

Decision Making Criteria for Outsourcing or In-sourcing of IT Service Provision in Public Sector

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The study focuses on the uncharted area of the Slovenian public sector. It uses an in-depth analysis of the contemporary pro et contra arguments and presents the research findings concerning IT outsourcing and insourcing in the Slovenian public sector. Regardless of the fact that state governments have always been purchasing some goods and services on the external market, the last two decades have shown an exponential growth of competitive tendering and outsourcing as a powerful tool of public management. In Slovenia, the use of competitive tendering and outsourcing of IT services has been growing rapidly, many will say unfoundedly and irrationally; the reported expenditures on contracting out in the public sector in the last years have doubled reaching in the time of global economic and financial crises, roughly estimated, tens of millions of euros. The research outlines some methodological, contextual, procedural and other aspects and considerations and eventually presents Saaty's multiple criteria decision model for planning IT outsourcing and provides guidelines on critical assessing IT outsourcing projects in the future development of the public sector and its services in Slovenia.

1. Introduction

The global social changes in the last three decades have initiated the need for reforms in both the private and the public sectors. The social, economic and technological development pressured the public finances and raised numerous issues on an efficient, transparent and earmarked spending of assets. The public sector is facing difficulties especially in three fields of its operation: global developmental trends and their growing pressure upon accounting expenditures, growing expectations of citizens as regards the offer of public services, despite fiscal restrictions, and an alarming demographic situation in which an already numerous population of retired persons grows by far faster in comparison with the creation of new jobs for the unemployed and the active population entering the labour market. All these result in a large financial burden when it comes to payments of pensions, offer of health care services and other public services. The above-mentioned events initiated some speculations on the type and scope of rights and services that should be offered by the public sector in a situation characterised by so restrained resources of public finances.

It is but for these financial problems in 1980s that a convergent development of technology and administrative and economic sciences led to the forming and implementation of new business strategies in the public sector. The public sector started using certain managerial instruments to reduce operations costs and improve efficiency in the first place, although the use of these instruments in the past was exclusively the characteristic of the private sector. The situation described above resulted in performing some jobs from outside, i.e., outsourcing¹ (English: outside source using) which means: by concluding a contract by which a specialized contractor outside the organization is assigned to perform some services and business processes which were primarily the liability of the public sector. It is in this way that outsourcing has become a major feature of the strategic development of the public sector. As well as the private sector, the public sector too started to transfer jobs to outside providers who provided public services in most diverse areas of social life based on the contract concluded with the public sector organizations: municipal utility works, social and health care, education, infrastructure maintenance, to even prisons and military issues. It did not take long,

¹ Here it is necessary to mention that, when talking about outsourcing in a strict sense, we primarily have in mind an outside provision of certain business processes or services, however, still within the boundaries of the country in which the organization that transferred some processes to outside providers, works; when talking about outsourcing in a broad sense, we think of the transfer of business processes and services to entities in some other country. In such cases, the terms "offshoring" or "dislocalisation" are often used although they have no direct connections with outsourcing in the public sector. In this paper, outsourcing will be primarily studied in its stricter sense, namely, within the country's boundaries. For either outside or inside performance we use the English terms outsourcing and insourcing which are equal in meaning; namely, both terms are part of very rich Anglophone economic terminology.

however, for the enthusiasm for these so-called revolutionary invention to expire. Already in the 1990s, according to the research of numerous experts, more than 75% organizations were dissatisfied with the inefficiency of outsourcing and poor results, and more than 50% organizations that practiced outsourcing tried to recover the provision of services and business processes, once outsourced, to their own organization [1]. Organizations were unanimous in complaining about an unpredictable rise in costs and an ever poorer quality of services provided by outsourcing.

The lack of an adequately critical and analytical approach in identifying the real needs for outsourcing has often left organizations in rather difficult positions, sometimes even to the brim of survival and worse. Trying to achieve short-term benefits, organizations endangered their long-term survival and made further development, as well as accomplishment of their visions and strategies, impossible. The negative experiences that accumulated for thirty years in the outsourcing area have in the last years reached a critical point and caused a turn back, or a return to insourcing certain business processes and services.

In addition to the analysis of outsourcing and insourcing strategies, the paper focuses primarily on the study of outsourcing and insourcing of information-technological services (hereinafter: IT services) in the public sector and the criteria such decisions are based on. The prevailing scientific paradigms in this field by no means approve of the outsourcing of key business processes, especially in the public sector and argue that focusing upon the fundamental activities of the organization and upon key tasks is becoming a strategic feature of the modern organizational development.

Finally, in the context of the abovementioned, it is necessary to take into consideration the insourcing of certain business processes and IT services that have so far been left to outside providers and that proved to be an instability and dysfunction factor in the long-term, since outsourcing of certain business processes led to the so-called “hollowing out effect”² on the organizations which means that transferred jobs had a decisive

impact upon losing some crucial competences and potentials of the organization and hence upon an inefficient performance of the key organizational tasks.

