PUBLIC ADMINISTRATION PROJECT SELECTION USING CASE-BASED REASONING

Meaza Haile, Jiri Krupka

Abstract: *European Union (EU) member countries design and implement different projects under programs designed by the union to improve standards of member countries. One of these programs is regional policy program. Thousands of projects have been funded under this program. Some of these projects are developed in collaboration between countries and some by a single country. The issues addressed by different projects are sometimes similar, for instance, improving quality of life for the elderly people. Q-Ageing and design led-innovation for active aging are two projects that focus on this issue. Even though these projects were designed independently and used different methods the main goal of both projects is to improve the quality of life for the elderly people. In this paper, case-based reasoning method is proposed for EU member countries to selects projects that has already been designed to address similar issues. Text parser and Chouquet fuzzy integral are used in the method for comparing cases in order to choose best matching cases. Application example was also performed to demonstrate.*

Keywords: *Acquis Communautaire, Case-Based Reasoning, Choquet Fuzzy Integral, Multiple Criteria Decision Making, Regional policy, Strategic Planning*

JEL Classification: *D70, D83, H83.*

Introduction

The lack of general European Commission legislation applicable in the domains of public administration and administrative law poses a problem for European Union candidate countries. Candidate countries are required to have administrative systems and public administration institutions capable of transposing, implementing and enforcing the acquis communautaire, EU legislation, according to the principle of 'obligatory results' (obligation de résultat). Candidate countries have to meet the criteria required for EU Membership as adopted by the European Council in Copenhagen, Madrid and Luxembourg. In addition, candidate countries' progress will be measured against those criteria, i.e. in the wording of the European Commission's Regular Reports, in terms of their 'administrative and judicial capacity to apply the acquis', which signifies implicitly that their progress will be assessed against European administrative standards (Sigma, 2014). Therefore, it is essential for the EU member states to use strategic planning to achieve the expected progress.

Strategic planning… is based on the premise that leaders and managers of public and non-profit organizations must be effective strategists if their organizations are to fulfil their missions, meet their mandates, and satisfy constituents in the years ahead (Bryson, 1995).

The framework, used by many authors in developing strategic plan is data collection, surveys, researches and thematic analyses – SWOT (strength, weakness, opportunity and threat) analysis (analytical part); vision – goals, aims, (strategic part);

actions and activities (action part) and a part of implementation, management, measurement and evaluation (Šilhánková, 2007). As long as measurement and evaluation is involved a strategic planning process is on-going where organizations evaluate their improvement, identify their weakness propose a solution to overcome their weakness implement it and back to evaluating improvement.

1 Statement of a problem

Even though EU member cities have their differences in many ways, most cities suffer from the same problem at one point or another. 'Our cities possess unique cultural and architectural qualities, strong forces of social inclusion and exceptional possibilities for economic development. They are centres of knowledge and sources of growth and innovation. At the same time, however, they suffer from demographic problems, social inequality, social exclusion of specific population groups, a lack of affordable and suitable housing, and environmental problems' (Bundesministerium, 2007). For instance based on studies conducted independently for the city of Vienna and Prague although presented in different categories and different words both countries face the following weaknesses:

- Poor coordination between public and private sector
- Low interaction between companies, authorities and education
- Relatively low outcome in research and development

