DECISION-MAKING SUPPORT AND ITS APPLICATION IN PUBLIC ADMINISTRATION

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Abstract: This article describes modern methods of decision-makingin companies and possible utilization of these methods in public administration.At the beginning, the articlefocuses on the current state of cooperation between the private and the public sectors.So-calledPublic-Private Partnership (Projects) are one option for such cooperation, the takeover of certain public sector services by private operators is another option for such cooperation. Then there are shown the different levels of the modern decision-making and utilization of the decision-making methods in the public sector. It includes Reporting, Ad Hoc analysis, Dashboards, Classification, Predictionand What-If modelling.Finally, there are shown two approaches in a decision-making case studyin the private sector. The first study concerns theimpact of exchange rate fluctuations in the volume of transactions at an electronic money institution. The analysis is then used in the standard reporting and has impact into Key Performance Indicators. The second example case study shows advanced techniques like statistical analysis, logistic regression, neural network and decision tree within the classification of clients.The methods in the case studycan be applied in public administration (e.g. in tax administration).

Keywords: Business intelligence, Decision-making, Public administration, Public-private partnership

JEL Classification:C15, D89, H74

Introduction

Long-term decision-making in public administration (PA) is becoming more and more complex. In the framework of projects influencing a large number of limited resources – like money and human resources, it is essential to evaluate not only definite inputs, outputs and individual elements of a system, but also the environment of the system that previously has not looked so important. It includes for instance ecology impacts, sustainable development, long-term strategies of national and multi-national corporations, assumptions of further science developments and similar [9], [12]. In the period of economic growth PA must also compete with price competition from private companies in the area of salaries of workers/human resources and also with prices of investment actions themselves. All of these mentioned inputs increase the insecurity of a decision-making process and they can lead to an end or at least to a negative view of a given project

Another factor that is often mentioned is slow reaction of PA to changes in externalenvironment and thus issuing worse ability to adapt to changing demands for services provided under a given project. One of the models that should change this situation is "Public Private Partnership" (PPP) [2], [21] model. The objective of the PPP [2], [21] model is to interlink public andprivate sectors (PS and PS) and thanks to that interlink better allocate individual resources from both of those economic units.

While a number of projects have been successfully implemented using the PPP methods, in particular in English speaking countries, in the Czech Republic PPP projects have been successfully used only in a couple of sectors (mainly in water management). This model (PPP) has not been much used in other sectors in the Czech Republic. In 2015 the volume of Concession Agreements (CAs) was less than 68 billion CZK (1,5% of GDP) [11], [16]. On top of that most of the CAs use, as a source of financing, the EU funds. Thus it is not possible to say here that the PS has taken over the financing of projects [4], [17].

Contrary to that some services that used to be managed by the PA have been taken over by the PS. This trend is very prominent in health services management where private companies (e.g. AGEL a.s.) buy up and then manage health facilities ranging from hospitals to polyclinics down to individual departments or to dialysis centres, transfusion centres or secondary medical training schools [1]. These companies demonstrate that also in the environment where entities managed by PA have economic/financial problems and must be provided with grants it is possible to be financially profitable. The reason is high quality management and decision-making, which means strict control of expenditures and costs, elimination or risks and utilization of opportunities.

Decision making manner in a private company differs not only based on the company size, or based on e.g. the size of its decision-making and support bodies, but also based on the company's sector orientation and on the branch in which it operates.A productioncompany observes primarilyinputs prices, supplies in stock and fulfilment of forecasted sales margins. Trading companies strive to understand trends, customers needs, to set prices in relation to competition andto run marketing campaigns [20]. For support to decision making it is possible to use methods that are stated for instance in Business Intelligence (BI) [7] pyramid where on the base level is regular reporting (charts and graphs), then follows selective reporting, Dashboards and Ad Hoc (AH) analyses; then follow advanced analyses (classification and prediction) and on the top there is modelling (What-If scenarios and sensitivity analysis).