Our topic of interest in this study is the interdisciplinary area of IT services outsourcing and insourcing in the public sector, that is, its cross-section between economic, administrative and other scientific paradigms. The very breadth of the topic of study clearly shows that partial approaches based exclusively upon analytical economic theories and normative articles, do not offer a conceptual and multiple criteria satisfactory model for a selection and development of an adequate strategy of the public sector operations. What we need is an in-depth and systems analysis of the IT outsourcing and insourcing strategies impact upon the operations of the public sector and their implications upon the entire social environment. From this aspect, the study is based on a combination of the scientific theory (methodological level), economic science theory (institutional level) and on the theories on economic entities behaviour (anthropological level).

Our aim in this study is to shape and structure a conceptually balanced approach to forming an integrated IT services outsourcing or insourcing in the public sector, on the basis of varied theoretical platforms. Making use of the results and conclusions of empirical studies of various authors, we attempted to present an analytical hierarchy multiple criteria decision-making model for appropriate decision making in selecting a certain strategy for provision of IT services and other business processes in the public sector.

In addition to basic economic methods that primarily throw light upon the financial background of the problem and offer exclusively quantitative estimates on the adequacy and legitimacy of the selection of one of the mentioned strategies, in the analysis and in making important strategic decisions, such as deciding in favour of IT services outsourcing or insourcing, it is necessary that a method should be employed that will include a multiple criteria structured and multidisciplinary approach to an insight into the entire problem matter. According to the experts, the in-depth scientific research should use analyses, the primarily socio-eco-

² The “hollowing out effect” is a common term for a set of negative results usually incurred by a loss of autonomy of one or more organizations. This effect may be caused by the acquisition of the organization or by joining by another organization. The term also applies to outsourcing since the transfer of services and/or business processes, sometimes even key ones, to outside providers may result in losing control and management, losing financial means, competences, organizational vision, trust, knowledge, creative potential and culture capital in the organization.

In some cases, we can talk of a “hollowing-out effect” in an example of a broader social phenomenon, environment or even the whole state, which in the globalization area sets a rather serious problem (excessive moving of production and other operations to other states – offshoring, etc.) [6].

conomic criteria and the Cost-benefit analysis, as well as the Balanced Scorecard to offer above all more conceptual and longer-term solutions to the problems posed [2], [3]. The Cost-benefit analysis and the Balanced Scorecard will, in addition to the economic criteria, employ their method of quantification of key strategic organizational factors to help select the most efficient business strategy, and strengthen this decision from the financial, organizational, personnel as well as the social aspects. In the final section of this paper the Analytical hierarchy process method (AHP method) will be presented, one of the best-known and most popular methods of multiparametre decision-making that could help find more rational and more efficient manner of spending of assets, where the quality of decisions really depends on a host of factors.

2. Outsourcing

2.1 Definition of outsourcing

The concept of outsourcing is burdened by numerous connotations and prejudices. This is seen in a broad range of definitions of this concept, from most concise to superficial and partial definitions of the phenomenon in consideration.

Greaver defines outsourcing as a transfer of certain repetitive activities and decision-making authority to outside providers, under the conditions previously defined in the contract on cooperation [4]. As these are repetitive activities, defined in the contract, outsourcing can be said to go beyond the use of external consultants. In a majority of outsourcing examples, actually, it is not only the activities and business processes that are transferred, but also the instruments of labour and the decision-making authority. Ellram and Maltz define outsourcing as a contracted transfer of liabilities to perform some operations within an organization to a third party [5]. The head office of the provider and the site where the operations are performed may be geographically the same or distant from each other. This primarily depends on the type of operation transferred to the outside provider and its logical needs.

The concept of outsourcing is therefore possible to interpret as a business strategy by which an organization, due to certain reasons (most times these reasons are of the cost type), transfers the performance of certain business processes or services to entities outside the organization, with the intention to focus on its key tasks and core activities.

The abovementioned definitions of outsourcing highlight some disagreements among the definitions of the concept, ranging from minor semantic differences to fun-

damental differences in the conception, understanding and defining outsourcing. Partial approaches, inconsistency and disagreement in defining the outsourcing concept itself set additional difficulties in its evaluation as well as in the analysis of its appropriateness, efficiency and performance. The accuracy in defining the strategic concepts of organizational business activities is much more important than it appears at first sight, the more in the public sector because each error is paid by public money. Namely, it is only with clearly defined future business strategies that we will be able to conduct a sound analysis of the current situation in the organization and evaluate the effects and results of the selected strategy. In case we fail to define the strategy correctly and we do not know its economic, normative, contractual, developmental and organizational frames and traps, our decision making is reduced to the level of intuition.

3. Reasons for introducing outsourcing

3.1 Advantages and benefits of outsourcing

Due to the scope of the problem that goes far beyond the boundaries and ambitions of this study, the organizational reasons that result into the project of IT services outsourcing, or its termination, will be only shortly described. The reasons, according to various authors, differ, however, they all meet in the following Greaver's classification [7]:

1. Organizational reasons
 - Organizational transformation,
 - Improvement of efficiency with a focus on core competencies.
2. Business improvement
 - Improvement of business results,
 - Improvement of managerial skills and increase of control.
3. Financial reasons
 - Reducing investments into ownership and setting the capital free to be invested further,
 - Acquisition of new capital with the transfer of material resources to outside provider.
4. Incomes
 - New market opportunities via the outside provider's network,
 - Acceleration of organizational growth using the outside provider's potential.