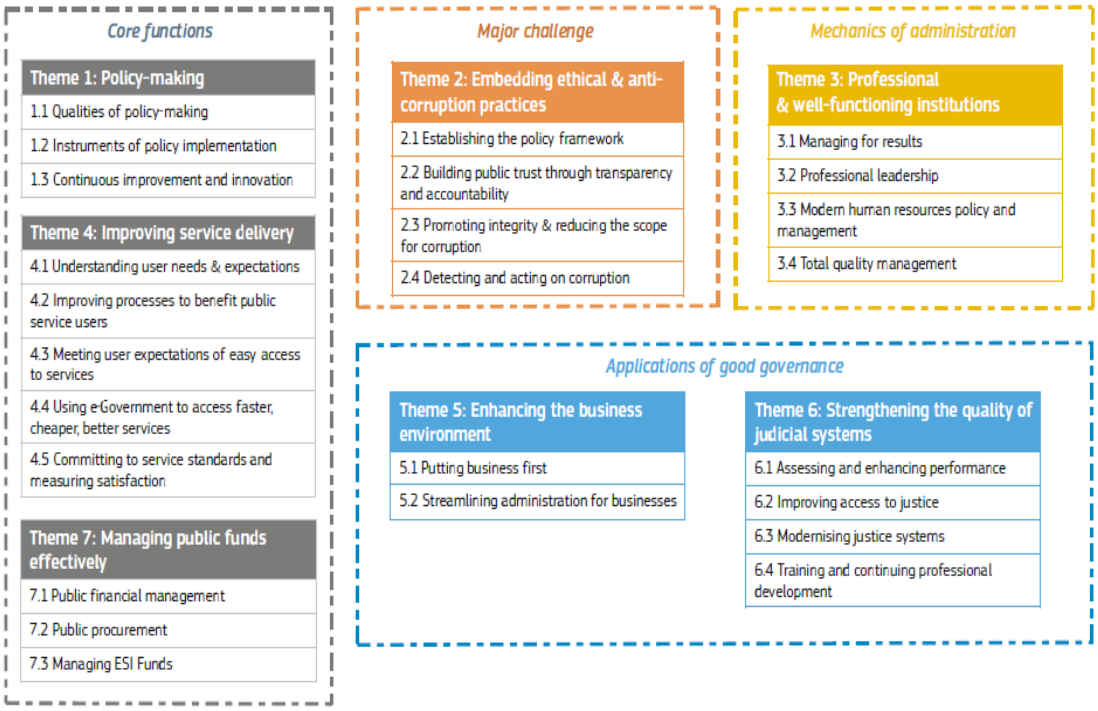
Over the years may frameworks and tools have been developed where EU member countries exchange experience and refer guidelines in order to improve their strategic plan and to create similar situation through the member countries. Among those are RFSC and Quality of Public Administration: A Toolbox for Practitioners.

RFSC is a web tool designed to help cities and urban territories promote and improve their integrated urban development actions (RFSC, 2012, 2016b). Where 'respect' means the RFSC values the diversity of European cities, respecting differences in local priorities and institutions. There is no one-size-fits-all solution for integrated urban development, no universal recipe for success. It is the shared vision that matters, the time frames, targets and themes should be decided locally. RFSC enables cities to move at their own pace and choose the scope of their involvement. It offers a set of tools for evaluating and monitoring public policies, and an online space for cities to share their experiences. The RFSC rethinks the basis for sustainable development of cities by proposing a grid of 25 common questions formulated based on the following four dimensions: enhance the economic efficiency of territories, foster social cohesion in conurbations, improve the environmental quality of cities, and develop integrated governance practices. It means that RFSC analyses four areas simultaneously: economy, social, environment and governance. The RFSC is a vibrant community of cities that learn from each other, share experience and discuss common challenges. By joining the RFSC community, cities get access to different forms of exchange and support, including dedicated training sessions, peer learning and coaching from urban governance experts. Finally, for 'cooperation', not competition, which is at the heart of the RFSC. Developed for cities and with cities, RFSC is a meeting place that aims to bring together various actors within one city, hundreds of cities and local authorities from across Europe and finally all those at the national and European level who believe that sustainable cities are the future (RFSC, 2016a,

2016b). The RFSC is used in countries such as Czech Republic, France, Italy, Netherlands, Poland, Portugal, Spain and Sweden (RFSC, 2016b).

Quality of Public Administration: A Toolbox for Practitioners was conceived as a helpful and practical guide for civil and judicial administrations to the challenges of good governance in a constantly changing environment. It examines the key elements of good governance and highlights positive real-world responses in Member States to dilemmas in administration, signposting the way that others may also wish to follow. The Toolbox concentrates solely on the administration of public policy and services, including both civil and judicial systems. It is about governance as a process. It does not cover the specifics of individual policies or services - for example regarding education, taxation, health, customs, competition, training, etc. (EU Commission, 2015). The figure below (Fig. 1) shows the toolbox.