The objective of this article is to demonstrate possibilities provided by utilization of decision methods that are used in the public sector in the PA. This is demonstrated by a case study for a trading company. This company decides on the basis of an elementary method – reporting and on the bases of classification that belongs among more advanced analysis methods.

1 Decision-making and public administration

Decision-making in PA has undergone significant changes in the last 25 years thanks to wide spread penetration of information technology. Especially in the areas that are deterministic, that means that it is possible to get unambiguous outputs from these areas [13]. On top of this they also draw from a long tradition. This tradition started to develop in the second half of the twenties century. They concernfor example solving crises situations where geographic information systems are used (e.g. maps of flooding areas and similar) [19]. The newer part of decision making in PA are sociology and economy areas. Sociology utilizes primarily questionnaires based research that is then evaluated by means of standard statistical methods [9]. Economy

science utilizes, next to statistics, also econometrics, mathematics and other branches of science. On a general level PA however lacks behind in utilization of software tools and in overall standardization.

PA exists in the same economic reality as the PS and it has started to take over and use the same tools in recent years. These tools are for instance Enterprise Resource Planning (ERP) and Customer relationship management (CRM) systems. The ERP systems are used to detect and save information. The ERP systems are used for instance by the Ministries of Defence, Interior and Culture, by the Capital City Prague Magistrate, the Labour Office of the CR, Statutory City Brno, Statutory City Ostrava (all ERP GORDIC Ginis), the Office of the Senate of the CR, Královehradecký region, cities Písek, Uherský Brod, Rokycany (ERP HELIOS Fenix). CRM systems that process „soft data" are utilized by Pražské služby („Prague Communal Services company"), Directory of Roads and Highways (HELIOS Green), city Svitavy, Hospital Nymburk (OR-INFO). BI is then implemented by a number of tools, from simple table processors (Excel, LibreOffice), to more advanced tools (Tableau, MS PowerBI, IBM Cognos) up to data mining tools (SPSS Clementine, IBM SPSS Modeler, Statistica, RapidMiner, Orange, Kmine, Weka).

Suitability of utilization of BI methods is possible to demonstrate on the example of a trading company. At first sight it seems that the demonstrated company has not much to do with PA, however its operates in the same economy environment and it has to deal with the same uncertainties as are for instance exchange rate fluctuations, economic environment abroad and similar.

2 Case study in a selected trading company

Regular reporting is the basis for decision-making. Basic reporting can not only summarize fundamental indicators of an entity, but it can also be helpful in the evaluation of these indicators. Its introduction is very cheap. In majority of cases MS Excel program is successfully used, or free open sourceis used – office packet software Libreoffice is available free of charge. In case more employees are supposed to work with the information in the reporting then it is useful to create a unified Dashboard that shows all key indicators at one place. Basic forms are on the Internet. From these examples it is possible to create by means of a simple adjustment unique decision-making reports [5], [6]. The daily profit report is such an example. Itis one of the key indicators for a company and it is a part of other further activities such as is for instance planning of costs.Top management, or possibly managers directly responsible for sales, are evaluated based on this indicator. This indicator influences also a number of other factors. In a payment institution one of such factors is exchange rate change. After very good results achieved for a couple of days consequent to the CNB interventions (the CNB introduced them in November 2013) drop of profits came about on a currency pair EUR-CZK. For this reason AH analysis has been executed, the results of this analysis are demonstrated in Figure 1. The Left side shows the volume of exchanged finance of clients in one day and the bottom line shows the Exchange rate change in the day on the currency pair Euro – Czech Crown in CZK/crowns.

The profit has been influenced by long-term stagnation in the exchange rate. Its development cannot be forecast with reliability and that is why only the long-term expected development has been included in the plan. However, the evaluation of profit and potential changes in the plan are done with the knowledge of this quantity. It is, jointly with other factors such as seasonal and weekly cycles, holidays and similar [15], the substantive part of the reporting.

