EUROPEAN COMMISSION
Directorate-General Regional Policy

Ex post evaluation of cohesion policy interventions 2000-2006 financed by the Cohesion Fund (including former ISPA)

Work Package C - Cost benefit analysis of environment projects

Case study - Project no. 03: Expansion of the water distribution the City of Plzeň, Czech Republic

May 2011

COWI   Csil CENTRE FOR INDUSTRIAL STUDIES   TECHNIVEST

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Foreword

This document presents one of ten case study that has been elaborated as part of the study 'Ex post evaluation of cohesion policy interventions 2000-2006 financed by the Cohesion Fund (including former ISPA) - Work Package C - Cost benefit analysis of environment projects. The study was commissioned by the European Commission, DG Regio. During the project ten case studies were elaborated that can be used as guidance or good practice for future Cost Benefit Assessments in relation to Cohesion Fund/ISPA applications.

The overall approach to the case studies is as follows:

The projects have been analysed in the period July to October 2010 and contains the simple and most important story concerning:

- Why the project was formulated?
- Who the relevant stakeholders were in the decision making process?
- How the project was analysed and decided upon?
- What the outcome of the project was in the ex-post perspective?

The project analyses include to the largest possible extent the ex-ante and ex-post figures in order to assess the project's performance. Due to the great variety in the data quality, data access and possibility to reconstruct data, the analyses vary in quality and extent. However, in every case there is a significant learning that can contribute to the fundamental questions of the study[1]:

- What were the impacts of the examined projects?
- How can ex post cost-benefit analyses contribute to the practice of ex ante cost-benefit analyses?
- What are the potentials and limits to carry out an ex post cost-benefit analysis to identify and/or analyse the impact of the projects? Is it an appropriate tool for impact analysis?

The CBA guidelines have been used to analyse the projects. In all cases the project teams have visited the project sites and the teams have interviewed technical, financial and managerial staff concerning the project development, implementation and the results of the project. Furthermore, the project teams have been in dialogue with the project beneficiaries on the data used in the ex-post analysis.

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[1] Terms of reference page 6 in chapter 3. Subject of the contract.

List of Abbreviations

B/C	Benefit-Cost ratio
CBA	Cost Benefit Analysis
CF	Cohesion Fund
CO_2	Carbon Dioxide
EC	European Commission
ENPV	Economic Net Present Value
ERR	Economic Net Present Value
EUR	Euro
FNPV	Financial Net Present Value
FRR	Financial Rate of Return
GDP	Gross Domestic Product
GDP	Gross Domestic Product
GHG	Green House Gases
H_2S	Hydrogen Sulphide
Ha	Hectare
IRR	Internal Rate of Return
ISPA	Instrument for Structural Policies for Pre-Accession
kW	Kilo Watt
LFG	Landfill gas
Nm3	Normal Cubic Metres
NPV	Net Present Value
NPV	Net Present Value
PV	Present Value
PV	Present Value
SDR	Social Discount Rate

1 Project no. 03: Expansion of the water distribution the City of Plzeň, Czech Republic

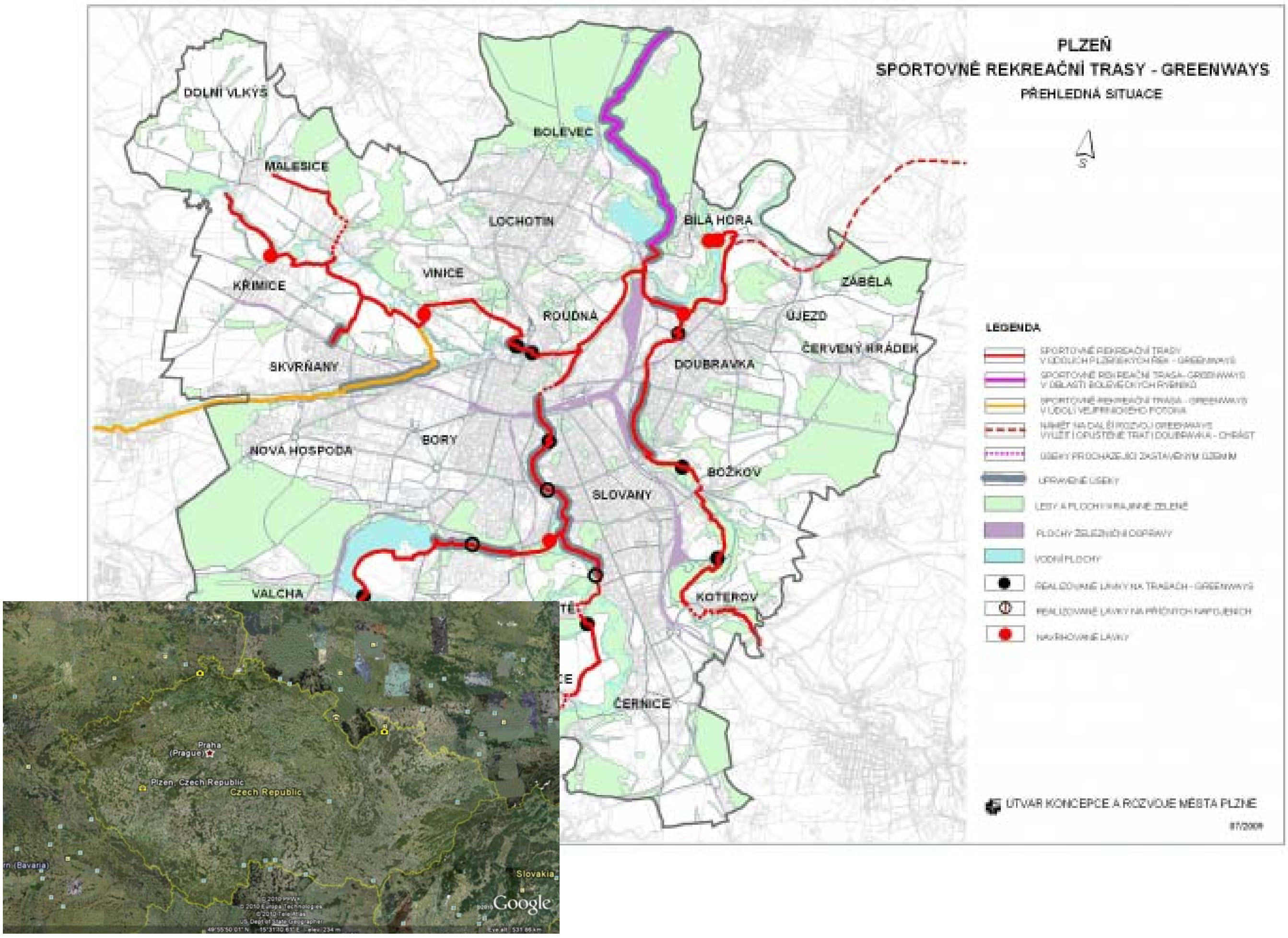
Background

Plzeň is the fourth largest city in the Czech Republic with approximately 170,000 inhabitants. It is located in western Bohemia about 90 km west of Prague at the confluence of four rivers - the Radbuza, the Mže, the Úhlava, and the Úslava - which form the River Berounka.