5. Costs

- Cost reductions due to higher cost efficiency of the outside provider,
- Fixed costs transformation into variable costs.

6. Personnel reasons

- Employees are given chances for career development,
- Increase in employees' commitment and efforts in the non-core organizational competencies.

Obviously, within each of the listed categories there are still more concretely and accurately stated reasons for outsourcing, however, for the needs of this paper, the above classification is quite satisfactory, since it describes the general trends in decision making in favour of outsourcing rather well.

Numerous research, conducted primarily in the USA, corroborate the above classification of the most important reasons in favour of IT services outsourcing [8]. The most important reason in favour of outsourcing is undoubtedly the cost reduction; as many as 48% organizations included in the research listed costs as the most important factor; then follows that the organizations reported a 40% higher focus upon the core competences; the third position is the lack of internal resources in the organization (35%). The reasons that follow refer mainly to the quality of the services and products and are more focused upon the customer satisfaction. Below are listed the access to the outside providers' ultimate technical competencies and knowledge, risk reduction, better opportunities for investments into strategic projects, etc.

3.2 Weaknesses and risks of outsourcing

As well as the above mentioned advantages and benefits of outsourcing, it must be noted that outsourcing projects bear numerous potential weaknesses and risks that have to be assessed and analysed before the decision on implementing an outsourcing project is made. The biggest problem in the outsourcing projects is the fact that problems emerge later in time, when the organization is already deeply involved in the outsourcing project. Causes of such a situation are many, in both business entities involved. Numerous experts argue that the private sector companies are most endangered due to the selection of the wrong outside provider, whereas the public sector organization are most seriously exposed because of outsourcing inadequate operations, unpredicted costs and the "hollowing-out effect".

Bongard classed the potential weaknesses and risks in outsourcing projects into six categories [9]:

1. Costs

- Rise of unpredicted costs,
- Fixed price of services contracted with the outside provider that really falls over a longer time span, especially in the IT services area.

2. Labour force

- Employees feel threatened, fear from losing jobs, lack of motivation to work,
- Fall in productivity, weaker organizational climate and culture.

3. Technology, technological knowledge

- Loss of core knowledge in organization, fall in the intellectual capital of the organization, "hollowing-out effect",
- Wrong estimate and transfer of organizational core competences to outside providers.

4. Information

- Discretion is threatened, possible loss of confidential information,
- The outside provider conceals information on potential problems until it is too late.

5. Dependence on outside providers

- Loss of control over the outside provider and consequently over business processes,
- The outside provider has too much power, especially in very complex outsourcing projects.

6. In-house resistance

- The outsourcer's distrust in outside provider may pose a serious threat to the relationship,
- Passive attitude and lack of interest among individuals within the outsourcer's organization in the outsourcing project.

The description of potential weaknesses and risks of outsourcing also includes the fact that each listed category includes a host of additional and concrete impact factors, which may affect the project as instability factors or even discontinue the outsourcing project; however, for the purposes of this study the above presented description of factors is illustrative enough.

4. Outsourcing and IT

Due to its applicability, IT is a rather specific field of study within all the subsystems and on all organizational levels, as well as in the relations with entities outside the organization. The abstract nature of the raw materials that enter the information system or information process makes IT outsourcing difficult to plan and construct as it is often hard to define the evaluation of the selected business strategy itself and its effects and long-term benefits it brings to the organization.

Economic analyses and classic methods of assessing IT services outsourcing projects are often inappropriate for an objective evaluation of similar projects, because of the dispersion of both vertical and horizontal effects these projects bring to all the organizational segments and entities in its environment. It is for this reason that assessing IT services outsourcing projects in the public sector, their achievement and efficiency and the very use of IT and the related services, calls for ultimate caution, as citizens are at the same time the majority owners and consumers of their services.

Our aim in this paper, as we have already stated in the Introduction, is to introduce a qualitatively structured multiple criteria decision-making model for making decisions connected to IT services outsourcing or insourcing in the public sector organizations. The nature of the outsourcing strategy itself requires that a dual approach should be used in forming such models founded on several criteria. A good decision making for the IT services outsourcing projects, based on objective criteria, has to include two aspects, the material and the formal ones, i.e., the content and the process aspects.

The material aspect focuses upon the contents of IT services that a public sector organization plans to transfer to outside partners to perform, as well as to the expected benefits that the organization should achieve through a selection of such a business strategy. There is almost no business activity that has not been outsourced, either partially or fully. This previous sentence raises some questions as to whether all services and operations are really adequate to be transferred to the outside provider, having in mind that public services are by a rule financed according to plans and that they are meant for a broader public benefit that should be provided by the public sector; and also, why do we need such a transfer of services and operations at all, if we take into account the number of highly trained experts that work within the public sector system itself. An important issue, too, is whether the public sector organizations have formed the criteria (financial and other),

namely, the strategic frameworks in which they decide which segment of operations of the organization or information system (IT services) is appropriate to be outsourced over a long-term period and why.

