 2.

Skilled labour force. The market is not distorted. Market wage reflects the opportunity cost for the economy.

Non-skilled labour force. Supply exceeds demand but there is a minimum wage of €5 per hour. Nevertheless in this sector the last employed workers come from the rural sector, where the wage is only €3 per hour. Only 60% of non-skilled workforce wages reflect the opportunity cost. The SCF is used to turn the opportunity cost of non-skilled work into a border price. CF = 0.6*0.8 = 0.48.

EXAMPLE: CONVERSION FACTORS FOR MAJOR TRANSPORT PROJECTS IN SOUTHERN ITALIAN REGIONS

Within the framework of the 2000-2006 National Operational Programme the Italian Ministry for transport has developed a set of conversion factors for the appraisal of all railway major projects to be implemented in objective 1 regions.

The following table provide some examples:

ITEM	CF
Equipment	0.909
Labour	0.348
Freights	0.833
Expropriations	1.000
Administrative costs	0.833
Maintenance	0.909
Extraordinary maintenance	0.909

Source: Italian Transport Ministry (2001).

A crucial input to investment projects, particularly of infrastructure, is labor. In principle, wages should reflect the social value of working time and effort, i.e. the marginal value to society of the product of a unit of labour. In the real world, however, wage distortions occur frequently. Current wages may be a distorted social indicator of the opportunity cost of labour because labour markets are imperfect, or there are macroeconomic imbalances, as revealed particularly by high and persistent unemployment, or by dualism and segmentation of labour conditions (e.g. when there is an extensive informal or illegal economy).

The proposer, in such cases, may resort to a correction of observed wages and to the use of conversion factors for computing shadow wages.

EXAMPLE: WAGE DISTORTION

- In the private sector, costs of labour for the private company may be less than the social opportunity cost because the State gives special subsidies to employment in some areas.

- There may be legislation fixing a minimum legal wage, even if under heavy unemployment there may be people willing to work for less.
- There are informal or illegal sectors with no formal wage or income, but with a positive opportunity cost of labour.
- There may be fundamental macroeconomic unbalances and wage rigidity.

Typically, in an economy characterized by extensive unemployment or underemployment, the opportunity cost of labour used in the project may be less than the actual wage rates.

The shadow wage is region-specific, because labour is less mobile than capital. It may often be determined as a weighted average of:

- the shadow wage for skilled workers and unskilled workers previously employed in similar activities: it can be assumed to be equal or close to the market wage;

- the shadow wage for unskilled workers drawn to the project from unemployment: it can be assumed to be equal to or not less than the value of unemployment benefits;

- the shadow wage for unskilled workers drawn to the project from informal activities: it should be equal to the value of the output forgone in these activities.

The weights should be proportional to the amount of labour resources employed in each case.

Under severe unemployment conditions and very low public unemployment benefits, the shadow wage may be inversely correlated to the level of unemployment.

Obviously if an investment project already has a satisfactory economic internal rate of return before corrections for labour costs, then it is not necessary to spend much time and effort on the detailed estimation of the shadow wage.

However, it is important to consider that in some cases the employment impact of a project may need a very careful consideration:

- it is sometimes important to check for employment losses in other sectors as a consequence of project: gross employment benefits, since the latter may overestimate the net impact;

- occasionally the project is said to preserve jobs that otherwise would be lost and this may be particularly relevant for renovation and modernisation of existing plants. This kind of argument should be supported by an analysis of cost structure and competitiveness both with and without the project;

- some objectives of the Structural Funds are concerned with particular employment targets (e.g. youth, women, long term unemployed) and it may be important to consider the different impacts by target groups.

A project that uses labour as an input must normally consider this fact as a social cost, in the same way as financial analysis considers the wage paid as a financial outflow. In principle, the social opportunity cost of additional project employment is either the value of the marginal product of labour in the economy, or the worker's subjective disutility of effort. In principle, the two measures would coincide for an equilibrium labour market, and would be equal to the observable market wage.

Fiscal corrections

Some items of financial analysis can be seen as pure transfers from one agent to another within society, with no economic impact. For example a tax paid to the Member State by the beneficiary of EU assistance is offset by fiscal revenues to the government. Conversely, a subsidy from the government to the investor is again a pure transfer that does not create economic value, while it is a benefit for the beneficiary.

