IMPROVING THE PUBLIC SECTOR DECISION MAKING PROCESS WITH DIGITAL APPROACH. CASE STUDY RADET BUCHAREST, ROMANIA

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ABSTRACT
In today's world's economy characterised by fast, unpredictable change, and higher competition, organizations to survive have to be able to adapt on new challenges, not only for improving their process, furthermore to create an competitive advantage. When we are talking about changes or transformation, we do not mean only for public organization but also for private sector. Nowadays managers are confronted with many difficulties with decision making process. According to Venkatachalam and Sellappan (2010) Organizational decision-making: The process of responding to a problem by searching for and selecting solution of course of action that will create value for organisational stakeholders. Decision making is not so easy, managers are often judged by the decisions they make. To make a decision involves choosing from two or more possible alternative for achieving a desired result. Management information systems can be used like a tool in decision making process. Our focus in this research is the role of Management Information system in decision making process, furthermore we are trying to create a model by combining Information Technologies respective Business intelligence, Cloud Computing and fuzzy method, that can be used for decision making process and the importance of MIS in decision making process.

KEYWORDS: *Business Intelligence, Cloud Computing, decision making processes, digital transformation, MIS*

JEL CLASSIFICATION: *L86, L95, M15*

1. INTRODUCTION

Public sector is composed by the sum of services and organizations operated by the government for their citizens. Public Sector Organizations, whether they be Local Authorities, National Government or other public bodies, make decisions every day. For a Local Authority that might be a decision to adopt a new local plan; grant a review of a license application; award a contract after a Tender process; build a new school or close another. Other public bodies make decisions in relation to their statutory functions which may have an effect on an individual, a group or community, sector of industry or, indeed, the public at large. (Spence, 2010, http://www.mondaq.com/uk/x/95044/Government+Statutory+Law/Public+Sector+Decision+Making). For such decisions to be made there must be a good understanding of what that decision can imply. To have a better understanding nowadays managers and decision makers are supported by Business Intelligence systems that allow them to have a better judgement and better evaluation of the situation.

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In Romania many public sector organizations lack the support of Business Intelligence solutions, lower than the private sector where in 2015 a study made by Relevance was showing only a third of companies are using BI solutions (Relevance, 2015). In this paper we are trying to show how a fully integrated software can improve decision making in public sector – RADET.

2. MANAGEMENT INFORMATIONAL SYSTEM

The role of the management information system (MIS) manager is to focus on the organization's information and technology systems. The MIS manager typically analyzes business problems and then designs and maintains computer applications to solve the organization's problems. As shown in (SCHOOL, 2017 http://mays.tamu.edu/department-of-information-and-operations-management/management-information-systems/) Management Information Systems (MIS) is the study of people, technology, organizations, and the relationships among them. MIS professionals help firms realize maximum benefit from investment in personnel, equipment, and business processes. MIS is a people-oriented field with an emphasis on service through technology. If you have an interest in technology and have the desire to use technology to improve people's lives, a degree in MIS may be for you. According (Saunders College of Business, 2017, https://saunders.rit.edu/undergraduate/majors-minors/what-is-management-information-systems)
Management Information Systems (MIS) is an interdisciplinary major focusing on how to leverage technology, people and processes to help improve, transform and support business operations. It a discipline which focuses on the management of information and communications technology elements within business organizations.

