CBA – problems for practice

1. A municipality wants to separate waste and earn revenues from selling sorted paper, plastics and tetra-pak to EKO-KOM. There are two options, 1) setting-up 5 drop-off sites, or 2) kerbside collection from individual households. Each drop-off site consists of 2 containers for plastics (each 7000 CZK), 2 for paper (each 6000 CZK) and 1 for tetra-pak (each 8000 CZK). For the kerbside collection municipality has to purchase plastic sacks for 9 CZK a piece with estimated use of 1.2 sack per household per collection per each waste type. Municipality has 140 households. In both cases the collection will occur biweekly, in case of drop-off sites it would take 5 hours, in case of kerbside collection 9. Costs for renting an appropriate vehicle are 400 CZK/hour. With drop-off sites we need 3 employees (driver+2), with kerbside collection 2 (driver+1). Driver costs 220 CZK/hour, helpers 120 CZK/hour (here total costs = net wage, no additional taxes apply here). With drop-off sites a household will produce 5 kg paper, 4 kg plastics and 3 kg tetra-pak per week, with kerbside collection 6 kg paper, 5 kg plastics and 4 kg tetra-pak. Buying prices are 1800 CZK per ton of paper, 1400 CZK per ton of plastics, and 2000 CZK per ton of tetra-pak. As social benefits consider positive effect from availability of separated collection 7000 CZK per year for each drop-off site, resp. 600 CZK per year per each household in case of kerbside collection. As social costs households consider decreased aesthetics of 13 CZK/household/each kerbside collection (the waste has to be on the street during the scheduled pick-up). Which variant would you prefer based on CBA according to the NPV and the R_i with project lifetime of 5 years and *r = 4%*, resp. *5%*?

   (*Solution: NPV_{EA} A = 146 779 CZK, NPV_{EA} B = 104 357 CZK; R_i A = 0.86; R_i B =0.88*;
   Partial results: A) CF_0 (FA) = -170 000; $CF_{1...n}$ (FA)= (-111 800+149 968); NPV_{FA} = -83;
   CF_0 (EA) = -170 000; $CF_{1...n}$ (EA)= 73 168;
   B) CF_0 (FA) = -117 936; $CF_{1...n}$ (FA)= (-173 160+187 824); NPV_{FA} = -52 654;
   CF_0 (EA) = -117 936; $CF_{1...n}$ (EA)= 51 344)

2. Municipality Horní Lhotice wants to cultivate a pond located in its territory:
   Project A – De-mudding and cultivation with building an outdoor swimming pool in one part (open June-September), free of charge to the people. Second part of the pond will serve as a fishing pond (expected amount of sold fishing permits for the whole project's lifetime is 500)
   Project B – De-mudding and cultivation. Whole pond will be used just for the fishing purposes (expected amount of sold fishing permits for the whole project's lifetime is 2000)

   Costs and benefits:
   1) costs of de-mudding and cultivation – 1.5 mil. CZK;
   2) costs for building outdoor swimming pool – 1 mil. CZK;
   3) gross wage for 2 persons maintaining swimming pool, employed only during the season – 15 thousands CZK/person/months (net wage 12 750 CZK);
   4) costs for the project documentation of cultivation – 150 000 CZK;
   5) revenues from renting private stands selling ice-cream at the swimming pool – 300 000 CZK/month;
   6) negative impacts due to the noise from swimming pool – 150 000 CZK per season;
   7) fishing permit – 200 CZK/person;
   8) subvention from the region for the cultivation (in year 1) – 50% costs of cultivation

*tax corrections for the wages are calculated as (gross wage)*1.34 minus (net wage)

Expected lifetime of the project is 3 years and a discount rate is 0.08 both for FA and EA.

- Calculate simple CMA
- Calculate financial and economic analysis (a CBA) and choose a better project
- Calculate CEA (real and simple) and as efficiency criterion select points acquired from a public poll – project A got 88 points out of 100, project B 47 points, and as an alternative criterion select amount of sold fishing permits

(*Solution: CMA_P: A = 3 132,4; B = 1 650*
CBA: NPV: A_{FA} = 980,3; B_{FA} = 75,3; A_{EA} = 745,2; B_{EA} = 75,3
R_i: A_{FA} = 0,370; B_{FA} = 0,046; A_{EA} = 0,281; B_{EA} = 0,046
CEA: $A_{pointsS}$ = 35,60; $B_{pointsS}$ = 35,11; $A_{pointsR}$ = 34,82; $B_{pointsR}$ = 35,11;$A_{permitsS}$ = 6.26; $B_{permitsS}$ = 0.83;
$A_{permitsS}$ = 6.13; $B_{permitsR}$ = 0.83)

Deriving price from the demand curves – problem for practice

1. Prague wants to construct a new tunnel Bianca, which will improve the traffic connection between two districts. New tunnel will decrease the costs per trip between the districts by 50 CZK for the saved fuel, by 150 CZK for the saved time, and moreover drivers will be much less stressed (without an appraisal). On the other hand, the drivers would pay a 20 CZK toll per each trip. Assume that the fee would become a revenue in the municipal budget and the drivers would only use the tunnel. Currently there are 2 million trips between the districts per year, and with the tunnel it is estimated to increase up to 2.6 million. Calculate the total benefit of building this new tunnel for the city and for the drivers?
   (*Solution: annual benefit for the drivers is 414 mil. CZK, revenue for Prague is 52 mil. CZK*)

WTP – problem for practice

1. Small community in a town is deciding between keeping the current playground for the children or alternatively building a new parking lot. Help them decide between these option if social benefits of the playground have been evaluated by experts as 7.5 million CZK (a big one). In case of new parking lot, based on the questionnaire the demand for the first 30 parking spaces is $d_1 = 1000 * (200 - 4q)$, for the rest $d_2 = 1000 * (110 - q)$. Calculate social benefits of the new parking lot using WTP method (assume no investment costs).
   (*Solution: Area under the pseudo-demand curve for parking lots is only 7.4 million CZK*)

Hedonic method – problem for practice

1. You are supposed to calculate (using hedonic method) the value of negative impacts of building a new road on the houses along it. There are 50 houses in total. Price of the individual houses is estimated as:

$$p_i = \alpha + \beta(room) + \gamma(noise) + \delta(x_i) + \varepsilon_i$$

where p_i means an estimated price of the house, $room$ amount of rooms in the house, $noise$ level of the noise from the road, and x_i some other house characteristics. Coefficients have values of $\alpha = 80$, $\beta = 30$, $\gamma = -90$ a $\delta = 1$. New road will increase the noise level from originally 0.1 to 0.6.

(*Solution: Value of the houses will decrease in total by* $50 * (-45) = -2250$)

TCM – problem for practice

1. Somewhere in deep woods there is an old ruin of a fortress. Local authority is deciding, whether to level it down and build there a wind power plant that would provide the municipality with a revenue of 10 million CZK per year (assume no investment costs). Based on the data below, using TCM estimate social benefits of the fortress and decide whether to keep the ruin or build a plant. Assume discontinuous changes in the demand for visits and no visits from the additional zones. Also assume the visits are one purpose only, as there is nothing of interest anywhere around in the woods.

Zone	Distance	Population	Probability of visit per year	Total costs per visit
1	10	10 000	15%	50 CZK
2	30	100 000	7%	170 CZK
3	70	300 000	3%	400 CZK
4	150	1 000 000	0.5%	1 000 CZK

(*Solution: Economic benefits of the ruin are 9 865 000 CZK per year, what is less than the revenues from the wind power plant – authority should thus build a new power plant*)