Some general rules can be laid down to correct such distortions:

- All prices of inputs and outputs to be considered for CBA should be net of VAT and of other indirect taxes: taxes are paid by consumers to the project, from the project to the Tax Administration, and are then redistributed to the consumers as public expenditures;

- Prices of inputs, including labour, to be considered in the CBA should be gross of direct taxes: the employee gets a net-of-tax salary, the tax goes to Government that pays it back to employees, pensioners, and their families, etc., as public services or transfers;

- Subsidies granted by a public entity to the project promoter are pure transfer payments and, should be omitted from revenues under economic analysis (i.e. CF=0).

Despite the general rule, in some cases indirect taxes/subsidies are intended as a correction for externalities. Typical examples are taxes on CO2 emissions to discourage negative environmental externalities. In this and in similar cases, it may be justified to include these taxes (subsidies) in project costs (benefits), but the appraisal should avoid double counting (e.g. including both energy taxes and estimates of full external environmental costs in the appraisal). Public funds transferred to economic entities in exchange for services supplied or goods produced by them (e.g. specific subsidies to schools for assisting disabled students) are not to be considered as pure transfer payments and they should be included as revenues in economic analysis, but only after checking if the subsidy reflects the social opportunity cost of the service.

Obviously, the treatment of taxation/subsidy should be less accurate whenever it has minor importance in project appraisal, but overall consistency is required.

In some projects the fiscal impact can be significant, because for example the revenues generated by the project may decrease the need to finance budgetary deficits by public debt or taxation7.

Monetisation of non-market impacts

The second step of the economic analysis is to include in the appraisal those project impacts that are relevant for society, but for which a market value is not available. The project examiner should check that these effects (either positive or negative) have been identified, quantified, and given a realistic monetary value (see Table 2.10 for some examples of the assessment of non-market impacts in different sectors).

Appropriate conversion factors applied to the financial values of the operating revenues should already capture the most relevant non-market benefits a project may generate. However, if conversion factors have not been estimated or the project is non-revenue generating, alternative approaches can be used to assess

non-market benefits. The most frequently used method is the willingness-to-pay (WTP) approach, which allows the estimation of a money value through users' revealed preferences or stated preferences. In other words, users' preferences can be observed either indirectly, by observing consumers' behaviour in a similar market or directly, by administering ad hoc questionnaires (but this is often less reliable). For the evaluation of some outputs, when the WTP approach is not possible or relevant, long-run marginal cost (LRMC) can be the default accounting rule. Usually WTP is higher than LRMC in empirical estimates, and sometimes an average of the two is appropriate.

The use of WTP or LRMC as shadow prices is mutually exclusive to the application of conversion factors to the project's financial operating revenues. For example, if electricity services are provided at 5 cents per kWh, a tariff below unit costs, we can either multiply the tariff by the conversion factor to get the shadow price; or we can substitute the tariff by the WTP as the shadow price.

Table 2.10 Examples of non-market impact valuation

Sector	Non-market impact	Impact assessment
Transport	- Savings in travel and waiting time	- The value of working time savings is the opportunity cost of the time to the employer, equal to the marginal cost of labour.
Healthcare	- Life expectancy / quality of life	- Quality-adjusted life year (QALY) is the most commonly used measure of health benefit. Tools such as the EuroQol instrument allow the estimation of the number of QALYs gained by the recipients of the project.
	- Prevention of fatalities/injuries	- The WTP for a reduction in the risk of death or serious injury.
Environment	- Landscape	- The Environmental Landscape Feature (ELF) model constitutes a first attempt at a benefits transfer tool for appraising environmental policies. The model provides estimates of the WTP for some features (e.g. heather moorland, rough grazing, field margins and hedgerows) on an area basis, and estimates of their diminishing marginal utility.
	- Noise	- Noise is measured in Noise Exposure Forecast (NEFs); one NEF is equal to a mean exposure over time to one decibel of noise. The sensitivity of real estate prices to changes in noise level is measured by the noise depreciation sensitivity index.

Source: HM Treasury Green Book (2003)

2.3 CASE STUDY

For the economic analysis preparation, it must be taken into account that the expenditures and revenues structure differ from that of the financial analysis. Thus, "economic analysis does not include the tax effort, taxes, because these, for the national economy, represent revenue and not spending" (Vasilescu, 2009). Market prices generally include taxes and subsidies, even transfer payments, and it is necessary to consider the prices without VAT and other indirect costs, or transfers to individuals (e.g. social security contributions).

Fiscal correction is required for those financial prices elements that are not related to the opportunity costs contents of the involved resources (ACIS, 2008).