The formal aspect focuses upon the entire process of IT services transfer to the outside provider and all the side effects. This aspect deals with the entire process, from the outsourcing idea, to a public tender and the selection of the outside provider, to concluding the contract with the outside provider and the evaluation of the business relations following each completed business cycle. It often happens that organizations do not follow the planned phases of the process, but rather make shortcuts towards the goal, which in a long term may prove to be a critical error. Such a thing is highly dangerous in the public sector, since the costs of wrong decisions made by the organization are paid by the entire social community, not only by the owners or liable individuals, as is the case in the private sector. All the phases in the process of the IT services transfer to the outside provider are of paramount importance and succeed each other in a regular order. A proper implementation of the outsourcing project requires a consistent and accurate implementation of all the phases of the process.

A rational and multiple criteria founded outsourcing decision requires that both aspects, material and formal, should be joined together and that a structured, multiple criteria decision-making model should be created. Only on the basis of such a decision-making model can we decide about the steps we will take and of the beginning of the outsourcing project procedure, as this model actually clearly and directly shows whether the IT services operations or the overall operations in general are appropriate to be outsourced.

5. Approaches to the development of a multiple criteria decision-making model

The development of a multiple criteria model for making decisions as regards the IT services outsourcing in the public sector inevitably requires, especially in the nowadays social and economic circumstances, that a balance be established among numerous different factors, such as: economic, social, political, normative, and technological. All these require that numerous stakeholders be involved, each with their own priorities and goals, into all the phases of the development process and consequently the decision-making process. Taking into account the abovementioned assumptions, the study continues to focus upon forming and development of a multiple criteria decision-making model (MCDM) which will help managers set priorities and

make adequate decisions in the field of IT services outsourcing in the public sector.

The multiple criteria decision making (MCDM) is one of the best known trends in the decision-making theory. MCDM includes a number of different methods, each of which has such qualities due to which its implementation is confined to defined, usually narrow, fields of complex decision-making. Following the analysis of these qualities and an estimate of their adequacy, the most appropriate method will be selected for the design of a multiple criteria decision making model in the area of IT outsourcing in the public sector. Thus, according to experts, the methods are classed according to the types of data used in the decision-making process; hence we know [10]: deterministic, stochastic, and fuzzy models. The methods are further classed in accordance with the number of individuals involved in the decision-making process; here we talk of the methods involving only one individual making decisions, or of the methods involving a number of individuals, namely, a group. In designing a multiple criterion decision making model for IT services outsourcing, due to the nature of the research area, we will implement a deterministic method with one individual making decisions, which will improve the reliability and accuracy of the model. It will also facilitate the implementation of the designed model. In addition to the above mentioned, it must be noted that the classification used is only one among many, since these methods, however different, have a lot in common (alternatives, attributes, objectives, decision criteria, ...), therefore two or more complementary methods can sometimes be used, in accordance with the nature of the decision-making process itself.

If the characteristics of IT services outsourcing are taken into account on the basis of the above said, then planning, development and designing a multiple criteria model has to satisfy three important criteria:

1. The decisions in complex problem solving have to be made on the basis of a larger number of relevant qualitative and quantitative criteria;
2. The subjectivity aspect of the decision-making person has to include potential ambiguities; that is, the lack of information in judging has to be valued and calculated into the overall decision-making process;
3. The model must be shaped in such a way that in its implementation phase, in making concrete decisions, it has to allow for the use and comparison between different alternatives, having in mind the definition of the goal, as well as the selection of key criteria and subcriteria.

The review of the methodological framework used in the development of the multiple criteria decision making model is shown in Figure 1. In the first step, the methodology focuses upon defining priorities and then upon the analysis of the complex structure of the problem and the inclusion of all the tangible and intangible factors, i.e., all the measurable qualitative and quantitative factors within the complex problem structure. In the second step, the methodology goes one level higher, including into the decision-making process some more complex interactions among factors, such as the interrelation among the factors and their hierarchical structure. This is the phase in which the final choice and assessment of the relevant criteria and subcriteria are made. In the third step, the entire range of chosen criteria is further weighted in a more adequate manner, taking into account their importance, time limit and other organizational preferences; namely, each decision-making process is burdened with some objective restraints that cannot be avoided and that are necessary to include if we want to achieve long-term strategic goals. It is also necessary that the subjectivity of the decision-making person be also assessed and, if needed, the criteria weighting should be assigned to other individuals, and only then a compromise should be reached, a solution that would enhance the objectivity of the model itself as well as facilitate its implementation and use in the future.

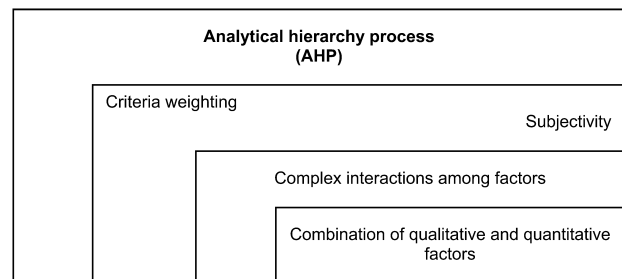


Figure 1: Methodological framework of the multiple criteria decision making model development

Given all the necessary conditions that have to be met as well as the above mentioned model characteristics, the **Analytical Hierarchy Process** model (hereinafter: AHP model) is selected for the needs of IT services outsourcing in the public sector. The analysis of all its characteristics and the assessment of its adequacy has proved that this model meets all the previously defined requirements (numerous similar models are used in similarly structured problems in the field of multiple criteria decision making, such as: ANP – Analytic Network Process, ELEKTRE, PROMETHEE, etc, which are usually the extension of the AHP model and serve as a corrective to calculate more precise and more reliable results). The AHP model will be further elaborated in the following chapters.