Fig. 1: Toolbox overview by theme and topic



Source: (EU Commision, 2015)

Many projects are also funded by the EU, under different programs, to improve public administration policies and other governance issues. One of these programs is regional policy. This program has funded different projects on the issues like sustainable development, technology, and quality of life for the elderly people. In this paper two projects under the regional program, focused on the issue of improving quality of life for the elderly people are discussed briefly. Most of these projects are designed in a way to be implementable by all EU member countries.

What is proposed in this paper is a reasoning system that could be used by EU member countries to solve specific city problems or make decision based on the experiences of others. By solving problems in the same or similar way, quality of public administration of cities could get closer to achieving unanimity. What makes the proposed method different from the RFSC discussed in the above section is the way data is stored and retrieved. City council or experts provide the system with desired criteria and the system returns top solutions based on those criteria. The

system focuses on cities since cities play a key role in the social and economic development of all European territories and provides home for the majority of population (EU Commission, 2011). A hypothetical case study was also performed to clarify the application of the method for project selection in solving a specific issue.

2 Case based reasoning

The idea behind CBR terminology is to solve a problem by using previous experience. A problem that has already been solved is referred to solve a new problem at hand. Otherwise, a solution with more similar criteria will be modified to suit current problem and the new solution will be stored in the case library for future reference. In CBR terminology, a case usually denotes a problem situation previously experienced which has been captured and learned in a way that could be reused in the solving of future problems. In general, a case is composed of problem description, problem solution, and outcome (Amodt, Plaza, 1994; Kolonder, 1993). The problem description essentially contains as much data about the problem and its context as necessary for an efficient and accurate case retrieval. Problem solution or outcome states the derived solution to that problem. CBR has the two main processes: storing and organizing cases in the case library and retrieving the solution that best suits current problem (Kolonder, 1992).

In order to solve problems using previously solved cases, there has to be an initial case memory with successful cases stored in an indexed and organized way. CBR scholars have proposed several guidelines on indexing; Indexes should be: predictive of the case relevance, recognizable in the sense that it should be understandable why they are used, abstract enough to allow for widening the future use of the case base and discrete enough to facilitate efficient and accurate retrieval. Methodologies for choosing indexing could be manual and automated methods. when cases are complex and the knowledge needed to understand cases well enough to choose indexes accurately is not concretely available, hand indexing is needed otherwise automated indexing could be used. Another important factor is case organization; the case base should be organized into a manageable structure that supports efficient and accurate search and retrieval methods. Accurate retrieval guarantees the retrieval of best matching case, and efficient retrieval guarantees fast retrieval of cases for acceptable system response times (Kolonder, 1992).

The retrieve solution task starts with a (partial) problem description, and ends when best matching previous case has been found. The subtasks of retrieve process are referred as identify features, initially match, search, and select, executed in that order. The identification task comes up with a set of relevant problem descriptors. The goal of the matching task is to return a set of cases that are sufficiently similar to the new case given a similarity threshold of some kind. The selection task works on these set of cases and chooses the best match (or at least a first case to try out) (Amodt, Plaza, 1994). In this step, a new case is entered into the system by the user; the system recalls cases that have relatively high similarity values, i.e., previous cases with similar indexes are retrieved. This process is called interpretation. When problem situations are interpreted, they are compared and contrasted to old problem situations. Different methods can be used to search cases (Kolonder, 1992). CBR has been applied by researchers since the 90's for different fields recent applications include business

failure prediction (Hui, Jie, 2011), eco-innovation product design (Cheng, Jahau, 2014), medical domains (Cindy et al, 2014; Isabelle et al, 2010).

In this paper instead of the traditional retrieving methods, such as inductive retrieval, Choquet Fuzzy Integral was applied, that is to use specific characteristics to compare cases and to find the best solution that satisfy the cities' requirement. Once a similar case is retrieved the next step is to adopt the solution to meet the demands of the new case and to store the new solution to the case base for future reference.

3 Discussion

As mentioned in the introduction strategic planning is on-going process and needs a constant monitoring and fix to improve success. What is proposed here is CBR system that records all the problems or weaknesses faced by EU member cities and their solutions so these solutions could be adopted by other cities in the future. This will create relation among cities in sharing experience, avoids redundancy and saves costs.