For example, a fee paid to the state by a beneficiary of EU assistance is offset by fiscal revenues to the government, a subsidy from the government to the investor is again a pure transfer that does not create

economic value, but it is an advantage for the beneficiary. Such distortions should be corrected, and the main recommendations of the European Commission (2008) are:

- prices of inputs and outputs must be taken into account net of VAT and other indirect taxes (which are paid for the project, to the Tax Administration, and then redistributed to the consumers as public expenditures);
- commodity prices, including labour, should not include direct taxes (the employer receives a net-of-tax salary, fees are directed to the Government, that pays it back to the employees / retirees and their families, as public services or transfers);
- subsidies from a public entity, that is pure transfer payment, should be omitted.

Also, in some cases, tax / indirect subsidies are intended as a correction for externalities (e.g. taxes on energy prices to discourage negative environmental externalities). Under these conditions, including these charges in project costs can be justified, but the assessment should avoid double counting (e.g. including both energy taxation and environmental external cost estimation in the assessment). A special case is that of public funds transferred to economic agents in exchange for services supplied or goods produced by them (for example, specific grants for schools assisting disabled students) are not to be considered transfer payments and these should be included as income in the economic analysis, but only after checking if the subsidy reflects the social opportunity cost of the service.

In the same context, employment is seen as very important in certain projects, especially infrastructure projects, because wages can be an indicator of social opportunity cost of labour distortion due to labour market imperfections. In such a case, it is needed a nominal wages correction and the marginal wage use. Examples of wages distortion are met in the private sector, when costs of labour for the private company may be less than the social opportunity cost because the State offers special subsidies to employment in some areas; when there may be legislation fixing a minimum legal wage, even if under heavy unemployment there may be people willing to work for less; when there are informal or illegal sectors with no formal wage or income, but with a positive opportunity cost of labour.

Usually, in an economy characterized by the existence of unemployment, opportunity cost is lower than real wages. In these circumstances, it can be used the "shadow wage", which is specific to each region in part because labour is less mobile than capital. Shadow wage can be determined as a weighted average of the shadow wage for skilled and unskilled workers previously employed in similar activities, which can be approximated to the market wage, the shadow wage for unskilled workers drawn to the project from unemployment, assumed to be equal to or not less than the value of unemployment benefits, and the shadow wage for unskilled workers drawn to the project from informal activities, equal to the value of the output forgone in these activities.

For investment:

In our case study we take into consideration applying correction factors for an investment made for the modernization of a wastewater treatment facility.

In our analysis we took into consideration the following assumptions:

- In order to implement the project, during the construction period we will use both qualified and unqualified working people;

- The materials used will be both from local internal sources (RO) and imported. We considered the imported materials to be half from those nationals;
- The total number of employees during the prognosis period will have a small increase rate affecting positively the regional economy;
- The gross income is divided among various workforce categories;

From Financial to economic analysis

	YEARS									
	1	2	3	4	5	6	7	8	9	10
Total operating revenues	0	42	115	119	126	126	126	126	126	126
Total inflows	**0**	**42**	**115**	**119**	**126**	**126**	**126**	**126**	**126**	**126**
Total operating costs	0	-56	-75	-98	-101	-101	-101	-101	-117	-117
Total investment costs	-165	-4	-4	-24	-3	0	-26	0	0	12
Total outflows	**-165**	**-60**	**-79**	**-122**	**-104**	**-101**	**-127**	**-101**	**-117**	**-105**
Net cash flow	-165	-18	36	-3	22	25	-1	25	9	21
Financial rate of return on investment - FRR(C)					**-5.66%**					
Financial net present value of the investment - FNPV(C)					**-74.04**					

1. Conversion of market to accounting prices
2. Monetisation of non-market impacts
3. Inclusion of indirect effects (where relevant)
4. Discounting
5. Economic performance indicators