6. Analytical hierarchy process

The author of the Analytical Hierarchy Process meant as a support to decision making in various areas is Thomas L. Saaty [11]. The multiple criteria decision making model in the IT services outsourcing or insourcing used in this study is called the Saaty application (Saaty©). The original Saaty© programme was established by Andrej Mrvar³. The application was devised on the platform of the analytical hierarchy process. Hence the application's name. The AHP model is one segment of a well known decision-making model and the Expert Choice, the expert programme system. Regardless of the fact that the model is more than ten years old, it is still used as one of the best decision-making support systems, and its use has even highly increased lately.

The entire AHP model is based on the structured or hierarchical order of the elements of an entity or a process. Generally, hierarchy means the structural order of the parts of an entity according to their importance or characteristics; organizationally, hierarchy is a system of control established in an environment for the purpose of an effective conduct and efficient achievement of goals. As regards the achievement of goals, each business entity has to, in accordance with its specific features, choose among a variety of decision-making processes and select the most optimal one when it comes to making decisions on important strategic and even tactical issues. Decision making in the given framework of rational and efficient business in the public sector always has the same objectives, namely, to find the best solution out of the group of offered solutions, on the basis of given criteria [12].

6.1 Saaty model in multiple criteria decision making

The Saaty© application is based on the AHP model that has lately become increasingly popular. Nevertheless, this model of outsourcing and insourcing is rather difficult to find in literature, especially in the IT services area, although the AHP has numerous advantages over similar models, as it allows for the study of both rational and intuitional factors, which considerably facilitates the selection of the best solution. This assumption is, naturally, possible if we take into account certain adequate and appropriately weighted criteria, which will be dealt with further below. The entire decision-making process is based on conducting a sim-

³ The version of the Saaty© application used in this paper was designed by Dimitrij Rejja, Andrej Mrvar and Dean Lamper. The application is based on the previous programme platform, devised for the DOS operational system. A new version of the Saaty© application allows for both student and professional use [13].

ple process of making comparisons between different valuations, which is further used in ranking the solutions achieved in the course of the decision-making process. In this decision-making phase, the Saaty© application serves to make the comparison via the comparison matrix of all the pairs of criteria. On the basis of all the pairs of criteria the most optimal solutions are selected. The identical procedure is repeated among potential subcriteria, too, if during the procedure we come to a conclusion that a further decomposition of criteria into subcriteria could ensure a more objective and a more argued decision making.

Together with its instruments the AHP includes and allows for the involvement of a large number of relevant factors which guarantees an appropriate and objective, i.e., consistent approach to making final decisions. The implementation of the AHP may help set realistic goals and priorities. Here it is important to take into account both qualitative and quantitative aspects of decision making. The essence of the AHP model is "breaking" the decision into a number of smaller decisions. In the first place, we mean breaking into "one-to-one" comparisons, which consequently allows for a more realistic assessment of the given problem [14].

The simplest way, used in problem structuring, is hierarchally constructed from three segments (Figure 2):

- Goals are set to the highest level;
- Criteria are set to the medium level;
- Solutions are set on the third, lowest level.

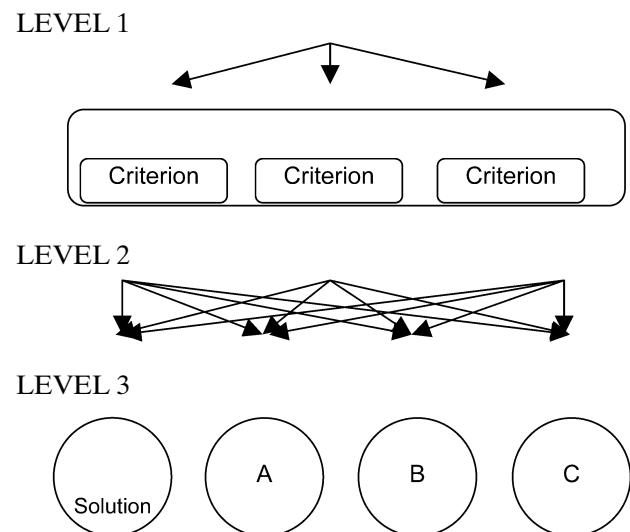


Figure 2: Decision-making hierarchy in outsourcing

Reja, 2002, p. 14

The above structure allows for the classification of elements in terms of their importance and ranks them into their appropriate levels that would meet the selected criteria and bring the organization to the set goals. In structuring the overall decision-making process we should keep only to the relevant factors that show implications as to the decision-making subject and be careful not to stray into an excessive dissection of the problem, which may disguise major aspects and result into low-quality decisions. Model design requires a good knowledge of the problems and a balanced application of data for an objective assessment of criteria. Too large a number of criteria may devalue the hierarchy relations and the relations among the criteria themselves, whereas too small a number of criteria does not allow for calculating all the important aspects of the problem and offers an unbalanced and partial solution to the problem in the decision-making process, as it does not include all the relations among the elements and their correlations. Hence accuracy, consistence, and good knowledge of the nature of the problem is of great importance in setting the criteria.