3.1 Theoretical application of the proposed method

While solving any problem cities consider solutions that are implementable on their capacity and structure. Capacity includes fund, human resource, time limit, the city the problem was solved in, and so on, which are considered as case attributes. Therefore, in case representation each case contains these attributes, problem statement, and solution. The advantages of the proposed method over existing tools include:

- Providing a way to adapt solution for a specific problem instead of strategic plan, based on the criteria set by city council or experts;
- The method is also cost and time effective by avoiding the process of proposing alternate solutions;
- Solving these specific problems improve the overall success of a strategic plan;
- The system provides cities with options and freedom to choose a detailed solution for a specific problem based on their capacity without going through strategic plans of other cities.

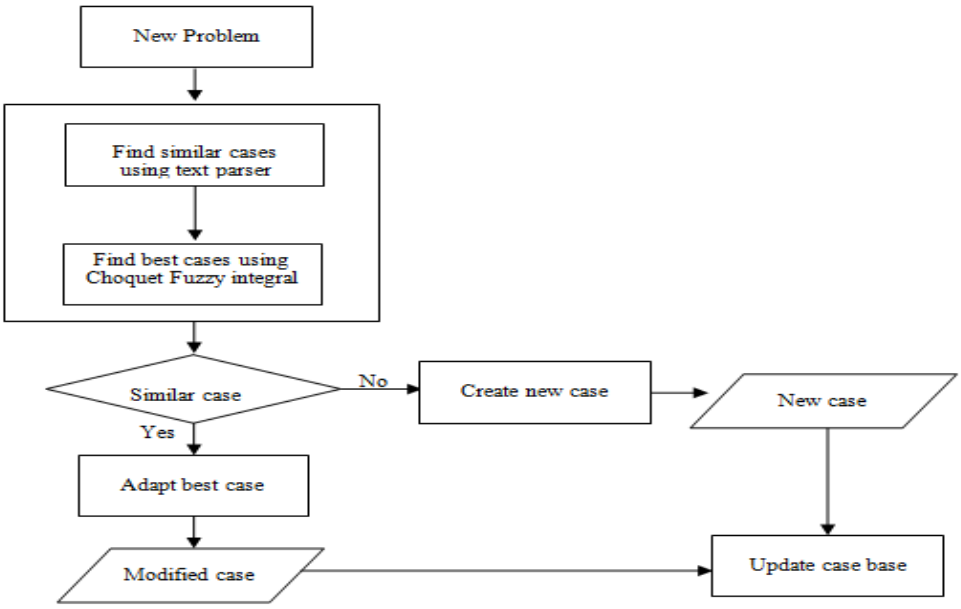
Generally, the method provides a bottom up approach where cities can solve their weakness and improve the success of their strategic plan.

In this paper, a two-step retrieval method is proposed. The first step is to use text parser to find cases with similar problem statement. Once these cases with similar problem statement are found Choquet fuzzy integral method will be used to choose the best-suited case for the current problem based on the comparison of case attributes.

In the first step of the case retrieval process, the problem statement of the new case will be compared with cases and the cases that match the new case will be chosen. This will limit the number of candidate cases. To further reduce candidate cases Choquet fuzzy integral method will be used to find the best matching solution based on criteria set by city council. For instance, cities with smaller population would prefer solutions generated in cities with similar population size, similar culture, and growth rate based on the type of problem the city is facing. Furthermore, the solution has to be implementable with resources affordable by the city. These criteria could be

implemented using multiple criteria decision-making methods such as analytic hierarchy process. For this paper, Choquet fuzzy integral method is chosen to avoid dependency issues among characteristics (Choquet, 1953). The following figure (Fig. 2) shows the two step case retrieval process.