		YEARS									
	CF	1	2	3	4	5	6	7	8	9	10
Fiscal correction*											
Decreased pollution elsewhere		0	11	11	11	11	11	11	11	11	11
External benefits		**0**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**
Output X	1.2	0	32.4	72	76.8	76.8	76.8	76.8	76.8	76.8	76.8
Output Y	1.1	0	16.5	60.5	60.5	68.2	68.2	68.2	68.2	68.2	68.2
Total operating revenues		**0**	**48.9**	**132.5**	**137.3**	**145**	**145**	**145**	**145**	**145**	**145**
Increased noise		0	-12	-12	-12	-12	-12	-12	-12	-12	-12
External costs		**0**	**-12**	**-12**	**-12**	**-12**	**-12**	**-12**	**-12**	**-12**	**-12**
Labour	0.8	0	-18.4	-18.4	-25.6	-25.6	-25.6	-25.6	-25.6	-30.4	-30.4
Other operating costs	1.1	0	-36.3	-57.2	-72.6	-75.9	-75.9	-75.9	-75.9	-86.9	-86.9
Total operating costs		**0**	**-54.7**	**-75.6**	**-98.2**	**-101.5**	**-101.5**	**-101.5**	**-101.5**	**-117.3**	**-117.3**
Total investment costs	0.9	**-148.5**	**-3.6**	**-3.6**	**-21.6**	**-2.7**	**0**	**-23.4**	**0**	**0**	**10.8**
Net cash flow		-148.5	-10.4	52.3	16.5	39.8	42.5	19.1	42.5	26.7	37.5
Economic rate of return on investment - ERR						**11.74%**					
Economic net present value of investment - ENPV						**53.36**					
B/C ratio						**1.06**					

* No fiscal correction is applied: it means no transfers, subsidies or indirect taxes have been included in the financial analysis in table 2.5

Economic analysis

To convert the prices in the financial analysis, both specific conversion factors and the standard conversion factor (SCF=0.96) have been used (see Table below).

Conversion factors for the economic analysis

Type of cost	CF	Notes
Labour: skilled personnel	1.00	The labour market is assumed to be competitive (15%)
Labour: unskilled personnel	0.80	Shadow wage for not-competitive labour market (The unskilled labour conversion factor is calculated on the basis of the shadow wage, as follows: SW = FW x (1-u) x (1-t), were SW is the shadow wage, SW in the wage assumed in the financial analysis, u is local (regional) unemployment rate and t is the rate of the social security and relevant taxes. In the case study, set u=12% and t=32%, the CF (SW/FW) is equal to 0.60).
Yard labour	0.64	10% skilled labour, 90% unskilled labour
Materials for civil works	0.83	55% machinery and manufactured goods, 45% building materials
Rentals	0.68	3% skilled personnel, 37% unskilled personnel, 30% energy, 20% maintenance, 10% profits95 (CF = 0)
Transport	0.68	3% skilled personnel, 37% unskilled personnel, 30% energy, 20% maintenance, 10% profits (CF = 0)
Project studies, works management, trials and other general expenses	1.00	100% skilled labour
Equipment, machinery, manufactured goods, carpentry, etc.	0.82	50% local production (SCF), 40% imported goods (CF = 0.85), 10% profits (CF = 0)
Building materials	0.85	75% local materials (SCF), 15% imported goods (CF = 0.85), 10% profits (CF = 0)
Electricity, fuels, other energy	0.96	SCF

prices		
Maintenance	0.71	15% skilled personnel, 65% unskilled personnel, 20% materials
Reagents and other specialist materials	0.80	30% local production (SCF), 60% imported goods (CF = 0.85), 10% profits (CF = 0)
Intermediate goods and technical services	0.71	10% skilled personnel, 60% unskilled personnel, 30% manufactured goods
Elimination of treatment sludge	0.80	30% unskilled personnel, 20% transport, 50% local services (SCF)
Administrative, financial and economic services	1.00	100% skilled personnel
Resulting value of investment costs	0.76	Weighted by the types of project costs
Replacement costs	0.82	100% equipment, machinery, manufactured goods, carpentry, etc.
Agricultural product	0.85	68% various agricultural input (CF=SCF), 2% skilled labour, 30% unskilled labour

The negative externalities taken into account are: the costs of the local impact (mainly due to the wastewater treatment plants) due to the noise, odors, aesthetic and landscape impact. The overall impact of the opening of the construction sites - in an extra urban area - is considered negligible and, in any case, it is absorbed by the corrected investment costs and by the aforementioned externalities.

Economic Analysis (thousands lei).