The leading experts in the study of outsourcing and its broad socio-economic implications stress a multi layer nature of this phenomenon [15], mirrored in an extremely complex and aggravated evaluation of all the effects of outsourcing, that are often well hidden due to the long time cycle of the project and emerge only after a long time period.

On the basis of the studies of the leading experts, and the complexity of the overall outsourcing area, we have chosen the following criteria for the design and practical illustration of the effects and use of the Saaty model in a multiple criteria decision making:

1. Costs
2. Competences
3. Quality
4. Customer satisfaction
5. Risk
6. Organization
7. Development
8. Innovation

For the purposes of this work a simulation of a hypothetical problem situation was made using the Saaty model, where the public sector organization selects one out of two offered solutions, or IT services outsourcing

and insourcing. The final decision must be based on the above quoted criteria, the hypothetical starting points of the project are € 500,000 for the outsourcing project and € 350,000 for the insourcing project. The absolute and relative estimate of the criteria and their decomposition into subcriteria was performed on the basis of subjective preferences and serves to better illustrate the overall procedure of the multiple criteria decision making.

We will proceed to present and more accurately analyse the entire Saaty procedure as well as its application and the selection of the most appropriate solution (alternative) in the concrete problem situation, which will be based on the above quoted data.

1. Mathematical computing using Saaty procedure (IT services outsourcing)

6.3.1 Comparison of criteria

The first step in the Saaty procedure is the comparison between the prepared and afore-selected criteria. The comparison of pairs in the analytical hierarchy model means comparing between homogenous elements. Weighting and comparison of the pairs of criteria in our example, the so-called reciprocal matrix for devising the decision-making model for IT service outsourcing is presented in Figure 3 and shows only one of numerous possibilities of weighting and assessment of the criteria within a given framework of the Saaty procedure. Naturally, each individual has his/her own point of view and goal, so they decide upon and weight criteria according to their individual preferences. The general comparison scale is shown below:

- 1 – criteria i and j are equally important
- 2 – criterion i is slightly more important than criterion j
- 3 – criterion i is substantially more important than criterion j
- 4 – criterion i is significantly more important than criterion j
- 5 – criterion i is absolutely more important than criterion j

The comparisons can be assigned with values 2,4,6,8 if we cannot make a decision on the basis of the values from the above quoted scale. The reverse value means that the criterion j is superior to criterion i, e.g. $a_{ij} = 1/7$ means that j is significantly more important than i.

In applying the multiple criteria models we often come across the situations where we deal with two very similar, however, not identical criteria. In such cases it is difficult to provide an objective rating of the characteristics of both criteria. When such a situation emerges in the process of structuring the decision-making model, the best solution is to make the comparison on the basis of the comparison between smaller segments of sub-criteria instead on the basis of larger entities [16]. It is necessary that the values of certain elements should be analysed accurately and compared between each other by segments, for which a 9-grade scale suffices. For the purpose of a more accurate analysis, therefore, segments of a certain element should be compared between each other.

In the decision making process on a complex problem we usually have to deal with a large number of criteria, which make them difficult to control and rate consistently. The AHP allows for joining the criteria into joint criteria which are further linked to other joint criteria into a tree structure. The hierarchy principle of arranging elements allows us here to control complex systems. It offers us a global insight into the major higher level factors as well as a detailed insight into the structure and functions on the lower levels. The hierarchy also helps reduce the number of comparisons of the criteria we have to enter into the decision-making procedure. It is for this reason that matrices are more reconciled [17]. The AHP within the Saaty procedure allows for a transition from lower ranked (on lower levels) to joint (on higher levels) value criteria.

Criteria	Costs	Competencies	Quality	Customer satisfaction	Risk	Organization	Development	Innovation
Costs	1	2:1	1:3	2:1	3:1	3:1	1	1:2
Competencies	1:2	1	1:2	1	3:1	3:1	2:1	3:1
Quality	3:1	2:1	1	1:3	3:1	3:1	2:1	2:1
Customer satisfaction	1:2	1	3:1	1	2:1	3:1	2:1	2:1
Risk	1:3	1:3	1:3	1:2	1	1:2	1:3	1:3
Organization	1:3	1:3	1:3	1:3	2:1	1	1:2	1:2
Development	1	1:2	1:2	1:2	3:1	2:1	1	2:1
Innovation	2:1	1:3	1:2	1:2	3:1	2:1	1:2	1

Figure 3: Positive reciprocal matrix

6.3.2 Relative and absolute comparison of criteria

In Saaty procedure, criteria can be compared in a number of ways (Figure 4).