The city's sewage system was established already in the 17th century and in particular developed in the beginning of the 19th century to match the demand of the urban development to a city with significant industry.

In 2002, just before the Czech Republic obtained its EU membership, the City of Plzeň applied for ISPA funds to rehabilitate the water and sewage system. The water and sewage system covered almost the entire population (water 99.5% and wastewater 96.7%) and all industry, but renovation of the wastewater and water system was needed to provide a better basis for flooding management, drinking water standards and recreational uses of the rivers in order to comply with EU regulation.

Figure 1-1 Map of City of Plzeň with rivers, water and wastewater infrastructure and snapshot showing the position of City of Plzeň in the Czech Republic



1.1 Project Description

The project described in the ISPA application (and later in a Cohesion Fund application) is presented below in five major themes:

- ✓ the project background,
- ✓ the institutional context,
- ✓ the timing,
- ✓ the technical implementation, and
- ✓ the major project outputs.

1.1.1 Project background context

The focus of the project was on the expansion and rehabilitation of the water and wastewater system in order to comply with the EU environmental acquis. At that time, the Czech Republic was in the process of acceding to the EU, and Plzeň's old water and drinking water systems needed to comply with the higher environmental standards of the EU regulation.

What was the project objective?

The project objectives were presented in the application as shown in below Table 1-1.

Table 1-1 Project objectives and references to EU legislation

Project objective	Reference to legislative framework
To *reduce pollution and to improve surface water quality* in the water reservoir "Ceské údoli" and downstream the Berounka River to improve basis for recreational activities	Council Directive 76/160/EEC concerning the quality of bathing water in the sites of existing or intended recreational points.
To *reduce pollution and to improve water quality* in the River Brounka and to improve water quality of the important surface water intake for Prague	Council Directive 75/440/EEC concerning the quality required of surface water intended of the abstraction of drinking water
To *improve the drinking water quality* within related areas of the City of Plzeň and to comply with the requirements of	Council Directive 98/83/EC on the quality of water intended of human consumption
To *reduce the soil, groundwater and surface water pollution* in the City of Plzeň area and its surrounding area and to contribute to the improvement of ground water and surface water quality, especially in the rivers of Mze, Radbuza and Berounka.	

Rationale behind application

In summary, the project aimed to:

- reduce pollution in surface water, water reservoirs, groundwater and soil
- improve drinking water quality
- improve the basis for recreational activities.

The EU environmental acquis required substantial investments into the existing water and waste water infrastructure in order to become compliant to EU legislation.

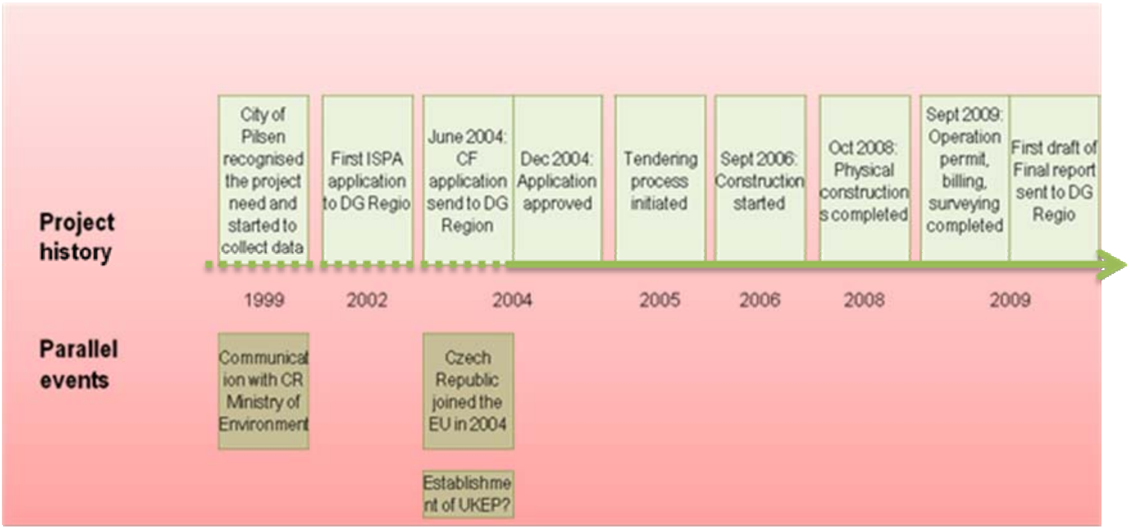
1.1.2 Project history and timeline

The project history goes back to 1999 when City of Plzeň recognised the need to rehabilitate the water infrastructure on its territory. At that time, the City of Plzeň started to prepare for an ISPA application.

The decision to apply for the funds to modernise and refurbish the water and wastewater infrastructure was primarily based on a technical assessment and on the master plan from 1998[2], which is updated regularly with the upcoming needs for municipal public infrastructure.

In 2004, the ISPA application was abandoned in order to - as a full EU member[3] - to apply for Cohesion Funds.

Figure 1-2 Project history timeline



CF=Cohesion Fund, UKEP=(European project unit in Plzeň)

Source: From COWI's meeting with City of Plzeň in September 2010.

The figure above shows the story of the project. The project was initially submitted into the ISPA pipeline but was later "automatically" transferred to the Cohesion Fund pipeline. Important actions or milestones in relation to the project are listed below:

- Plzeň established the UKEP, an European Project Unit with the purpose to enhance the coordination of CF application on behalf of the City of Pilzen
- The Application was submitted in 2004 , the project was approved in 2005 and the tendering process was hereafter initiated

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[2] The history of land use planning goes back to 1900 but the water and wastewater infrastructure was implemented in the master plan in 1998 as the basis for planning and prioritising the municipal investments in the water and wastewater infrastructure.

[3] The Czech Republic became received its membership of EU as per 1 May 2004.

- Construction started in the September 2006, and project implementation was completed in 2008
- Operation of the project was initiated in 2009

The final report[4] was finalised and sent to Ministry for Regional Development and State Environmental Fund in 2010, although there was some problems with the final payment of the grant as explained below.

Otherwise the project implementation was largely an efficient process without many problems.

Renegotiation of contract with contractor

The major problem with the final payment of the grant to the City of Plzeň originated from the contract agreement originally set up with the private operator of the water and wastewater infrastructure. The conditionality of the Cohesion Fund support depended on the contract to reflect best international practise in contract management. This forced the City of Plzeň to renegotiate the contract with the operator[5]. As the contract was established in 1994 according to Czech national rules it was not fully compliant to EU competition legislation. Eventually, the parties agreed to renegotiate the contract according to the EU competition legislation implying a shorter contracting period, establishment of relevant performance indicators and sanctions in case of performance below targets.