Figure 1: Average volume of trades on the currency pair EUR/CZK accordingtoexchange rate development
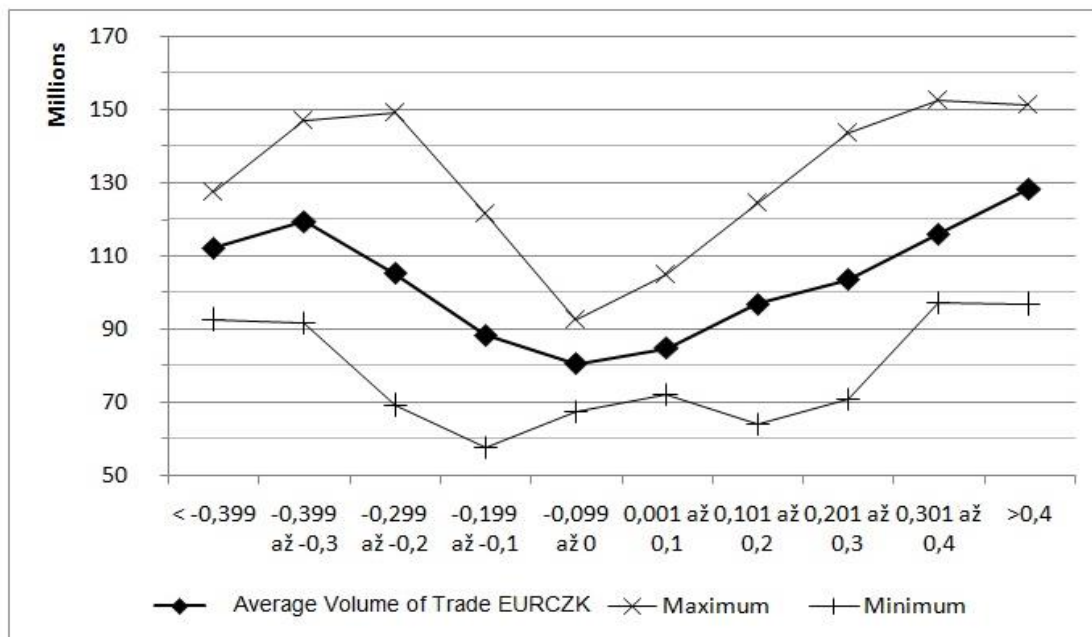
Utilization of the above-stated method in PA is possible to see in „collection of taxes from abroad that is influenced by exchange rate development or by the CNB forecast of the CR balance of payments.

Advanced analyses deal with the detection of so far undetected interlinks or they should determine the rate in which output parameter is influenced by the individual input parameters. When doing classification we strive to assign an element, based on the information we have already, to a group of similar elements. Based on the group (into which the element have been assigned) we can later deduce its future behaviour [18]. With prediction we strive to estimate the volume of the input parameter that is in majority cases solved by regression methods. It is possible also to use different methods such as neural networks [10, s. 98], decision trees, logistic regression, and similar. In the framework of these analyses it is essential to find valid parameters that in fact really influence the outputs. With a growing size of the company there usually also growths the number of these parameters and by that, at the same time, the volume of data that is possible to process. There are two possible approaches for this large volume of data. The first approach is decomposition of large units into smaller ones and consequently solving the smaller ones. This is less demanding regarding capacities and all capabilities of statistics and of BI can be used for this task. The second

approach is to work with big data (Big data – terabytes or petabytes size/volume) [8]. The advantage here is that any hidden connections can be detected that cannot be detected at data decomposition. On top of that standard BI methodology can be used "Cross Industry Standard Process for Data Mining", commonly known by the acronym CRISP-DM. The disadvantage is high demands on company technical and human capacities. That is why a number of such services, also in large companies, are outsourced. The results of such analysis are then used in standard reports or on decomposed observations [3].