	CF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sales		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wastewater treatment external benefits	-	0	0	0	3,680	5,378	5,501	5,627	5,756	5,888	6,022	6,159	6,299	6,442	6,588	6,737
Benefit due to improvement of production	-	0	0	0	18,677	27,082	27,488	27,900	28,319	28,743	29,175	29,612	30,056	30,057	30,965	31,429
Savings in groundwater resources	-	0	0	0	5,756	8,321	8,420	8,521	8,623	8,726	8,830	8,936	9,043	9,151	9,260	9,371
Positive externalities		0	0	0	28,112	40,780	41,409	42,048	42,697	43,357	44,027	44,707	45,398	46,100	46,813	47,537
Total economic benefits		0	0	0	28,112	40,780	41,409	42,048	42,697	43,357	44,027	44,707	45,398	46,100	46,813	47,537
Skilled personnel labor	1.00	0	0	0	576	588	599	611	624	636	649	662	675	689	703	717
Not- Skilled personnel labor	0.60	0	0	0	551	561	572	583	594	605	617	629	641	653	665	678
Electrical energy	0.96	0	0	0	123	180	185	190	194	199	204	209	214	220	225	231
Materials (Chemicals, reagents, inert, etc)	0.80	0	0	0	1,932	2,812	2,864	2,917	2,971	3,026	3,082	3,140	3,198	3,257	3,318	3,379
Intermediate services and goods	0.71	0	0	0	2,802	4,067	4,132	4,199	4,267	4,336	4,406	4,477	4,550	4,623	4,698	4,774
Maintenance	0.71	0	0	0	375	544	552	560	569	577	586	595	604	613	622	631
Elimination of treatment sludge	0,80	0	0	0	2,255	3,291	3,363	3,435	3,509	3,585	3,663	3,742	3,823	3,905	3,990	4,076

Total operating costs		0	0	0	8,614	12,043	12,267	12,495	12,728	12,965	13,207	13,453	13,704	13,959	14,220	14,485
Feasibility Study, work management	1.00	7,363	0	1,896	0	0	0	0	0	0	0	0	0	0	0	0
Land expropriation	0.60	435	221	0	0	0	0	0	0	0	0	0	0	0	0	0
Labor	0.64	2,723	16,586	8,417	0	0	0	0	0	0	0	0	0	0	0	0
Materials for civil works	0.83	821	5,836	3,385	0	0	0	0	0	0	0	0	0	0	0	0
Rentals	0.68	18	1,094	1,092	0	0	0	0	0	0	0	0	0	0	0	0
Transports	0.68	30	906	889	0	0	0	0	0	0	0	0	0	0	0	0
Electromechanical components and equipment	0.82	0	9,466	14,412	0	0	0	0	0	0	0	0	0	0	0	0
Investments costs		11,391	34,109	30,092	0	0	0	0	0	0	0	0	0	0	0	0
Replacement costs	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residual Value	0.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other investment costs		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL INVESTMENT COSTS		11,391	34,109	30,092	0	0	0	0	0	0	0	0	0	0	0	0
Noise, odors, etc	-	0	0	0	617	894	908	921	935	949	963	978	992	1,007	1,022	1,038
Negative externalities		0	0	0	617	894	908	921	935	949	963	978	992	1,007	1,022	1,038
Total economic costs		11,391	34,109	30,092	9,231	12,937	13,175	13,417	13,663	13,914	14,170	14,431	14,696	14,967	15,242	15,523

Net economic benefits		-11,391	-34,109	-30,092	18,882	27,843	28,235	28,632	29,034	29,443	29,856	30,276	30,702	31,133	31,571	32,014

	CF	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sales		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wastewater treatment external benefits	-	6,889	7,045	7,204	7,366	7,532	7,701	7,874	8,050	8,231	8,415	8,604	8,796	8,993	9,194	9,400
Benefit due to improvement of production	-	31,901	32,379	32,865	33,358	33,858	34,366	34,882	35,405	35,936	36,475	37,022	37,577	38,141	38,713	39,294
Savings in groundwater resources	-	9,483	9,596	9,711	9,827	9,945	10,063	10,184	10,306	10,429	10,553	10,680	10,807	10,936	11,067	11,199
Positive externalities		48,273	49,020	49,779	50,551	51,334	52,130	52,939	53,761	54,596	55,444	56,305	57,181	58,071	58,975	59,893
Total economic benefits		48,273	49,020	49,779	50,551	51,334	52,130	52,939	53,761	54,596	55,444	56,305	57,181	58,071	58,975	59,893
Skilled personnel labor	1.00	731	746	761	776	792	808	824	840	857	874	892	910	928	947	966
Not- Skilled personnel labor	0.60	691	704	717	731	745	759	774	789	804	819	834	850	867	883	900
Electrical energy	0.96	237	243	249	255	261	268	274	281	288	296	303	311	318	326	334
Materials (Chemicals, reagents, inert, etc)	0.80	3,442	3,506	3,571	3,637	3,705	3,773	3,843	3,915	3,987	4,061	4,137	4,213	4,292	4,371	4,452
Intermediate services and	0.71	4,851	4,929	5,009	5,090	5,172	5,256	5,340	5,427	5,514	5,604	5,694	5,786	5,880	5,975	6,071