Type of criteria	
	Relative ratio
X	Absolute values – less is better
	Absolute values – more is better

Figure 4: Possible methods of comparison between criteria

The relative method serves to compare pairs of values and, on the basis of the comparison, to rate the differences among them [18]. The analytical hierarchy process uses both relative and absolute comparisons.

Relative comparison (Figure 5): In this measurement we compare all the criteria by pairs. In the example of the n criterion, this means $n(n-1)/2$ comparisons. In Saaty model, the relative comparison of criteria uses a 9 – grade scale, as shown in Figure 5.

Ratio between criteria													
Costs							Competencies						
2:1													
							X						
9:1													
1:9													

Figure 5: Relative comparison of “costs“ and “competencies“ criteria

As shown in Figure 6, the Saaty model allows for a relative comparison of individual criteria among each other, too, taking into account the possible solutions (alternatives).

Criteria	Competencies	Outsourcing	Insourcing
	Outsourcing	1	2:1
	Insourcing	1:2	1

Figure 6: Reciprocal matrix for relative comparison of “competencies“ criterion and the highest individual value in two potential solutions (alternatives)

The absolute comparison (Figure 7): absolute comparison refers to a certain rating of the criteria. The rating may be absolutely arbitrary, e.g., 1-excellent, 3-medium, 5-poor. In this phase, it is necessary to define which grade is better (lower or higher). The subcriteria grades therefore affect the value of the joint criterion. In our concrete example, the financial rating of a certain solution (alternative), i.e., the cost of an IT service out-

sourcing project was set, which, according to our approximation amounts to € 500,000, while the cost of an IT service insourcing project, was estimated to be cca. €350,000. The Saaty procedure requires that an absolute criterion should be additionally defined and that the decision on which grade is better should be entered; in the case described it is obviously the grade “less is better“ (Figure 7).

Criteria	Costs	Less is better
	Outsourcing	500,000
	Insourcing	350,000

Figure 7: Absolute comparison between criteria

6.3.3 Preferential relations and utility functions

The selection, the rating and the weighting of criteria is followed in the Saaty procedure by a calculation of the utility function. In the multiple criteria decision making we deal with two highly important notions [19]:

- Preferential relation S (preferable to ...): xSy

- Utility function $\omega(x)$ which measures the preference level for the solution x

which in the concrete case means that we know which solution we prefer (we know the preferential relation), but we cannot assign or determine any definite value to the solution (we do not know the utility functions).

The square matrix $A = a_{ij}$ ($i = \dots m; j = 1 \dots m$)⁴ represents all the pair comparisons of the m criterion.

6.3.4 Comparison matrix A and utility ω

This matrix gives us the utility vector ω with the solution of the problem of single values of the matrix A. The calculation of the individual value of the matrix [20]:

$$A\omega = \lambda\omega$$

where λ is the highest single value of the matrix A, ω is the adherent single vector⁵. The single value that belongs to the obtained single vector is calculated using the formula:

$$\lambda = \frac{1}{m} \sum_{i=1}^m \frac{(A\omega)_i}{\omega_i}$$

The A matrix is characterised by the following features (Figure 3):

- values one are distributed along the diagonal,
- symmetrical values are inverse.

Such a matrix is called a positive reciprocal matrix. Using a positive reciprocal matrix, a single vector that belongs to a single value can be calculated in a number of ways:

- An accurate method – raising method – matrix is raised to a certain big enough power and then we sum the power and normalize it by rows, so that the sum is 1.
- Approximate method⁶ - matrix is normalized, so that the sum by columns is 1, and then we calculate the average value of an element in a row. Thus we obtain the vector $\omega, i = 1..m$.

The ratings in the matrix are interconnected, hence at least an approximate transitivity is present:

$$a_{ik} * a_{kj} = a_{ij}$$

The extent to which the comparisons of criteria are mutually reconciled can be calculated for each reciprocal positive matrix. Here, in the example of total reconciliation, the highest single value is equal to the A matrix dimension $\lambda = m \Leftrightarrow$ absolute reconciliation. The highest single value is actually higher than m ($\lambda > m$). On the basis of this deviation the consistency index I is worked out:

$$I = \frac{\lambda - m}{m - 1} \quad \lambda = m \Leftrightarrow I = 0$$

Using this index, the AHP computes the consistency ratio CR:

$$CR = \frac{I}{I_R}$$

Where I_R is a random index obtained from randomly generated positive reciprocal matrices. If $\frac{I}{I_R} < 0,1$, then the matrix is consistent enough, if not, then the matrix should be adjusted because it is otherwise useless. The results will be incorrect due to inconsistent comparison. In our example $CR < 0,1$ which means that the matrix is consistent enough.

Throughout the calculation process in the Saaty application the most important coefficients are visible; so it is in our concrete example of decision making on the IT services outsourcing or insourcing in the public sector. On the left we observe: the name of the model, the size of the model (8x8 matrix), the highest single value of lambda (λ), CI, CR, MaxD (maximum deviation from consistency) and the position of the largest deviation in the matrix. In the example that $CR < 0,1$, the entire text in the status row is written in the Bold or Italic form, which means that the matrix is not consistent enough, i.e., that the whole procedure should be repeated.