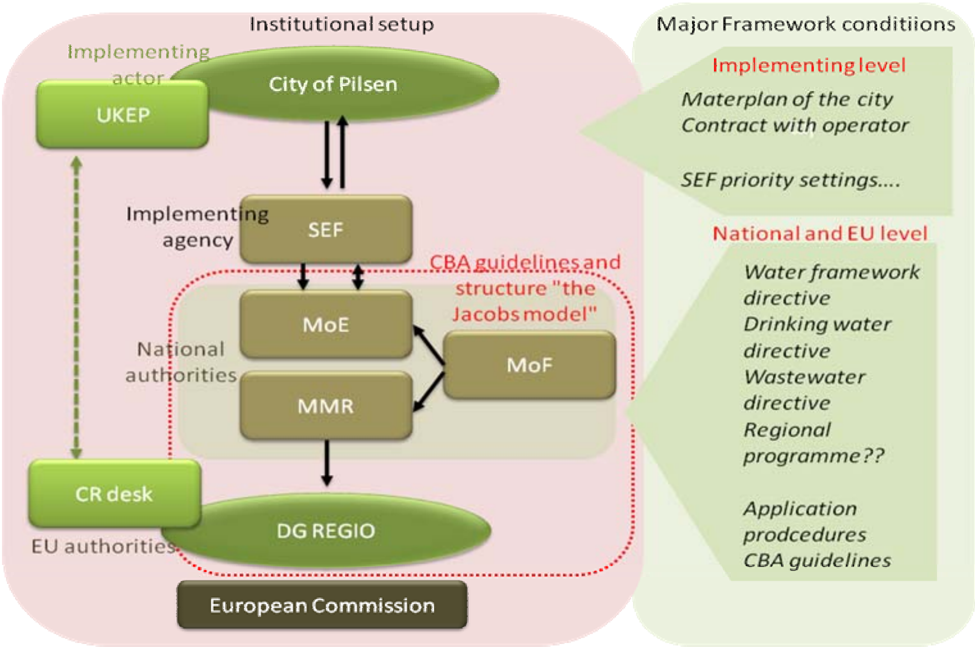
1.1.1 The institutional setup

The institutional setup provides an important input to understanding the implementation of the project and not least the use of CBA in the decision-making process.

[4] CCI: 2004/Cz/16/C/PE/003 project - Final report of the Addition to the water management infrastructure of the City of Plzeñ

[5] http://www.vodarna.cz/

Figure 1-3 Institutional setup in relation to the decision making process of Cohesion fund projects



Note: UKEP = European Project Unit in City of Plzeň, CR=Czech Republic, SEF=State Environmental Fund, MoE= Ministry of Environment, MoF=Ministry of Finance, MMR=Ministry of Regional Development

Fundamentally, there are two levels of relevance to the Czech decision-making process of Cohesion Fund projects: 1) The implementing level and 2) The national and EU level.

The implementing level, consisting of City of Plzeň and State Environmental Fund (SEF), formulates and applies for projects. The CBA guidelines are used following the principles agreed on by the national and EU levels, consisting of the Ministry of Environment (MoE), the Ministry of Regional Development (MMR), the Ministry of Finance (MoF) and naturally DG Regio which published the guidance to CBA.

In 2004, the MoE published a CBA model to be used for CF projects. This model tool was developed under a Twinning project at the MoE and took extensive use of a model "the Jacobs model" named after the consultants originally developing it[6]. For the 2004 application for the renovation of Plzeň's water and wastewater system the Jacobs model was applied for the economic part. The financial part was developed by Mott MacDonald in Cooperation with the on-going Twinning project[7].

[6] www.jacboc.com

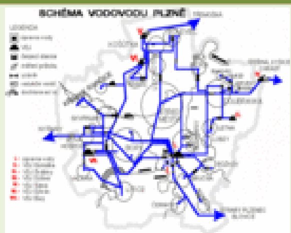
[7] Timothy Yong, Mott MacDonald who was leader of the Twinning project at the time and now senior consultant in Mott MacDonald, on e-mail 18 October 2010 as answer to questions from case-study team.

The CBA was further applied in the ex-post assessment performed by the City of Pilzen in 2010. The current ex-post analysis is based on the Mott MacDonald and Jacobs's models handed over to COWI for assessment with respect to this ex-post evaluation.

1.1.2 Technical overview

In brief, the project can be presented by three investment components.

Table 1-2: The three components of the project

Water and Wastewater	Component A Water supply	Component B Sewage connection	Component C Retention tanks
Main investment Units	 **Approximately 20MEURO**	 **Approximately 18MEURO**	 **Approximately 5,4 MEURO**
Description	1. Water supply complex "Lobzy": Construction of drinking water reservoirs containing two chambers of each 10,000 m^3, installation of chlorine dosage unit, pumping station and 8,290 m intake and distribution pipelines. 2. Water supply complex "Vinice": Construction of drinking water reservoirs containing two chambers of each 6,000 m^3, installation of chlorine dosage unit, pumping station and 3,150 m intake and distribution pipelines.	1. Construction of 15,520 m gravity sewerage pipelines providing sewerage connection for approx. 4,500 inhabitants 2. Installation of 10 wastewater pumping stations for pumping of new connected areas to the existing sewerage system 3. Construction of 7,840 pressure mains connecting the new pumping stations to the existing sewerage system	1. Retention tank "Bolevec": Construction of a new storm water outlet chamber and a 3,100 m^3 retention tank with gravel and sand trap and flushing system 2. Retention tank "Geva" Construction of a new storm water outlet chamber and a 2,350 m^3 retention tank with gravel and sand trap and flushing system
Main outputs/benefits	Reliability of water supply and improved quality of drinking water for 50-70% of the City of Plzeň's population of 170.000 inhabitants. Eliminated problems of capacity, pressure and chlorinated water. Thereby increasing the comfort level of public water consumers, including hotel guests and other visitor's tap water consumption.	Cost savings for the 1400 inhabitants for maintenance of septic tanks Avoidance of ground and soil pollution due to mis-maintenance of septic tanks Reduced discharge of sewage water from out-dated WWTP not fulfilling current requirements to cleaned sewage water	Reduction in the number of overflows from approximately 30 ex ante to in the order of 5-10 ex post (not known yet due to lack of operating data) leading to less pollution of surrounding rivers and groundwater

1.1.3 Technical assessment

Major problems addressed in the application

The major problems in water supply and sewerage infrastructure in Plzeň that the project addressed were:

<u>In water supply</u>

- The water supply suffered from both capacity and pressure problems due to the insufficient volume of drinking water reservoirs in part of the city
- The insufficient pressure caused drinking water to remain in the distribution network with a longer retention time, which resulted in exceeding of some drinking water quality parameters in Council Directive 98/83/EC on the quality of water intended for human consumption

<u>In sewerage</u>

- Capacity shortfall in the existing combined sewerage system during heavy rain to adequately store and transport excess wastewater to the wastewater treatment plant(s)
- Some 4,500 inhabitants in the suburbs were not connected to the public sewerage system and thereby the WWTP
- Leakage of wastewater to ground water and surface water due to problems stated above caused ground water and surface water quality problems in many part of the relevant areas

The proposed technical solutions were in line with regional and municipal master plans for the water and wastewater infrastructure as well as with the regional master plan for the achievement of compliance with the Urban Wastewater Treatment Directive 91/271/EC.