2.1. Cloud Computing

IT people talk about three different kinds of cloud computing, where different services are being provided for you (Woodford, 2017, http://www.explainthatstuff.com/cloud-computing-introduction.html). Note that there's a certain amount of vagueness about how these things are defined and some overlap between them. Infrastructure as a Service (IaaS) means you're buying access to raw computing hardware over the Net, such as servers or storage. Since you buy what you need and pay-as-you-go, this is often referred to as utility computing. Ordinary web hosting is a simple example of IaaS: you pay a monthly subscription or a per-megabyte/gigabyte fee to have a hosting company serve up files for your website from their servers. Software as a Service (SaaS) means you use a complete application running on someone else's system. Web-based email and Google Documents are perhaps the best-known examples. Zoho is another well-known SaaS provider offering a variety of office applications online. Platform as a Service (PaaS) means you develop applications using Web-based tools so they run on systems software and hardware provided by another company. So, for example, you might develop your own ecommerce website but have the whole thing, including the shopping cart, checkout, and payment mechanism running on a merchant's server. App Cloud (from salesforce.com) and the Google App Engine are examples of PaaS.
As shown in figure 1 public cloud services revenue for Infrastructure-as-a-Service (IaaS), permanently is growing at a 23.31% Compound Annual Growth Rate (CAGR), will outpace the overall market growth of 13.38% through 2020. Software-as-a-Service (SaaS) revenue is estimated to grow from $58.6B in 2017 to $99.7B in 2020. Taking into account the entire forecast period of 2016 – 2020, SaaS is on pace to attain 15.65% compound annual growth throughout the forecast period, also outpacing the total cloud market. The following graphic compares revenue growth by cloud services category for the years 2016 through 2020.

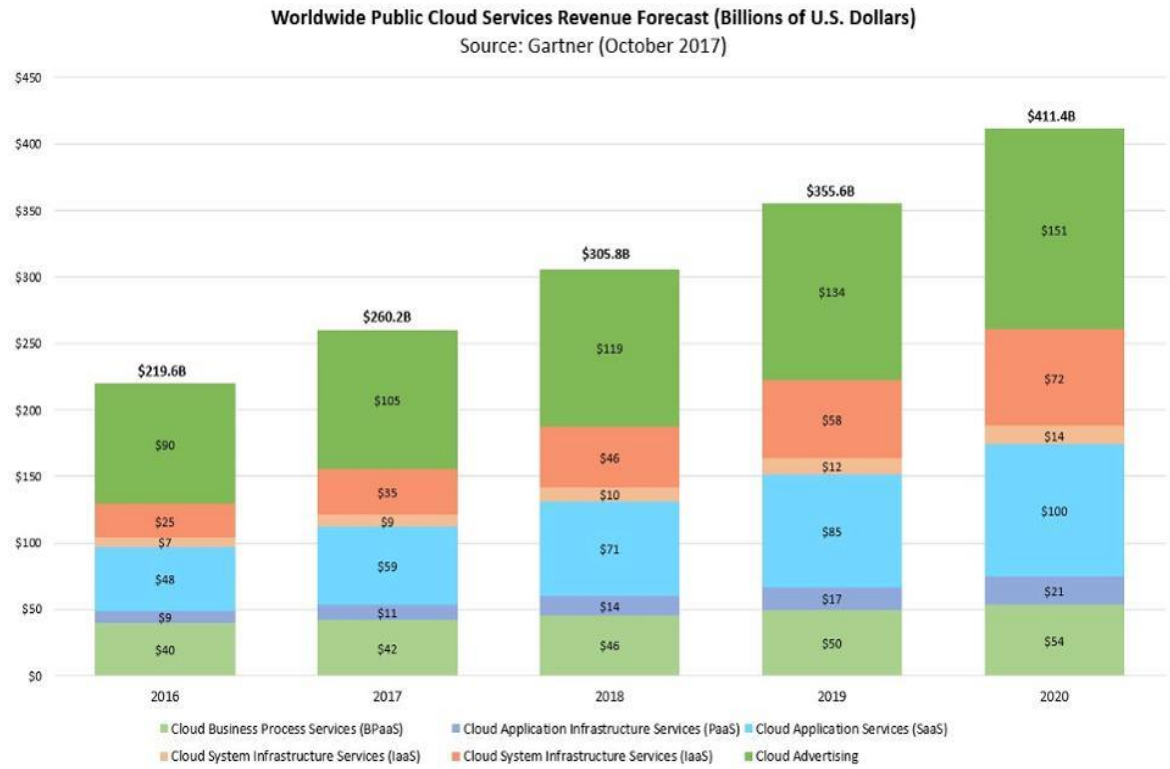


Figure 1. Gartner's latest worldwide public cloud services revenue forecast
Source: adapted from (Columbus, 2017 https://www.forbes.com/sites/louiscolumbus/2017/10/18/cloud-computing-market-projected-to-reach-411b-by-2020/?ss=cio-network#14cc8f3778f2)