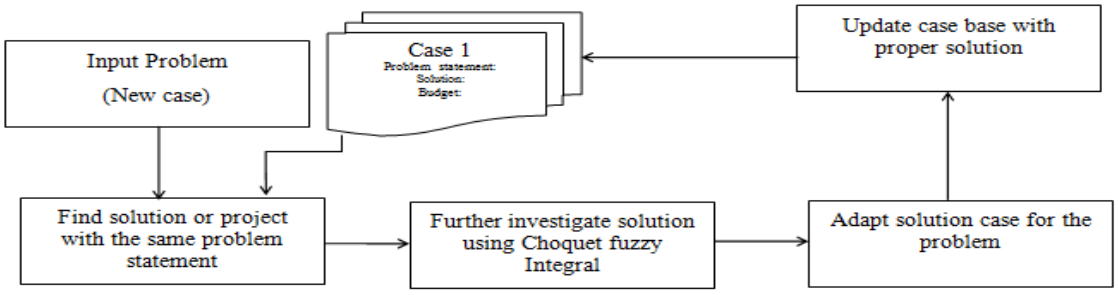
Fig. 2: Case retrieval process



Source: (Haile, Krupka, 2016)

If a case that satisfies the given criteria is found then the solution will be adapted and implemented by the city. The adaption process highly depends on knowledge and experience of experts. After the adaption and implementation process the new solution will be stored in the case library for future reference. If there is no such case that satisfies the given criteria a solution for the new case will be created, implemented by the city and stored in the case library (Haile, Krupka, 2016). The following figure (Fig. 3) shows the process flow while accessing a solution from a case base using the proposed method.

Fig. 3: Process flow for the proposed model CBR



Source: (Haile, Krupka, 2016)

For instance in section 1, the common weaknesses of the cities of Prague and Vienna was discussed. If one of these cities were to solve those problems, using the proposed method, the city specifies the problem, and the characteristics the expected solution has to fulfill. Since it is unlikely to find a case that fulfill all required characteristics the characteristics has to be assigned priorities. Then the case library will be searched for proper solution, if a solution is found it will be adopted, implemented, and the new solution will be properly indexed and uploaded to the case

library. If the problem has not been solved by another city in the past, a solution will be created, implemented, and uploaded to the case library. (EU Commission, 2014).

3.2 Application demonstration

There have been different projects on improving the standard of living for the elderly people, in the EU. Some of those projects are implemented in collaboration between cities for example Q-Ageing and design led-innovation for active aging.

European Regional Development-funded Q-Ageing united partners from Germany, Hungary, Italy, Poland and Slovenia. Together they demonstrated the significant contribution older people can make to society through a final set of pilot projects tested in each country.

A key feature of Q-Ageing is its toolbox, which is a culmination of the work carried out under the project. It paves the way for the development of senior-friendly public spaces and improvement of mobility through senior recreation parks, open air space, as well as urban transportation facilities. The toolbox is intended for use by all EU-Member States. A Transnational Ageing Resource Centre was also established under Q-Ageing and serves as an online community space for the elderly. 30 temporary jobs were created as a result of the project (EU Commission, 2014).

Main attributes of the project include problem statement, budget, duration, and solution, the following table (Tab. 1) shows these attributes and their values.

Tab. 1: Attributes of Q-Ageing

Attributes	**Values**
Problem statement	Making aging better for elderly people
Budget	2 218 871 Euro
EU investment	1 768 345 Euro
Duration	12/2008-03/2012

Source: (EU Commission, 2014)

The findings under Q-Ageing support the idea that demographic ageing could be better tackled by ensuring elderly people stay longer in the labor market and remain healthy, active, and autonomous well into retirement. Q-Ageing partners have demonstrated the significance of actual and potential contribution that older people can make to the society through a final set of 18 pilot projects tested in various central European countries and regions. These include the online ‘SkypeCare’ for the elderly in Hungary and a day care center in Slovenia (EU Commission, 2014).

