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Changes in the Concept of Public Greenery on the Basis of an Analysis of Czech Municipal Financing

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Abstract. The public sector is an inseparable part of every economy. It performs a number of functions such as providing public services, environmental protection, defense, security, education, health, justice and many others. Each institution's duty is to care for its own property. Public spaces, parks and other public greenery are mostly owned by municipalities. Taking care of public greenery is a part of public spending because the source of money is municipal budgets.
Key words: green area, municipal financing, analysis, costs

1 Introduction

Green spaces play a great role in developing urban ecological and social environment. The amount of greenery, the distribution of green space in populated areas and the easiness by which city inhabitants can access such spaces are regarded as key factors of social and ecological quality of urban environments [1]. Urban green areas play a significant physical and psychological role in human health. One of the medical contributions rests in mitigating the human health impacts of rising temperatures resulting from global climate change. According to Bowler et al. [2] review evaluating the evidence on whether green space affects the air temperature of urban areas within parks, it is broadly assumed that these sites are cooler than non-green sites; the meta-analysis results in Bowler et al. [2] confirmed a park space was 0.94 °C cooler in the day on average.

Green area coverage differs considerably among cities. Fuller and Gaston [3] used standardized regression to examine the relation between urban green space coverage, city area and population density in 386 European cities; their results showed that green space within a city is primarily related to city area rather than the population density, which proofs that largely a space-filling effect is being promoted.

Besides the benefits named above, it is necessary to consider diverse real and potential costs that have to be taken into account when optimizing the net benefits from urban vegetation [4]. According to Nowak and Dwyer [4], the environmental costs can be initiated by the inappropriate landscape designs, tree selection, and tree maintenance, which

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can result in pollen production and chemical emissions from trees and grass. Improper maintenance procedures can contribute to air pollution, excessive energy waste, poor excess waste management and water consumption. The most obvious direct costs are the explicit economic costs associated with urban green development and treatment covering, for instance, the costs of planting, maintenance, management, and removal, the costs of damage from falling tree limbs and cracked sidewalks due to tree roots [5].

The hot problem of many cities leans in a surplus of grass cuttings resulting from the urban green maintenance. Its management is usually financially demanding despite the energy saving up to date technologies; this is caused by the high acquisition costs of technologies and considerably high variable costs resulting from the human resource consumption and costs of the waste disposal. The cost reduction of waste management is discussed in a number of papers. For instance, Nakasaki, Aoki and Kubota [6] state that the progress in accelerated composting resulted in decreased costs; however, as Maroušek et al. [7] points out, the accelerated composts have the low ion-exchange capacity, hence it hardly provides any advantage in terms of its fertilization value. The grass cuttings can be utilized in biogas production [8]; in this case, though, this is associated with bad odor for which reason the approach to the waste cost reduction is difficult to implement on a large scale.

The European regulation of waste management affects the increasing necessity of municipal waste separation and recycling. In the Czech Republic, major changes have taken place based on national waste treatment legislation adopted in 2001 [9]. Nowadays a fundamental principle rests in waste recovery, which is prior to waste disposal. The practical realization of waste management differentiates economical and efficiency view. Based on scientific research [10] it was shown that the variable charges can be considered as an effective choice for the waste management regulation; the effectiveness of variable charges is greater than the effectiveness of fixed fees. Unfortunately, as the authors concluded, the key question for local representatives in the Czech Republic is not the effectiveness but the economy of waste management fees.

2 Data and Methods

Data sources for these analyses are Czech public budgets databases [11-13] led by the Ministry of Finance of the Czech Republic. Municipal expenditures are divided into current expenditures, capital expenditures, and total expenditures. Authors calculate basic data at current prices, which then convert to constant prices in 2015 or measure with gross domestic product.

This part is dedicated to public expenditures on public greenery in Czech public budgets. Budget breakdown by branch [14] states care for public greenery under subheading 3745 as part of following headings:

- 3 – Services for the population;
- 37 – Environmental protection;
- 374 – Nature and landscape protection;
- 3745 – Care for the appearance of villages and public greenery.

2.1 Case study Prague

There is a case study as a part of the paper. It attempts to evaluate efficiency, effectiveness, and efficacy (so called 3E) of Prague Municipal Expenditures for the Public Greenery. In this case, efficiency means “cheap public service delivering”, effectiveness means “right public service delivering”, and efficacy means “delivering public service in the right way”.

3 Results and Discussion

Current technology allows lowering of public green care expenditures. "It was shown that it is possible to construct and operate newly proposed technology which utilizes the urban green cuttings with profit instead of the usual loss making. This has been achieved by maceration and intensive anaerobic fermentation followed by mechanical and heat dewatering and the subsequent pyrolysis of the fermentation residue" [7].

For this reason, this part of the paper discusses whether the cost reduction is only a theoretical option or whether it actually occurs. Those facts relate in particular to current expenditures. The starting point for verifying this thesis is the time series of Czech public expenditures for care of public greenery.