Tender procedure

The works contract was tendered in 2006 in an international competitive tender based on a detailed project (FIDIC Red Book). Five consortia submitted tenders, and a contract was awarded to the lowest bidder consisting of a consortium of German, Austrian and Czech contractors.

Project budget and actual cost

In the table below, the project budget as stated in the Cohesion Fund Application and the actual costs of the project are presented.

The total investment was supposed to be 54MEURO of which approximately 20 MEURO as to be invested in fixing the problem of water supply, e.g. construction of the two water reservoirs. Another 18 MEURO was invested in extending the public sewerage network to serve a suburb of 4500 citizens. Finally, the construction of the water retention tanks amounted to around 4,5 MEURO. In reality the investment costs turned out to be more around 7 MEURO more expensive.

Table 1-3 Project budget and actual cost (Euro)

Item	Budget (Application)	Actual price
Planning/design	515,000	1,171,344
Land purchase	774,000	939,078
Site preparation	645,000	- [1)]
Technical assistance/construction management	645,000	959,602
Publicity	194,000	152,286
Works contract	37,296,000	46,905,674
Contingency	3,730,000	- [2)]
VAT	8,321,000	9,345,892[)]
TOTAL	**52,120,000**	**59,473,877**

[1)] Site preparation included in Works contract
[2)] Contingency included in Works contract

The main reasons for deviations from the project budget and actual cost of the project were reported to be:

- Ordinary price escalations (the Cohesion Fund Application was submitted in 2004, the project was tendered in 2006 and finalised in 2009)
- The extent of the works contract was extended especially related to the length of the branch pipelines to the individual houses
- Partly due to unforeseen geotechnical difficulties that impacted construction costs.

Technical assessment

In general, the consultant finds the project to be well justified and the selected technical solutions to be in accordance with normal international practice. No major technical shortcomings or failures have been identified.

During interviews with employees of Plzeň Municipality's Infrastructure Department, the background to the selection of the sizes of the retention tanks could not be established, i.e. if the size of the retention tank was determined by a hydraulic model, the assumed maximum number of overflows per year, if future impacts from climate changes had been taken into consideration etc.? The employees explained that the sizes were determined in the wastewater master plan and that the decision was probably made as part of the preparation of the master plan.

Furthermore, it turned out to be impossible to obtain precise figures for the operation and maintenance costs of the new water and wastewater facilities, but it was reported that the impact on the operation and maintenance cost for the overall water and wastewater facilities was minor, i.e. between 0.1 and 1 per cent of the overall operational and maintenance costs of the water and waste water system in the City of Pilzen.

Upgrade of the existing water and waste water system

It is important to bear in mind that the current investment regards an upgrade or modernisation of and existing water and waste water system. Hence, as mentioned above the operational costs are to be regarded as incremental. Likewise, it appears that the no additional revenue was to be foreseen due to the upgrade, e.g. no additional increases in tariffs to be paid by the citizens are foreseen other than normal index regulated increases.

1.2 Revision of ex ante cost benefit analysis

It is the case study team perception that the quality of ex ante the cost benefit analysis is high. The financial analysis was conducted by external consultants with good insight in cost benefit analyses and how to address the problems of environmental infrastructure projects.

The economic analysis was based on a relatively conservative assessment including only a few quantifiable benefit items, namely the saved costs for not having to buy bottle water for consumption by the most affected citizens and recreational benefits for, as assumed, half the population of Pilzen that will direct benefit from the river water environment. Other benefits, such as health benefits and benefits of reliable water supply and improved quality of ground water therefore were not included in the economic assessment. Since the project was compliance driven project it was regarded to be more relevant to address the financial analysis with higher emphasis.

1.2.1 Use of ex-ante cost benefit analysis for decision-making

A comprehensive ex-ante CBA was conducted as part of the CF application by the Prague branch of the international consultancy company Mott MacDonald who was responsible for the financial appraisal[8].

The Cohesion Fund application in 2004 was based on much more refined calculations of the economic indicators than the original ISPA application. The economic analysis was based on the Jacobs model, and the review show that the calculations are in line the CBA guidelines and the practices of compliance driven projects at that time[9].

The project had already been identified, defined and described before Mott MacDonald and the Jacobs model was involved in the process. The CBA was therefore not part of the early decision making. It is, however, the perception of Mott MacDonald[10], that model results e.g. on the financial foundation of the project, or similar the affordability or other key issues could have impacted the structure of the project.

[8] www.mottmac.com

[9] The benefits of compliance with the environmental acquis, DGENV Contract: Environmental Policy in the applicant countries and their preparations for accession, Service contract B78110/2000/159960/MAR/H1, Final Report, July 2001 prepared by ECOTEC, UK, www.ecotec.com.

[10] Based on a telephone interview in October 2010.

Below, the main key figures of the model calculations are presented.

Table 1-4 Financial key figures of the Ex-ante CBA of the water and wastewater project in City of Plzeň, 2004-prices

Indicator	Result of ex-ante analysis
Before EU grant	
FRR(K)	-1,9%
FNPV(K)	-31.5 MEUR
After EU grant (74,8%)	
FRR (C)	5.9%
FNPV(C) (6%)	-0.19 MEUR
EIRR	2.6%
ENPV (5%)	-0.3 MEUR
Benefit/Cost ratio	0,74

Generally, the Cost Benefit Guidelines valid in 2004[11] were followed, including the recommendations for incremental cash-flows and financial and economic real term discount rates at 6 per cent and 5 per cent based on a 30-year horizon.

Table 1-4 reflects a case where the project is not viable without an EU Grant of 75 per cent, which corresponds to EUR 41.1 million in 2004 prices.

The ex-ante calculations did not show a positive return in the economic analysis. 'The Economic Net Present Value (ENPV) should be above zero and the Benefit/Cost ratio above 1 to indicate that the society is better off with the project[12]. Despite this the project was approved.