goods																
Maintenance	0.71	641	650	660	670	680	690	700	711	722	732	743	755	766	777	789
Elimination of treatment sludge	0.80	4,764	4,254	4,346	4,440	4,536	4,634	4,734	4,836	4,940	5,047	5,156	5,268	5,381	5,498	5,617
Total operating costs		14,756	15,031	15,312	15,598	15,890	16,187	16,490	16,798	17,113	17,433	17,760	18,092	18,431	18,777	19,129
Feasibility Study, work management	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land expropriation	0.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Labor	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for civil works	0.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rentals	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transports	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electromechanical components and equipment	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investments costs		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement costs	0.82	0	0	0	0	18,563	0	0	0	0	0	0	0	0	0	0
Residual Value	0.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-4,590
Other investment costs		0	0	0	0	18,563	0	0	0	0	0	0	0	0	0	-4,590
TOTAL		0	0	0	0	18,563	0	0	0	0	0	0	0	0	0	-4,590

INVESTMENT COSTS																
Noise, odors, etc		1,053	1,069	1,085	1,101	1,118	1,135	1,152	1,169	1,187	1,204	1,222	1,241	1,259	1,278	1,297
Negative externalities	-	1,053	1,069	1,085	1,101	1,118	1,135	1,152	1,169	1,187	1,204	1,222	1,241	1,259	1,278	1,297
Total economic costs		15,809	16,101	16,397	16,700	35,570	17,322	17,641	17,967	18,299	18,637	18,982	19,333	19,691	20,055	15,836
Net economic benefits		32,464	32,920	33,382	33,851	15,764	34,809	35,298	35,793	36,296	36,806	37,324	37,848	38,380	38,920	44,057

Discount Rate	5,5%
ENPV	295,519.10
ERR	28,9%
B/C	2,2

Source: Analysis performed by the Author

3. CONCLUSIONS

In the financial analysis of a project, money wages (and other benefits) paid to employees are treated as the financial price of labour. The shadow wage rate (SWR) is an estimate of the economic price of labour.

The economic price of labour is measured through its supply price. At very low wages, people may prefer leisure to work. The supply price of labour depends upon several factors, such as the value placed on leisure and other nonwage activities, family income, the cost of migration, and the nature of employment and other benefits accruing from that employment.

There are large variations in the types of labour, depending on skills, regions within countries, and even individual jobs. It is thus often necessary to use a set of shadow wage rates, one for each skill, location, economic sector, and even season, rather than a single rate for the whole country. A simplified approach based on the prevailing wage rates for the various types of skills and locations, and the degree of unemployment relating to those skills can be used to estimate the SWR. For purposes of analysis, workers may be divided into three categories corresponding to their degree of qualification: skilled, semiskilled, and unskilled.

In estimating the SWR, the degree and nature of unemployment and underemployment in the project area and its environs should be carefully assessed. It is preferable that independent surveys made in the project or surrounding areas be used to confirm the estimates obtained from official sources.

Estimation of the SWR is particularly important in projects where the wage component in the total cost or benefit stream is significant, and where technological options exist in formulating projects. For these projects, expected changes in the SWR over the project cycle should be assessed, on the basis of forecasts about the supply and demand for labour. Other projects may involve only a few workers. For projects that have a very small wage component, and that are not sensitive to the valuation of labour, it will not be necessary to estimate a project specific SWR.

The main **conclusions** of the paper are:

As regards methodology:

- The production factor prices used for implementing an investment project as well as all goods and services (outputs) of the project should reflect the opportunity cost;
- The methodology and computing way vary for each production factor, according to its characteristics;

As regards the value of conversion factors:

- The standard conversion factor used is FCS = 1;
- For investment costs is recommended to use specific conversion factors.

In all cases, determining the shadow pricing involves multiplying each market price by an accounting price ratio (APR), where: APR_i = (accounting price of good i) ÷ (market price of good i)

= (shadow price of good i) ÷ (market price of good i)

Therefore, the shadow price of good i = APR_i x market price of good i.

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