2.2. Business Intelligence

Business Intelligence (BI) is a collection of data warehousing, data mining, analytics, reporting and visualization technologies, tools, and practices to collect, integrate, cleanse, and mine enterprise information for decision making. Today's BI architecture was designed for strategic decision making, where a small number of expert users analyze historical data to prepare reports or build models, and decision making cycles last weeks or months. This architecture may be viewed as an information supply chain (Figura DATA FLOW). Data from distributed, often heterogeneous, sources such as online transaction processing (OLTP) systems is periodically extracted, cleansed, integrated, transformed, and loaded into a data warehouse (DW), which in turn is queried by analytic applications (S. Chaudhuri, 2001)

OLAP is an approach for analysing multi-dimensional data as shown in Figure 2. OLAP stands for "online analytics processing", but it in fact relates to something much more tightly defined in data analytics: the treating of multidimensional data as a cube. An OLAP cube is a multi-dimensional array of data. Data points are made up of one or more metrics. (In our cases, uniques, visits, page views, transactions, revenue, number of content items consumed etc.) Data can be viewed by a range of different dimensions. (In our case, examples include time of day, day in the week, time of the year, year, customer cohort, type of device, type of browser etc.) An OLAP reporting tool makes it easy for analysts to view the metrics they want, sliced by the particular dimensions they're interested in. When we say OLAP cube, then, we visualise a "cube" of data points (i.e. metrics) at the intersection of multiple dimensions.

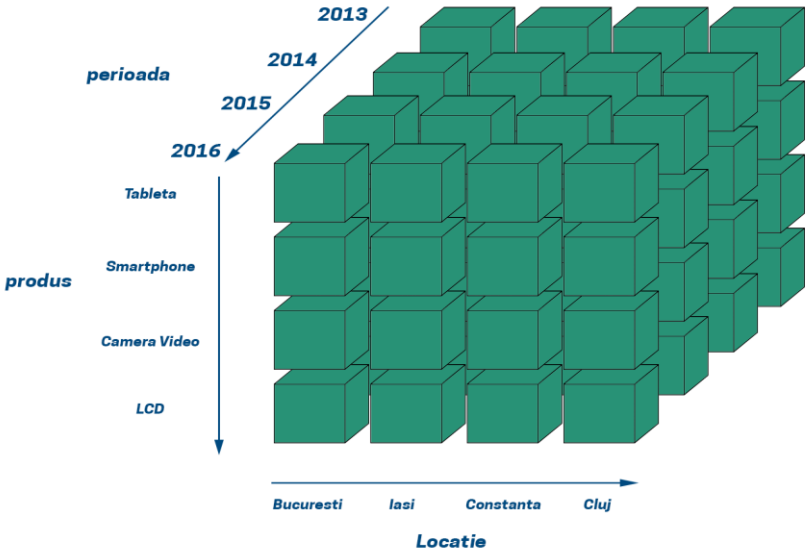


Figure 2. OLAP online analytics processing

Source: adapted from Github (2016(, https://github.com/snowplow-archive/snowplow.github.com/blob/master/guides/guides/olap/index.m

3. DECISION MAKING PROCESS

The principle function of a manager is to take a decisions, the process of managing is a process of decision making. According (Ionita, 2009) all the measures taken, all the decisions adopted, must rely on a very realistic and structured diagnostic of the human resource, organization culture, IT experience, and, very important, the level of the entropy inside the firm or public institution.According Haynes and Massie A decision is a course of action which is consciously chosen for achieving a desired results. Decision-making is a mental process. It is a process of selecting of one best alternative for doing work. (Diwan, 2002) A decision is an act of choice-wherein an executive forms a conclusion about what must be done in a given situation. A decision represents a course of behaviour chosen from number of possible alternatives (Kumar and Sharma, 2000). As shown in (Dartmouth, 2017 http://www.umassd.edu/fycm/decisionmaking/process/) Decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions. They identified 7 step, this approach increase the chances to choose the most satisfying alternative.