The Cohesion Fund Application[13] explains that some of the environmental benefits were not quantified and the main reason is likely to be the uncertainty of the valuating environmental benefits. As ECOTEC (2001) states in the executive summary: *"it is not easy to attribute particular benefits to the implementation of a particular directives"* and therefore the calculations of economic impacts from the water and wastewater project were based on conservative estimates accompanied with some qualitative statements of the future impacts.

[11] The Guide to Cost Benefit analysis of investment projects following previous 1997- edition (the Guide to Cost Benefit Analysis of Major Projects).

[12] European Union, Regional policy, 2008: The Guide to Cost Benefit Analysis of Investment projects, page 27, Figure 2.1: The structure of project appraisal.

[13] The request for support to the Cohesion Fund, Annex III B, Organisation report, Financial and Economic Analysis, 2004, page 48.

In the application the economic benefits listed were:

1 Environmental benefits due to improved quality of treated wastewater discharged to the rivers and improved sludge treatment (as described in component A, B and C)

2 Improved resource utilisation for users due to new connections to the public system (as described in component B)

3 Improved saving of operating costs due to improved system efficiency (as described in component A and C)

Assumptions at the time

The assumptions at the time were based on the following well founded assumptions:

- Discounted constant cash flow at incremental basis
- A 6% discount rate[14]
- 30 years time horizon of the analysis
- Project implementation period was expected to be four years from beginning of 2005 to 2008
- Project operation was assumed from beginning of 2009 to end of 2034
- Depreciation of equipment based on the following assumptions:
  - Electro-mechanical parts 15 years life time
  - Building construction 30 years life time
  - Water networks 40 years life time
  - Sewage networks 60 years life time
- The cash-flows were net of VAT
- The correct number of financial indicators were calculated based on the cash-flow analysis
- Water consumption was ex ante assumed to be 120l per capita, but has in reality decreased to 100 l per capita
- No increase in tariffs were foreseen in the calculations, hence no incremental 'income' is included in the calculations

The model calculations were based on the Mott MacDonald/Jacobs models reflecting the principles of the Cost Benefit Guidelines of DG REGIO. The assumptions are considered well justified and correct applied.

1.2.2 Project identification and alternative options

The CBA did not include an analysis of the options. As previously mentioned, the technical options were identified based on previously conducted feasibility studies including technically, legally and environmentally driven needs.

[14] The guidance in the "Guide to cost benefit analysis of investment project" Annex B, chapter B1, was followed

1.3 Ex post cost benefit analysis

The ex post CBA was conducted in 2010 by Mott MacDonald using the Jacobs model to assess how the real term figures (at 2004 price level) could be compared with the expected figures at ex-ante level of the project.

1.3.1 Project identification

The original project did not change in scope, purpose or use. As can be seen in the following analysis even the financial and economic outcome of the project was rather close to what was anticipated in the application. Only some of the wider benefits or unintended effect was obviously not identified in the originally application.

1.3.2 Ex post financial analysis

The financial analysis was conducted on an ex-post basis and as the below Table 1-5 indicates, the ex-post key figures are more and less at the same level as anticipated in the CF application.

Table 1-5 Overview of results of the financial analysis on ex-post basis (ex-ante figures are included for comparison reasons), 2004-prices

Indicator	Result of ex-ante analysis	Ex-post analysis
Before EU grant		
FRR(C)	-1,9%	-2,1%
FNPV(C)	-31.5 MEUR	-28.8 MEUR[15]
After EU grant (74,8%)		*76,4%*
FRR (C)	5.9%	6,0%
FNPV(C) (6%)	-0.19 MEUR	-0.06 MEUR

The FNPV are slightly improved in the ex-post case and the primary reasons for this are that:

[15] The ex-post analysis reflects the ex-post project capex and its timing, together with changes in operational parameters (opex, volumes, …) but does not reflect the real ex post grant. Instead, the ex-post analysis calculated the grant that the project would have been entitled to, had the ex-post values been used in place of the ex-ante ones.
Since in fact the capital costs of the project increased but were delayed, this explains the first effect – the FRR/C of the project (which does not take into account the grant of course) deteriorates. However the FPNV/C becomes less negative – because of the delay in the timing of the expenditure and the effect of discounting to reduce the negative impact of capex on the NPV.

- The incremental operational and maintenance costs from the project turned out to be lower than assumed ex ante

- The recalculated grant is higher in the ex-post analysis than in the ex-ante analysis – which reflects the level of grant that would have been the case based on the assumptions made in the ex post analysis.

Table 1-6: Review of relevant areas

	Ex-ante analysis	Ex-post analysis
Financial discount rates	6% p.a.	6% p.a.
Economic discount rate	5%	5%

Reasons for different results between financial and economic net present values or rate of returns

As the final report for the project explains, the methodology for the ex-ante and ex-post analyses was the same. The only difference was in the following input data, which in the ex-post analysis follow the observed (as opposed to forecast) values: project capital expenditures and their distribution over time, operational expenditures, volumes of drinking water and wastewater collected, and water and sewerage prices.

The financial NPV is based on the financial costs and the whole system revenue that is apportioned to the project based on its full costs. The economic NPV is based on essentially the same costs but on resource cost savings (especially the cost savings associated with no longer using wells and septic tanks, and the costs of bottled drinking water) and environmental benefits. Ex post Economic analysis

An ex-post economic analysis was made in the same model setup as the ex-ante calculations. Conversion from financial into economic prices was made by the assumption that skilled labour operate in a competitive labour market. Thus, if the skilled labour is not engaged in the project, it is engaged elsewhere in society. The use of unskilled labour is adjusted by 0.695[16] in the economic analysis, since the resource would largely be occupied and create output elsewhere in society if not engaged in the project. All other input factors in the financial cash-flow model correspond to a conversion factor of 1 and do not impact the economic cash flows.

The economic analysis of the project is based on the thinking that there are four basic quantifiable sources of benefits:

1. Newly connected consumers save resources from being connected to the public infrastructure compared with a private solution to wastewater treatment or water supply. In the calculations, the benefits directly arise from the differential costs of private contra public provision, e.g. waste water

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[16] I.e. that input from 1,000 EUR unskilled labour count 305 EUR (1,000*(1-0.695))

tariff to be paid to the operator compared with the costs of investing in and operating own septic tank..

2 The value of the improved water quality enables the population with poor water quality to drink tap water and save the difference between bottled water and tap water.

3 The increased efficiency of the operator provides a basis for both financial and economic gains from replacement of old/inefficient equipment. Since the financial cash flows capture this efficiency gain, the additional economic gains are very limited.

4 The value of increasing the environmental values from reduced pollution - which is subject to substantial uncertainty. The values have been estimated on a very conservative basis, based on the assumption that 50 per cent of the population are recreational users that benefit from recreational improvements. The specific figures applied were the value of EUR 26.3 per person per year in use value of bathing waters and similar surface waters and EUR 0.0045 per household per km year in improved river ecosystem quality (non-use value)[17].