Design led-innovation for active aging is a project conducted by eight cities, RÉG. Bruxelles-Cap./Brussels Hfdst, GEW, Belgium, Antwerpen , Belgium, Yugozapaden, Bulgaria, Helsinki-Uusimaa, Finland, Etelä-Suomi, Finland, Berlin, Germany, Norge, Norway, Mazowieckie, Poland, Cataluña, Spain and Stockholm, Sweden. Each of these eight cities focused on a specific aspect of elderly care services, called ‘scenarios’. The project aimed at an integrated approach, including stakeholders and users (EU Commission, 2016). The aim of the project was:

- Rethink and redefine senior care by using innovative processes and design methods

- Find feasible and sustainable solutions that keep senior citizens physically and socially active and that provide them with the care they need
- Improve the effectiveness of local policies by learning from best practices elsewhere and assessing their transferability
- Use design to build the innovation capacity of cities, to enhance their service development, and to improve their policy making
- Adopt a 360-degree approach by searching for systemic solutions in different areas and by involving all kinds of stakeholders
- Make it easier for public authorities to find strategic and service design competencies to support their policy making
- Increase awareness of the complex issues that arise from demographic ageing and the many challenges that senior care poses
- Jointly develop action plans, design briefs, best practice descriptions, field visits, thematic workshops, and guidelines for policy makers and public organizations (EU commission, 2016).

The following table (Tab. 2) shows the main attributes of Design led-innovation for active aging project

Tab. 2: Attributes of Design led-innovation for active aging

Attributes	**Values**
Problem statement	Making aging better for elderly people
Budget	2 022 700 Euro
EU investment	1 366 133 Euro
Duration	01/2012-06/2014

Source: (EU Commission, 2016).

For demonstration purpose, a hypothetical case where one of the weaknesses of a city is low quality of life for elderly people is considered. The city desires to implement a project for improving life standard for elderly people. For the sake of simple demonstration the two projects, discussed above are the only cases in the case library that were performed on improving life standard for elderly people. Also, let the three attributes: budget, duration and EU investment be the only important variables. EU investment is assumed as an important variable believing the EU will grant the same amount of money for the same project implementation. The two cases discussed here are only used to show the possibility of implementing the proposed method and the information used here is general.

The first step is to find a project whose objective is similar with the hypothetical problem, using text parser and key words like elderly people and aging. Once the two cases are found, the next step is to compare them based on the attributes of the hypothetical case. The city needs a project with lower budget. EU investment is very important for the city since the city needs to spend as minimum amount of budget as possible. Time duration is not a big issue for the city. The following table (Tab. 3) shows cases, their attributes, and the weight of the attributes.

Tab. 3: Case attributes and their values

Attributes	Case 1	Case 2	Weight
Budget	2 218 871 Euro	2 022 700 Euro	0.5
EU investment	1 768 345 Euro	1 366 133 Euro	0.7
Duration	12/2008-03/2012	01/2012-06/2014	0.2

Source: (EU Commission, 2014, 2016)

First, the measurement of the attributes will be changed to similar unit. In this case sequencing method was used. Since there are only two cases and two sequences the interval from 1 to 2 is used. The table below (Tab. 4) shows the value of case attributes on the scale of 1 to 2.

Tab. 4: Case values on the scale of 1 to 2

Attributes	Case 1	Case 2	Weight
Budget	1	2	0.5
EU investment	2	1	0.7
Duration	2	1	0.2

Source: Authors

Definition: Let $\lambda \epsilon (-1, \infty)$ and let $X = \{x_1, x_2, \ldots, x_n\}$ be a finite set. If (X, P(X)) is a measurable space and if set function g_λ: P(X)→[0,1] satisfies the following conditions, then g_λ is denoted by a Sugeno λ measure and $g_\lambda(\varnothing)=0$, $g_\lambda(X)=1$; $A \cap B=\varnothing$, $A \cup B \neq X$ $g_\lambda(A \cap B)=g_\lambda(A)+g_\lambda(B)+\lambda g_\lambda(A) g_\lambda(B)$ that

$$\lambda+1=\prod_{i=1}^{n}\left(1+\lambda g_\lambda\left(x_i\right)\right), \lambda>-1 \quad (1)$$

where $g_\lambda(x_i)$ is fuzzy measure.