Step 1: Identify the decision

You realize that you need to make a decision. Try to clearly define the nature of the decision you must make. This first step is very important.

Step 2: Gather relevant information

Collect some pertinent information before you make your decision: what information is needed, the best sources of information, and how to get it. This step involves both internal and external "work." Some information is internal: you'll seek it through a process of self-assessment. Other information is external: you'll find it online, in books, from other people, and from other sources.

Step 3: Identify the alternatives

As you collect information, you will probably identify several possible paths of action, or alternatives. You can also use your imagination and additional information to construct new alternatives. In this step, you will list all possible and desirable alternatives.

Step 4: Weigh the evidence
Draw on your information and emotions to imagine what it would be like if you carried out each of the alternatives to the end. Evaluate whether the need identified in Step 1 would be met or resolved through the use of each alternative. As you go through this difficult internal process, you'll begin to favor certain alternatives: those that seem to have a higher potential for reaching your goal. Finally, place the alternatives in a priority order, based upon your own value system.
Step 5: Choose among alternatives
Once you have weighed all the evidence, you are ready to select the alternative that seems to be best one for you. You may even choose a combination of alternatives. Your choice in Step 5 may very likely be the same or similar to the alternative you placed at the top of your list at the end of Step 4.
Step 6: Take action
You're now ready to take some positive action by beginning to implement the alternative you chose in Step 5.
Step 7: Review your decision & its consequences In this final step, consider the results of your decision and evaluate whether or not it has resolved the need you identified in Step 1. If the decision has not met the identified need, you may want to repeat certain steps of the process to make a new decision. For example, you might want to gather more detailed or somewhat different information or explore additional alternatives.

4. CASE STUDY RADET

4.1. Analyzing the customer satisffacion

RADET Bucharest is the operator of the centralized district heating system of the capital, the largest heating system of Romania, accounting for 43% of the market. It is organized as an autonomous body (ro. regie) according to the provisions of Law no.15/1990 on the reorganization of the state economic units as autonomous bodies (regii) and commercial companies and it was established by the Decision of the Municipality of Bucharest no.1200/1990 and is under the authority of the General Council of the Municipality of Bucharest (CGMB)). The main activity of RADET Bucharest is the production, transport, distribution and supply of thermal energy in Bucharest. In addition, it carries out other activities to support the object of activity, in accordance with its own Statute and the legislation in force (maintenance of equipment, remediation of damages occurred in the system, design, IT, etc.). RADET provides 72% of the heat demand of Bucharest, supplying heat to approximately 565,000 apartments, accounting for more than 8,500 blocks of apartments and buildings, housing more than 1.25 million inhabitants, as well as to the about 5,400 institutions, social establishments and businesses; 95% of consumers are households, the rest are social and industrial (public institutions and businesses). The district heating system of Bucharest is presented as a well-defined set of thermo-energetic installations which ensure the provision of heating and domestic hot water and includes:

- production sources, including heat metering;
- Primary heating networks – HPN;
- Thermal substations – TS and module stations – MS with the associated facilities and machinery;
- Secondary heating networks – SHN, .