Table 1. Czech Municipal Expenditures for the Public Greenery Care (Current Prices, thousands CZK) [11-13].

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	2 705 100	331 345	3 036 444
2001	2 717 392	456 325	3 173 716
2002	2 959 707	548 575	3 508 282
2003	3 142 977	518 189	3 661 166
…			
2007	4 202 685	1 069 699	5 272 385
2008	4 594 565	978 845	5 573 410
2009	5 230 116	1 762 026	6 992 142
2010	5 626 348	1 689 377	7 315 725
2011	5 408 944	1 210 432	6 619 376
…	…	…	…

Based on current prices, it is not possible to draw the consequences of the development over time. Data is distorted by inflation. Therefore, it can not be ascertained whether nominal growth is caused by real changes or just by raising the price level.

For this reason, authors recalculated data to permanent prices in 2015 (Table 2) and the share of Gross Domestic Product (Table 3). These are the methods commonly used to filter the undesirable influence of inflation.

Table 2. Czech Municipal Expenditures for the Public Greenery Care (Permanent Prices in 2015, thousands CZK).

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	3 731 332	457 047	4 188 378
2001	3 580 026	601 184	4 181 211
2002	3 830 319	709 941	4 540 260
2003	4 063 435	669 946	4 733 381
…	…	…	…
2007	4 922 601	1 252 938	6 175 539
2008	5 062 662	1 078 570	6 141 232
2009	5 705 904	1 922 320	7 628 224
2010	6 047 470	1 815 824	7 863 294
2011	5 705 391	1 276 772	6 982 163
…	…	…	…

The data from Table 2 show that the development of all indicators had its minimum in 2000 or 2001. A period of gradual growth until 2009 or 2010 followed. However, in the crisis and in the years immediately following, the development turned and there was a decrease in expenditures for urban green maintenance.

In the period of growth (the first decade of the 21st century) we can see that current expenditures grew at the rate of 274 million Czech crowns per year. Current prices show annual growth of over 292 million, but an increase of 18 million is due to inflation, as noted above. Capital expenditures grew at a slower rate of about 163 million a year. For total expenditure, annual growth is 409 million (427 million nominal – 18 million)

Expressed as a percentage, growth is the following. The difference between the real and the nominal value is always due to the rise in the price level or inflation.

- Current expenditure real growth rate + 6.0% (nominal growth rate +7.6%);
- Capital expenditure real growth rate +17.3% (nominal growth rate +20.4%);
- Total expenditure real growth rate +7.3% (nominal growth rate + 9.2%).

On the other hand, in the period of decline (the second decade of the 21st century), we can see the following changes in expenditure. Current expenditures in permanent prices declined by 291 million a year (nominally -137 million), capital expenditures in permanent prices declined by almost 242 million a year (nominally -196 million), and total expenditures in permanent prices declined by 600 million a year (nominally -395 million).

If we express the values in percent change, the trend of the annual decrease has the following values:

- Current expenditures -4.9% real rate of decline / -2.5% nominal rate of decline;
- Capital expenditures -14.6 real rate of decline / -12.7% nominal rate of decline;

– Total expenditures -7.9 real rate of decline / -5.6% nominal rate of decline.

Table 3. Czech Municipal Expenditures for the Public Greenery Care (Percent GDP).

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	0.11401	0.01397	0.12798
2001	0.10604	0.01781	0.12384
2002	0.11066	0.02051	0.13117
2003	0.11220	0.01850	0.13070
…	…	…	…
2007	0.10968	0.02792	0.13759
2008	0.11443	0.02438	0.13880
2009	0.13336	0.04493	0.17829
2010	0.14231	0.04273	0.18504
2011	0.13409	0.03001	0.16410
…	…	…	…

From the share of public green maintenance expenditures to GDP, we can see the same conclusions – growth followed by a decline. In the first decade of the 21st century, the share of these expenditures increased by 0.004 percentage point per year (current expenditures), 0.003 percentage point per year (capital expenditures) and 0.007 percentage point per year (total expenditures). In the second decade of the 21st century there was a decrease of -0.005 pp annually (current exp.), -0.005 pp annually (capital exp.) and -0.012 pp annually (total exp.).

3.1 Case study Prague

Within the Czech Republic, Prague is the capital city, the city with the largest population, the city with the largest municipal budget. Due to its area, many public spaces, parks, and gardens are also within its territory. The total area of parks and gardens reaches almost 40 square kilometers, some of them of the Prague-wide significance and other local significance. The basic overview is shown in Table 4.

Table 4. Parks of Prague-wide significance [15].

Park	Area	District
Garden complex Petřín	42.7 ha	Prague 1, Prague 5
Deer-park Hvězda	85.5 ha	Prague 6
Royal Deer-park Stromovka	84.4 ha	Prague 6, Prague 7
Park Vítkov	31.3 ha	Prague 3
Park Letná	46.5 ha	Prague 7
Others (local significance)	3 674.6 ha	Prague
Total	**3 965.0 ha**	**Prague**

In this case, study authors will focus on whether and how the reduction of municipal expenditures for public greenery care in the Czech capital is being achieved.