Definition: Let set function g: P(X)→[0,1] be a fuzzy measure on measurable space (X, P(X)), and h: X→[0,1] be a measurable function on X. If $h(x_1) \leq h(x_2) \leq \ldots \leq h(x_n)$, $A_i=\{x_i, x_{i+1}, \ldots, x_n\}$ then (Choquet, 1953; Grabisch, 2000; Sugeno, 1974).

$$E^{def}=\int h dg^{def}=h(x_1) g(A_1)+\sum_{i=2}^{n}\left(h(x_i)-h(x_{i-1})\right) g(A_i) \quad (2)$$

Where E^{def} denotes the overall function $h(x_i)$ is viewed as the performance of sub characteristic x_i of the organization at a specific time $g(A_i)$, express the grade of importance for the subset A_i. The fuzzy integral of $h(x_i)$ with respect to g denotes the overall evaluation.

The first step is to Calculate lambda based on the equation (Eq. 1).

$$\lambda+1=\prod_{i=1}^{3}\left(1+\lambda g_\lambda\left(x_i\right)\right)=(1+0.5\lambda)*(1+0.7\lambda)*(1+0.2\lambda), \lambda>-1$$

After calculating the roots of the polynomial resulted from the above equation, the following results were obtained: λ=0, λ=-0.744 and λ=-7.69. λ =-0.744 was chosen since it is the value that satisfies fuzzy measure criteria. Then the combined aggregate for the attributes was computed: $g_\lambda(12)=g_\lambda(1)+g_\lambda(2)+\lambda g_\lambda(1) g_\lambda(2)$, where, $g_\lambda(1)$ is the weight for the first attribute (budget), $g_\lambda(2)$ is weight for EU investment and $g_\lambda(3)$ is

weight for duration of project. By substituting the values $g_\lambda(12)=$ 0.9396, $g_\lambda(13)=$ 0.6256, $g_\lambda(23)=$ 0.79584 and $g_\lambda(123)=1$ was calculated

The next step is to calculate the aggregate evaluation of each case to determine the better choice, based on Equation (Eq. 2)

Tab. 5: Fuzzy aggregate evaluation of attributes

Case 1 E^{def}	**Case 2 E^{def}**
1.78	1.5

Source: Authors

Based on the result from the above table (Tab. 5) case 1 is the better choice for the hypothetical city but since the results of both cases is close the best solution will be for the city to consider both cases and design a new solution based on the two cases. The budget for the project will be significantly less since by using this method some steps of project development cycles will be avoided.

Conclusion

Over the years, different frameworks and tools have been available by EU to assists member countries to have administrative systems and public administration institutions capable of transposing, implementing, and enforcing the acquis according to the principle of 'obligatory results'. The method discussed in this paper is application of CBR for solving cities' problems based on others experience. Project developed by a city as any project follows the steps of project conception, design, implementation, evaluation, and, once the project tasks are completed and evaluated, closing of the project. When the proposed system is used the tasks and costs of project conception and design will significantly decrease.

The advantage of the proposed method over existing tools include: the proposed method provides a way to adapt solution for a specific problem instead of a strategic plan. Solving these specific problems improve the overall success of strategic plan. The method also provides cities with options and freedom to choose a detailed solution for a specific problem based on their capacity without going through strategies of other cities. This is a bottom up approach where cities solve weakness and improve the success of strategic plan. Practical implementation of the system will be presented in the future.

Acknowledgement

This article was supported by the projects No. SGS_2016_023 'Economic and social development in private and public sector' and No. SGS_2017_019 'Models Synthesis and Analysis for Implementation Support of Smart Cities and Regions Concept' of the Ministry of Education, Youth and Sports of CR at the Faculty of Economics and Administration, University of Pardubice.

References

Amodt, A. A., Plaza, E. (1994). Case-Based Reasoning: Foundational Issues, Methodological Variations, and System Approaches, *AI Communications,* 7, IOS Press.

Bryson, J. M. (1995). *Strategic Planning for Public and Non-profit Organizations: A Guide to Strengthening and Sustaining Organizational Achievement,* (Rev. ed.), San Francisco, CA: Jossey-Bass Publishers.

Bundesministerium, (2007). Leipzig Charter on Sustainable European Cities, Available at: http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Nationale_Stadtentwicklung/leipzig_charta_en_bf.pdf [Accessed June 2016].

Cheng, J. Y., Jahau, L. CH. (2014). Accelerating Preliminary eco-Innovation Design for Products that Integrates Case-Based Reasoning and TRIZ Method, *Journal of cleaner production*, pp. 998-1006.