Table 1-7 Overview of results of the economic analysis on ex-post basis (ex-ante figures are included for comparison reasons), 2004 prices

Indicator	Result of ex-ante analysis	Result of the ex-post analysis
EIRR	2.6%	1.9%
ENPV (5%)	-0.3 MEUR	-0.4 MEUR
Benefit/Cost ratio	0.74	0.66

The net benefits calculated in the ex-ante and the ex-post analyses were based on the same assumptions. No changes were made after the realisation of the project. The assumptions made were correct and no changes in the model set-up from implementation to operation are relevant. The primary source to the reduced value of EIRR and ENPV is the increase in costs.

1.3.3 Qualitative assessment of project benefits

. The following analysis includes the non-monetary benefits including both the direct and the wider benefits.

[17] From the document: "Financing Tools to Implement Acquis in the Environment Sector, Twinning number CZ02/IB/EN/04, page 9: section 5.2.1.1 Values for environmental benefits - Acquis report, from where it appears that the values are based on 1999-prices and were national Czech standards in 2004. The figures are derived from contingent value studies in western and Eastern European countries.

Improved drinking water quality

Drinking water quality is improved on several parameters as appears from the below table.

Table 1-8: Selected drinking water parameters on ex-ante and ex-post basis

Indicator	Ex-ante (2005)	Ex-post (2009)
Chlorine	5.8%	0%
Ferrum	4.4%	3.3%
Manganese	3.4%	3.3%
Cloud	0.8 NTU	0.62 NTU
Average manganese	O.023 mg/l	0.06 mg/l
Average ferrum	0.07 mg/l	0.06 mg/l

The reliability of the water supply has improved considerably, and this affects more than half of the Plzeň citizens. Before, the citizens often experienced water shortage, now they are certain that there is always water in the hose at appropriate pressure and at a quality fulfilling EU requirements.

Furthermore, for a number of citizens that before experienced heavily chlorinated water, which is unacceptable as drinking water to most consumers, they can now enjoy tap water and do not depend on bottle water. According to the online survey of the webpage of the operator, now only 5 per cent never drink tap water[18]. Before the project, at least 15% of the population were said not to use tap water and was relying on bottle water for consumption

Clean and reliable public water supply also has an impact on the image of the city, both with respect to the attraction of new inhabitants but also with respect to the city's image as a tourist attraction. The comfort of clean and reliable water supply will further contribute with a certain share to a positive image of the city's attractiveness to foreign businesses.

Reduced pollution

The reduction in pollution in the river has not been quantifiable in available data as the consultants have had access to. The major reason is that the pollution reduction impact arises from movement of effluent downstream of the city. This provides only local improvements in the river that have not been measured on a before and after basis.

However, the project has been a contributor to cleaner environment in the larger picture.

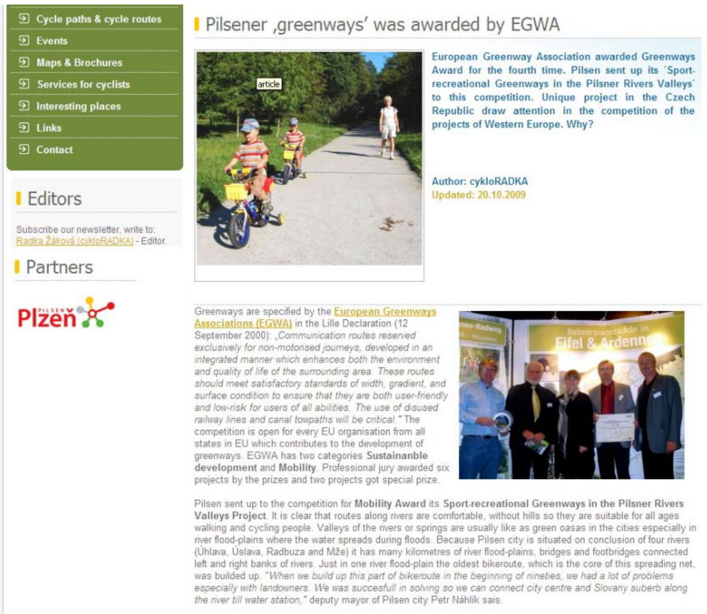
[18] http://www.vodarna.cz/kvalita-pitne-vody.html

Prior to the project, four communities on the outskirts of the city were not connected to the central sewage system involving a total of 4,500 persons or about 1,000 households. The main benefits to the individual household are costs savings related to the maintenance (emptying) of septic tanks. The yearly cost of maintenance of a septic tank is in the order of EUR 250. This was included in the CBA but the wider benefits associated with reduced ground and soil pollution due to lack of maintenance of septic tanks, which apparently is a prevailing problem, was not included in the economic analysis.

Construction of the retention tanks will reduce the risk of spill-over of sewage from the sewage system to the ground water and rivers in extreme weather situations. As spill-over is an important source of pollution to both the ground water and the river, eliminating or at least minimising this risk can only contribute positively to the quality of the ground water and the water quality of the river.

Contribution to cleaner water environment

Although it is difficlt directly to attribute the impact on the water environment due to the specific measures of this project it is evident that the river has become cleaner. There are many factors influencing the quality of both the groundwater and the water quality of the river. For instance, change in agricultural practices upstream, less construction and industrial waste released to the river upstream as a result of improved waste water treatment facilities upstream likewise contribute to the environmental status. However there is no doubt that the project has contributed considerable to the overall improvement in water quality.



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Partners

PILSEN Plzeň

Pilsener ‚greenways' was awarded by EGWA

European Greenway Association awarded Greenways Award for the fourth time. Pilsen sent up its 'Sport-recreational Greenways in the Pilsner Rivers Valleys' to this competition. Unique project in the Czech Republic draw attention in the competition of the projects of Western Europe. Why?

Author: cykloRADKA
Updated: 20.10.2009

Greenways are specified by the European Greenways Associations (EGWA) in the Lille Declaration (12 September 2000): „*Communication routes reserved exclusively for non-motorised journeys, developed in an integrated manner which enhances both the environment and quality of life of the surrounding area. These routes should meet satisfactory standards of width, gradient, and surface condition to ensure that they are both user-friendly and low-risk for users of all abilities. The use of disused railway lines and canal towpaths will be critical.*" The competition is open for every EU organisation from all states in EU which contributes to the development of greenways. EGWA has two categories **Sustainanble development** and **Mobility**. Professional jury awarded six projects by the prizes and two projects got special prize.