An example of de-composed observation may be classification of a client, to a profitable and a non-profitable client, based on data from the first three months after contract signature. This classification is done after one-year time have elapsed from contract signature. The estimate is thus very complex. A number of factors enter into the business relation and these factors cannot be easily quantified – for instance competition offers, production failure, exchange rate disadvantageous for the client, and similar issues. However it is essential to try to do this because of margin settings, price list and agent compensations. In year 2015 the payment institution found out by means of an analysis that the share of non-profitable clients that were classified as profitable is among natural entities (FO) bigger that among legal entities (PO) or among natural entities-entrepreneurs (FOP). On the other hand with the PO group a high rate of errors in the existing classification has been identified. 2385 clients have been tested, out of that 743 FO and 1292 PO. According to standard statistical methods (comparison of the median value, median and other parameters according to individual attributes) classification parameters have been changed. Thanks to that the quality of the output (profitable and non-profitable) has improved by more than 10% (see Table 1). Consequently also other possibilities for classification improvement have been researched into. In Table 1 there are stated three most successful algorithms: the Top Down Induction of Decision Trees (TDTID) – C5 algorithm, the neural network – Multi Layer Perceptron (MLP), logistics regression. The above-stated classification algorithms have shifted the quality of the classification again by about 10% (with FO over 87%). The results are stated here for or a test group comprising 30% clients (223 FO and 388 PO).

Thanks to this significant improvement profits have increased (less profitable clients have less friendly tariffs and margins, more profitable clients have relevant trading conditions and are less prone to switch to competition) and costs have become optimized (optimization of the reward system).

Tab. 1: Comparison of analytical methods

Client Classification Method	PO - correct/incorrect classification	FO - correct/incorrect classification
Original classification	62.71% / 37.29%	66.03% / 33.97%
Standard statistical methods	73.54% / 26.46%	76.31% / 23.68%
TDIDT – C5	81.76% / 18.24%	87.15% / 12.85%
MLP	83.65% / 16.35%	87.25% / 12.75%
Logistic regression	79.25% / 20.75%	86.85% / 13.15%

Source: Own research

Decomposition thus not only reduces demands on capacities of companies in comparison with utilization of BD, but at the same time, it is a way how to improve individual decision-making processes and to increase efficiency especially in those cases where this efficiency is managed according to the behaviour of very different groups of the researched objects. Utilization of similar principles is possible also for e.g. tax administration – it also deals with different groups of tax payers (FO, FOP and PO).

Conclusions

In this article standard decision making processes in the PS have been introduced and their possible utilization in the public sector-PA. At the beginning of this article the existing overlaps of PA and PS are described (PPP and takeover of some public services by PS) as well as the utilization of BI tools in PA. From this overview it is clear that BI methods and tools are already used on the various levels in PA. Not only by regulatorsof PS such as the Czech National Bank or the Ministry of Finance of the Czech Republic, but also in other PA subjects.

The first case illustrates a simple utilization of reporting for review of an undertaking's financial results. Exchange rate changes cannot be predicted for a longer period of time. Despite that they significantly influence business parameters including for instance meeting the profit goals. Thereby it is important to monitor their development and when it is necessary to adjust company's evaluation or company's business plan respectively because the difference between the lowest and the highest average value is more than 60%.

In the second example options for clients' classification in the time period of three months after contract signature are compared. The original situation with error rate from 33% to 38% has been improved by means of statistical modelling methods and new classification criteria have been introduced which led to accuracy improved by 10%. These criteria are used in the system of agents' rewardssince they are simple and unambiguous. More advanced methods the accuracy of which is yet again by 10% higher have been utilized for setting trading parameters (margin, price list) for the period after three months of contract signature. This arrangement is fully in the payment institution'scompetence and as such it does not have to be totally unambiguous and it may change. In this way savings in costs have been achieved by means of optimization of bonuses for agents as well as increased profits per clients have been achieved – for those clients that otherwise have been little profitable or even represented loss for the company.

Both of the executed analyses show how the BI methods are employed in the PS. The illustrated differences in profit fulfilment in the first case and the improved quality of classification in the second case are a clear evidence that BI provides a very strong support for decision-making and it prevents hasty and inaccurate decisions.

Utilization of decision-making support in the PA is thus one of the possible ways to improve quality of management in the PA. In the PA this can be demonstrated both as cost savings and higher satisfaction of citizens with the PA services. Direct utilization of these two examples can be executed in the taxes administration area.

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