Choquet, G. (1953). *Theory of Capacities*, Annales de l'Institut Fourier, 5, pp. 131–295.

Cindy, M., Stefania, M., Isabelle, B. et al. (2014). Synergistic Case-Based Reasoning in Medical Domains*, Expert systems with applications*, pp. 249-259.

EU Commission, (2011). Cities of Tomorrow Challenges, Visions, Ways Forward, Available at: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/citiesoftomorrow_final.pdf. European Union regional policy.

EU Commission, (2014). Q-Ageing, Available at: http://ec.europa.eu/regional_policy/en/projects/poland/q-ageing-creating-better-lives-for-the-over-60s [Accessed on November, 2016].

EU Commission, (2015). Quality of Public Administration - A Toolbox for Practitioners. Available at: http://teismai.lt/data/public/uploads/2016/03/eu_publicadmin_toolbox_full_en.pdf, [Accessed on November, 2016].

EU Commission, (2016). Making Ageing Better: service design can innovate senior care, Available at http://ec.europa.eu/regional_policy/en/projects/belgium/making-ageing-better-service-design-can-innovate-senior-care [Accessed on November, 2016].

Grabisch, M., Murofushi, T., Sugeno, M. (2000). *Fuzzy Measures and Integrals, Theory and Applications (edited volume)*, Studies in Fuzziness, Physica Verlag.

Haile M, Krupka, J. (2016). Application of CBR in Public Administration, *Proceeding of Public Administration 2016*, pp. 74-81.

Hui, L., Jie, S. (2011). Principal Component Case Based Reasoning Ensemble for Business Failure Prediction, *Information & Management*, pp. 220-227.

Isabelle, B., Stefania, M. (Eds.). (2010). *Case-Based Reasoning Research and Development, 18th international conference on case-based reasoning*, ICCBR 2010 Alessandria Italy, July 19-22, proceedings, Springer.

Kolonder, J. (1992). An Introduction to Case-Based Reasoning, *Artificial Intelligence Review*, 6, pp. 3-34.

Kolonder, J. (1993). *Case-Based Reasoning*, Morgan Kaufman.

RFSC, (2012). Develop your strategy/project. Reference framework for European sustainable cities. [online]. Available at: http://app.rfsc.eu/tools/develop-your-sustainable-strategy-1 [Accessed 29 Jun 2016].

RFSC, (2016a). Referenční rámec pro udržitelná evropská města [Reference Framework for Sustainable Cities]. Ministerstvo pro místní rozvoj ČR [Ministry of Regional Development CZ] [online]. Available at: http://www.mmr.cz/cs/Podpora-regionu-a-cestovni-ruch/Regionalni-politika/Referencni-ramec-pro-udrzitelna-evropska-mesta [Accessed 20 Feb 2016].

RFSC, (2016b). Reference Framework for European Sustainable Cities. A toolkit for the integrated approach. [online]. Available at: http://www.rfsc-community.eu/ [Accessed 24 Feb 2016].

Sigma, (2014). The Principles of Public Administration, 2 Rue André Pascal 75775 Paris Cedex 16 France Available at: http://www.sigmaweb.org/publications/Principles-Public-Administration-Nov2014.pdf [accessed on May 2016].

Sugeno, M. (1974). *Theory of Fuzzy Integrals and its Applications*, Tokyo Institute of Technology, Japan.

Šilhánková, V. (2007). *Teoretické Přístupy k Regionálnímu Rozvoji [Theoretic attitudes to the regional revelopment*]. Vyd. 1. Pardubice: Univerzita Pardubice.

Contact Address

Ing. Meaza Haile, doc. Ing. Jiří Křupka, PhD.
University of Pardubice, Faculty of Economics and Administration, Department of System Engineering and Informatics.
Studentska 95, 532 10 Pardubice 2, Czech Republic,
Email: Meazabi@gmail.com, jiri.krupka@upce.cz
Phone number: +420 774 239 248, 466 036 144

Received: 01. 09. 2016, reviewed: 24. 04. 2017
Approved for publication: 23. 10. 2017