Table 5. Prague Municipal Expenditures for the Public Greenery Care (Current Prices, thousands CZK) [11-13].

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	407 473	85 811	493 284
2001	432 307	88 917	521 225
2002	462 388	136 420	598 808
2003	527 848	143 635	671 483
…	…	…	…
2007	782 165	505 313	1 287 478
2008	778 895	418 147	1 197 043
2009	1 021 910	558 712	1 580 622
2010	1 085 135	681 127	1 766 262
2011	903 812	338 632	1 242 445
…	…	…	…

For the same reason, as in the case of data for the whole of the Czech Republic (influence of inflation), it is not appropriate to work with current prices.

The values of Prague municipal expenditures for the public greenery care at constant prices in 2015 and the share of these expenditures on gross domestic product of the Czech Republic follows in Tables 6 and 7.

Table 6. Prague Municipal Expenditures for the Public Greenery Care (Permanent Prices in 2015, thousands CZK).

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	562 056	118 365	680 421
2001	569 543	117 144	686 687
2002	598 402	176 548	774 950
2003	682 435	185 700	868 134
…	…	…	…
2007	916 149	591 873	1 508 022
2008	858 250	460 748	1 318 998
2009	1 114 874	609 538	1 724 412
2010	1 166 355	732 108	1 898 463
2011	953 347	357 192	1 310 539
…	…	…	…

Concerning Prague expenditures and their comparison with the national development, we have similar results. The growth period in the first decade is changing in 2010 to decline. Perhaps the only difference is that Prague has these periods more pronounced - faster growth is followed by a deeper fall.

Period of growth:

- Current expenditures annual growth +60 mCZK or +7.6%;
- Capital expenditures annual growth +68 mCZK or +22.6%;
- Total expenditures annual growth +122 mCZK or +10.8%.

It is interesting to note that at the time of maximum there is an annual maintenance of each hectare of public greenery of almost half a million crowns. One third of this amount is capital spending and two thirds of operating spending.

Period of decline:

- Current expenditures annual decline -123 mCZK or -11.2%;
- Capital expenditures annual decline -189 mCZK or -30.5%;
- Total expenditures annual decline -312 mCZK or -18.1%.

Table 7. Prague Municipal Expenditures for the Public Greenery Care (percent GDP).

Year	Current Expenditures	Capital Expenditures	Total Expenditures
2000	0.01717	0.00362	0.02079
2001	0.01687	0.00347	0.02034
2002	0.01729	0.00510	0.02239
2003	0.01884	0.00513	0.02397
…	…	…	…
2007	0.02041	0.01319	0.03360
2008	0.01940	0.01041	0.02981
2009	0.02606	0.01425	0.04030
2010	0.02745	0.01723	0.04467
2011	0.02241	0.00839	0.03080
…	…	…	…

The share of Prague public green expenditures on GDP grew by 0.001 pp per year (operating), 0.002 pp per year (investment) and 0.003 pp per year (in total) in the first decade. The decade of decline is -0,003 pp annually (operating), -0,004 pp annually (investment) and -0,007 pp annually (in total).

4 Recommendations and Suggestions for Practice

Companies and other institutions (municipal companies and municipalities included) must consider multi-source funding. The size of the enterprise is important. “The companies that mostly finance corporate training exclusively through their own financial resources are micro-companies. In contrast, large companies finance corporate training from these resources the least” [16]. Really significant in case of human resources and corporate training are innovation activities, which can change the ratio between costs and outputs rapidly [17].

A modern method of similar predictions is the use of neural networks. “The suggested neural structures are useful in practice for an enterprise financial plan composition” [18]. Like predicting enterprise financial plans, the municipal expenditures could be predicted as well.

5 Conclusion

The examination of Czech municipal expenditures and previous or potential changes made several findings. The analysis of the time series of maintenance costs for urban green has

proved that the data contain two local extremes. The minimum is in the years 2000 or 2001 and the maximum in 2009 or 2010. The above applies to a number of municipalities (including the Capital City of Prague) and municipal expenditures of the Czech Republic as a whole.

Changes in municipal expenditures are triggered by changes in the gross domestic product. The negative correlation is demonstrated by the impact of the fiscal policy that stimulates the economy during the crisis and prevents its overheating at the time of expansion, as other studies have shown. [19] Unfortunately, the new concept [7], which would save public funds, has not been implemented yet.

The analysis further revealed that the trend periods in public expenditures are different. The growth period comes after economic expansion is longer and slower. The decline period begins in the post-crisis years and is shorter, more intense and steeper.

Further research may be about how to put this information into practice. Finding a concrete formula to improve the prediction of spending would help. This would considerably improve public sector planning, where the most important planning document is the one-year budget. Expenditure frameworks with a longer future horizon are often only a formal document without any practical application.

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