Pilsen sent up to the competition for **Mobility Award** its **Sport-recreational Greenways in the Pilsner Rivers Valleys Project**. It is clear that routes along rivers are comfortable, without hills so they are suitable for all ages walking and cycling people. Valleys of the rivers or springs are usually like as green oasas in the cities especially in river flood-plains where the water spreads during floods. Because Pilsen city is situated on conclusion of four rivers (Úhlava, Úslava, Radbuza and Mže) it has many kilometres of river flood-plains, bridges and footbridges connected left and right banks of rivers. Just in one river flood-plain the oldest bikeroute, which is the core of this spreading net, was builded up. "*When we build up this part of bikeroute in the beginning of nineties, we had a lot of problems especially with landowners. We was succesfull in solving so we can connect city centre and Slovany suberb along the river till water station,*" deputy mayor of Pilsen city Petr Náhlík sais.

<u>The observed environmental impacts are:</u>

- ✓ The quality of the river waters has improved over the last 10 years,
- ✓ Crayfish is back in the river,
- ✓ People have started to swim in the rivers and a number of beaches have been created.
- ✓ A number of projects are being implemented dealing with restoring the river banks and creating bicycle and walking paths along the rivers, e.g. Green Ways project

All these factors are likely to have a positive influence on the local surroundings, as nice and clean river environments might attract both tourists and local residents as well as cafés, restaurants, canoeing and bicycle outlets, local businesses etc. Actual knock-on effects on house prices and property prices along the rivers have not yet materialised. In fact, property prices are subject to conflicting influential trends; besides the impact of the financial crisis, there are also an issue of insurance prices due to the flooding risk in combination with the fact that new construction is not allowed in a 100 m zone from the river bank.

1.4 Comparing the ex-ante and ex-post cost benefit analyses

Technically, the model calculations were based on the same benefit values and therefore no new monetised values of benefits were established. As appears from the above section, it is evident those benefits accounted for in the model underestimate the wider project benefits and that the benefit calculations are based on rather conservative assumptions. The table below summarises the results of the comparison of the ex-ante and ex post calculations.

	FNPV *M€*	FRR *%*	ENPV *M€*	ERR *%*	B/C ratio
Ex ante	0.19	5.9%	0.3	2.6%	0.74
Ex post	-0.6	6%	-0.45	1.9%	0.66

An examination of the risk assessment and the actual risk bearers

During the project implementation a supervising company for risk mitigation was hired and during the operation period risk mitigation has been undertaken by the operation company (Vodarna Plzen a.s.).

The investor and beneficiary of the EU grant – i.e. the City of Pilzen – bore and continue to bear the main risks associated with the project. No major risks have been identified. The incremental operational costs due to the project investments are minor, also since there are savings of the maintenance costs on the old infrastructure due to the new investments of the project. Obviously mitigation measures to cover any additional operational or maintenance costs would involve an assessment of the tariff policy and eventually to increase the tariff to be paid by the households.

1.5 Risk analysis

Sensitivity and risk analyses have been carried out according to the new CBA guidelines.

Due to the fact that investment costs are historical data therefore not subject to any uncertainty, the sensitivity test has been performed only with regard to the economic performance of the project, since the financial performance is not affected by the variation of the input variables. On the contrary, all variables that refer to forecasts and not to historical data have been considered in the economic sensitivity test. Variables that resulted to be critical are:

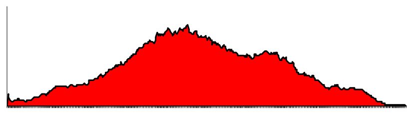
	Risk analysis				
	Independent variables	unit	Base value	Low	High

1	Water supply quality	EUR/year	5000000	-25%	25%
2	Environmental benefits/recreational	EUR/year	300000	-10%	10%

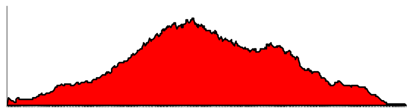
The return on investment calculations were performed probabilistically, by doing 500 Monte Carlo simulations, with the following results:

Figure 1-4 Probability distributions of the results

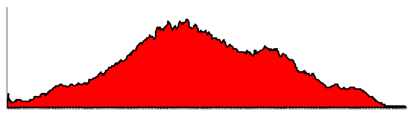
NET PRES VAL	
Expected value	-13171
10%	-15498
50%	-13278
90%	-10780



INT R OF RET	
Expected value	2.1559
10%	1.6190
50%	2.1345
90%	2.7045



NPV / PV INV	
Expected value	-0.3022
10%	-0.3556
50%	-0.3046
90%	-0.2473



The NPV was computed using 5.5% as a discount rate, instead of the 6% used in the ex-ante evaluation. The expected NPV is EUR -13,171 million. In the table above the percentages in the left column indicate cumulative probability values. Thus an 80% confidence interval is given by the range of EUR -10.780 million to EUR -15.498 million which is an acceptable dispersion. Further the graph show a rather regular shape and there for it can be concluded that the outcome of the analysis is robust.

The computed ERR is expected to be 2.2% with at confidential interval of 80% between 1.6% and 2.7 %. This again has a similar shape as the result of the NPV analysis.

The expected value and confidence interval of the ratio of NPV to the present value of investments is also shown in the above table. This ratio is equal to the familiar B/C minus 1. Thus the expected value of the B/C ratio is 0.7 which is similar to the one estimated in the economic analysis. As show in the figure the results are rather negative but not under minus one and therefore provides a positive B/C ratio.

The results indicate that discounted benefits do not cover discounted costs. The likelihood of this project being economically unfeasible is therefore 100%.

The sensitivity analysis performed shows that the most important variables are the investment cost, the water supply quality and the discount rate. These all have elasticity above 1 (expresses a ratio of change). The variables related to willingness to pay are less important because of the relative low value of those benefits.

Based on these observations it can be concluded that the project is very likely never to generate a surplus and the result of the analysis is robust.

1.6 Unit costs

The data available at the project level concerning unit costs relates to the investment cost of the different components, these actual costs are listed in the table below:

WASTE WATER MANAGEMENT		
Tariffs (for households, 2008 prices	EUR/m3	
Drinking water	0,80 EUR	25,02 CZK/m3
Waste water	0,37EUR	11,51 CZK/m3
Investment costs (2008 prices)	*MEUR*	*Capacity*
Gera Retention Tank	2,3	2350m3
Bolevec Retention Tank	3,1	3100m3
Lobzy Water Supply block/drinking water reservoirs	12,9	20000m^3 (reservoirs) 1 chlorine dosage unit 8290m distribution pipelines
Vinice Water Supply Block	7,5	12000m^3 1 chlorine dosage unit 3150 m pipelines
Walcha Drainage System	5,9	15520m gravity sewage pipelines
R Krimice and Lochotin Drainage Systems	12,3	7840m pressure mains connecting the new pumping stations to the existing sewage system 10 wastewater pumping stations

1.7 Project specific lessons

The project specific lessons are summarised in the below table.