This index has still to be compared to the index we obtain from randomly generated positive reciprocal matrices of equal dimensions on the 1 – 9 scale. The random index I_R (random index – Table 1).

m	2	3	4	5	6	7	8	9
I_R	0.50	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Table 1: Random index

⁴ Such a matrix is called a positive reciprocal matrix – symmetrical values on either side of the main diagonal are reciprocal numbers.

⁵ The explanation of the vectors and functions can be found in the following paragraphs in chapter 6.3.5.

⁶ Saaty© application allows for the use of either approximate or accurate method

The above presented phases of the AHP or the Saaty multiple criteria decision making procedure follow each other sequentially, which the application performs by itself. The user then has only to define and select the criteria and determine their relative and absolute values in the comparisons. In addition, in weighting the criteria it is necessary that the consistency ratio should be controlled, and this must be $CR < 0.1$. Otherwise the matrix is, as we have already stated, inapplicable due to the inconsistency of ratios.

6.3.5 Formal sequence of the Saaty procedure in the IT services outsourcing example

1. R_j – criterion ($j = 1..m$)

X_i – solution ($i = 1..n$)

ω_j – criterion j advantages ($j = 1..m$)

q_{ij} – advantage of solution i per criterion j

P_j – joint advantage of solution i per all criteria

2. The result of the Saaty procedure are the matrix Q and the vector .

Matrix Q

ω	ω_1	ω_2	ω_3	...	ω_j	...	ω_m
Q	R_1	R_2	R_3	...	R_j	...	R_m
X_1	P_1	
X_2							P_2
...							
X_i					q_{ij}		P_i
...							
X_n							P_n

3. We achieve the vector as a single vector of the matrix of pair comparisons of all m criteria.

4. For each criterion R_j ($j = 1..m$) we compare by pairs all the solutions between each other. $R: X/X$ q_{ij} , vector q_j presents the advantages of all the solutions in relation to the criterion R_j , and we put it as a column by the criterion R_j into the matrix Q .

5. We calculate the joint advantages as related to all the criteria. The advantage of the solution i is:

$$P_i = \sum_{j=1}^m \omega_j q_{ij}$$

We choose the solution i because it has the highest value P_i .

P_i for the solution Insourcing reached the value 0.5131. The value reached by the solution Outsourcing, in our example, is slightly lower and amounts to 0.4869.

As regards our choice of criteria, their weighting and their both absolute and relative comparisons, the solution Insourcing was rated higher, which is clearly shown in our above calculations.

As we can see, we have chosen 8 criteria in our example, those that are deemed to be most relevant by the majority of literature dealing with this problem. A large number of criteria supports the multilayer nature and the complexity of outsourcing and its implications upon numerous spheres of organizational operations. Due to all the listed reasons, a serious scientific study of this problem requires a broader and deeper insight into the background and contents of the overall phenomenon of outsourcing.

7. Conclusion

Regardless of various attempts to reform, reengineer or reconceptualize it, the public sector has in the last thirty or so years remained in an unfavourable position. The dilemma of the public sector between the wishes and needs of the citizens, on one hand, and planned restrictions and savings on the other, is best illustrated by the legend on Buridan’s ass which, as we know, ends sadly.

It is necessary that steps should be taken towards understanding and study of strategic factors of operations in organizations that are, due to the nature of the public sector, engaged mainly in service provision, where the importance of choice between outsourcing and insourcing is even greater. A thorough analysis of the above mentioned issues may significantly help experts in their future research of this problem, either as a whole or as only one segment. Large investments into IT and the modernization of business processes are often ineffective if organizations neglect a planned and systematic design of the respective business strategies which due to their importance rank among the most important factors of an efficient and successful public sector.

The selection of a suitable business strategy (outsourcing or insourcing) is a factor that may act as a catalyser in creating a more efficient and a more rational public sector. It is clear from the study of the public sector and its specific features that a deeper insight is needed into the existing concepts of its work as well as an identification of both the elements, i.e., the business processes

and services that need to be sustained and developed further, and the elements that should be changed or re-designed. Such activities could significantly contribute to setting the foundations for a potential study of deeper and hidden levels of the IT services outsourcing or insourcing strategies in the entire public sector, which can be a long-term process, spanning over several years. The results of such research that highlight different aspects of outsourcing or insourcing implementation are of great importance for the organizational strategy planning itself, which is especially important for the proper work of the public sector. The business performance of the organization is actually a proof of the consistency of systems and strategies within the organization itself, as well as their reconciliation with a broad systemic organizational environment.

Finally, it is important to note that this paper is only one illustrated example of the possible implementation of a scientific model in planning and designing the organizational business strategy which only proves that in an attempt to manage and do business efficiently in the public sector, it is necessary that, in the phase of the selection of a long-term business strategy, some content and process criteria should be satisfied. The decisions of the public sector organizations on IT services outsourcing have to be based on multiple criteria and must not be founded on short-term cost efficiency exclusively. In addition, the public sector organizations must develop an awareness of long-term strategic implications of their decisions in favour of outsourcing and thus avoid possible negative impacts. And finally, it is necessary that we think about insourcing in certain areas of the public sector activities that can, in adequate circumstances and aided by a quality project management, achieve much better results in the long run, in comparison with outsourcing.

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