Key reporting topics	03 Czech Republic
Identification of project	The project identification was primarily driven by compliance with the environmental acquis and reduced pollution and improvement of standards of storm water management and drinking water.
Technical analysis	The technical solution is sensible and straightforward and the implementation of the project was efficient without any major problems.
Options	COWI was told that option analyses were conducted in order to identify the most feasible solutions - however, the feasibility reports were not handed over for review. This means that it is not possible to justify if the option was cost-effective.
Demand analysis including rate of utilisation	The demand for water and wastewater services was estimated as part of the ex-ante and ex-post, however, with primary focus on the household demand. The industrial demand is more difficult to estimate. The rate of utilisation is high as all households that were supposed to be connected to the sewage system have actually been connected. Concerning the water retention tanks, it is still too early to say if they are of sufficient capacity to reduce the number of overspills into the river as they just recently came into operation. The drinking water reservoirs also appear to be doing the job of ensuring reliable drinking water supply to the citizens of Pilzen.
Financial sustainability	The financial key figures do not leave much room for negative influence on the cash-flow. Also, since the affordability analysis of the total tariffs showed no risk of payment problems among household consumers. The concept of the financial sustainability of a project like this that is fully embedded within an existing system is a bit difficult. The current Czech methodologies for OP Environment address this by concentrating primarily on achieving the overall financial sustainability of the water supply and sewerage system as a whole. The amendments to the contract (to bring it into line with international best practice) also address sustainability and should ensure that from 2012 or so the city's water and wastewater infrastructure should be sustainable, i.e. including this project
Economic analysis	The ex-ante and ex post analyses were made based on the same conceptual idea. The consumer savings from being connected to the public systems were included and the general user and non-use value of the environmental improvement was included in the economic value flow. The B/C-ratio landed on approximately 0.7 in both the ex-ante and the ex post assessment, although below 1, it must be said that this calculation is based on a rather conservative estimation of the economic benefits.
Project outcome – wider benefits	The wider benefits are connected to the recreational values and the contribution to the image of city of Plzeň but with regard to the citizens, business locations and tourist visits.
How was CBA used to support the project decision process?	The CBA was not really used as the decision for the project came out of the master plan and the need to comply with EU legislation. The financial calculations could have led to a review if the rate of support had fallen short of what was expected when the project was proposed (because of the inability of the city to finance the project without the expected level of EU support). The negative ENPV showed that the economic model results had no impact on the decision making.
Could a more optimal use of CBA had changed or influences the decision process (and planning and execution of	Since the project was a compliance driven project the CBA did not influence the decision making process in the same way, as if it was a project formulated to improve the public infrastructure and the environmental, health and social impacts.

Key reporting topics	03 Czech Republic
the project)?	
Which other aspects might be more important than the CBA to support the decision process?	Decision making is largely influenced by the specific needs, but in this case the ability to get regional funds did also impact the decision. CBA was more something that was done to be able to apply for funds.
What are the main lessons learned from the case study related to success of the project in terms of achieving the objectives of the project?	In this specific case, it was found that the Municipality demonstrated a strong will to ensure that the project was promoted by establishing a unit aiming at coordinating CF applications. In fact, the national Czech setup for analysing and implementing CF projects further seemed to improve the institutional environment to formulate, apply and implement the project. The case is in this respect subject to inspiration and demonstration. Besides this institutional learning, the wider impacts of the project is interesting, that the project lead the way for other projects to emerge.

1.8 Interviewees

Area	Contact person
General information project and institutional setup	Ing. Ereich Benes, Director Bc. Jan Vanecek, Legal expert European Proejcts Management Unit of the City of Pilzen, Divadelni 105/3, 301 21, Plzen
Technical information	Ing. Josef Holy, Technical manager European Projects Management Unit of the City of Pilzen, Divadelni 105/3, 301 21, Plzen Ing. Jaroslav Stvan Municipality of Pilzen, Palackeho nam. 6, 306 32 Plzen
Environmental information	Bc. Jan Vanecek, Legal expert Ing. Josef Holy, Technical manager European Projects Management Unit of the City of Pilzen, Divadelni 105/3, 301 21, Plzen
Financial and economic information	Jiri Strupl, MSc, Water, Environment, EU Funds Mott MacDonald Tim Young, External consultant (former manager of the Twinning project) Mott MacDonald Praha, spol. s r.o. Purkyňova 74/2 110 00 Praha 1

1.9 Literature

Reports and guidelines

City of Pilzen, 2004, Request for Support, Annex III B, Ref. no: 2004/CZ/16/C/PE/003, Cohesion Fund - 2000-2006, Organisation report, financial and economic analysis

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COWI, 2010, Export evaluation of cohesion policy intervention 2000-2006, Short description of 20 projects - TASK 1

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Twinning CZ02/IB/EN/04: A practical approach to the economic analysis of water sector projects for the Cohesion Fund, Financing tools to implement Acquis in the Environmental Sector, November 2004.

Internet Links:

1. Flooding model of City of Pilzen - http://gis.plzen.eu/povodnovymodel/2008/files/
    a. Section „Výstupy"
2. Flooding model – better one - http://gis.plzen.eu/uzemnisprava/default.aspx?MarExtent=-830065000%20-1076430000%20-813510000%20-1064920000&MarUid=0d6c0dac35bc08472f7b4c5f90b90e09%206c05fa7cdf3ac8473c092d986068e2c2%20ccc5ebc86248b3e336a3e4ff1727e330
3. Cycling paths - http://gis.plzen.eu/uzemnisprava/default.aspx?MarExtent=-830065000%20-1076430000%20-813510000%20-1064920000&MarUid=0d6c0dac35bc08472f7b4c5f90b90e09%206c05fa7cdf3ac8473c092d986068e2c2%20ccc5ebc86248b3e336a3e4ff1727e330
4. Recreation possibilities - http://gis.plzen.eu/turistika/ - in Czech only
5. Feasibility study and application form 2004 – We do not have a hard copy right now. It will be easier for you to ask for copy from DG Regio as there will be an English copy (which we do not have at all).
6. http://gis.plzen.eu/uzemnisprava/ - layer city plan – "vrstva" "územní plánování"; legend "legenda"
    a. http://ukr.plzen.eu/files/ukr/pdf/UPMP_2009_FUNKCNI_VYUZITI_PLOCH.pdf in pdf form
7. water project webpage on UKEP website:
    a. http://www.ukep.eu/content/category/6/39/34/
8. Vodárna Plzen – operator
    a. Quality of cleaned water: http://www.vodarna.cz/kvalita-vycistene-odpadni-vody-z-cov-plzen.html

b. Quality of drinking water: http://www.vodarna.cz/kvalita-pitne-vody.html
c. Legislation: http://www.vodarna.cz/legislativa-ve-vodohospodarstvi.html
d. Website: http://www.vodarna.cz/
e. water duality: http://pocasi.chmi.cz/en/ - in navigation choose “CHMI” and then in left navigation pane “Výsledky monitoringu“. There you can choose many different options and years.
f. http://www.pvl.cz/informace/zaplavova_uzemi.html?lang=en – povodi vltavy, state enterprise