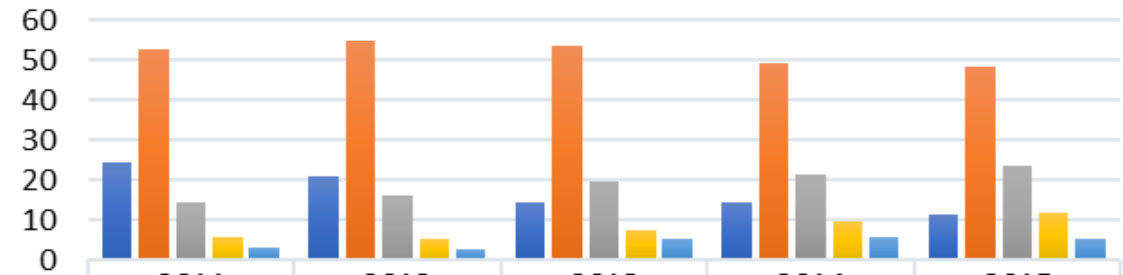
R.A.D.E.T. Bucharest is the only operator having under its management powers the centralized district heating transmission and distribution network which belongs to Bucharest urban infrastructure; RADET has in operation:

· 987 km pipelines – primary heating networks (of which 81% is older than 20 years) and
· 2964 km pipelines - secondary heating networks (distribution of domestic hot water and heat for heating), of which 60% is older than 20 years.

Heat transmission and distribution installations have an advanced degree of physical and moral wear, over 80% being in service for more than 20 years, with significant consequences for heat loss in the system, which in 2016 accounted for about 27% of the thermal energy entering the system.
The old age of many of the transmission and distribution networks causes a considerable number of accidental interruptions, so that the repair and maintenance works to maintain the district heating system functional (preventive, programmed works) require major funding.
A very important indicator is the degree of consumer satisfaction. In order to determine it, RADET conducts surveys among its customers, usually in December, the most demanding period of the year for the district heating service. The analysis of the data collected during the surveys conducted between 2011 and 2015 illustrates the evolution of the main indicators regarding domestic hot water and heating, briefly presented bellow.
Respondents - representatives of owners associations - had to answer closed-ended and open-ended questions, following several directions:

- district heating service: domestic hot water parameters: heating parameters; condition of facillities; informing and communicating with the client etc.

The samples defined in each of the 5 years varied from one year to the next, yet, for a more consistent interpretation, the answers to each of the questions were considered in percentages.

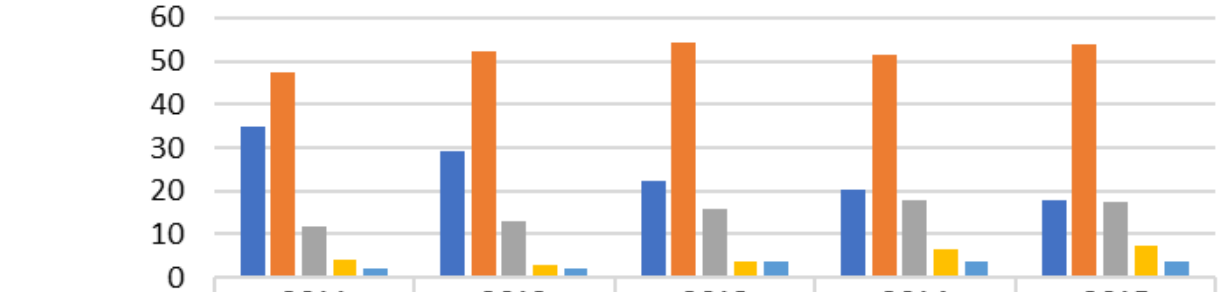


	2011	2012	2013	2014	2015
Foarte bună	24,4	21,1	14,3	14,3	11,3
Bună	52,6	54,9	53,4	49,1	48,1
Satisfăcător	14,3	16,3	19,7	21,5	23,6
Slab	5,7	5,1	7,6	9,5	11,6
Foarte slab	3	2,6	5,1	5,6	5,3

Figure 3. Consumer satisfaction with domestic hot water temperature
Source: adapted from (RADET, 2016 http://www.radet.ro/despre-radet-bucuresti.php)

With regard to consumers satisfaction with the temperature of domestic hot water, based on the analysis of the collected data, it can be noted that the number of the satisfied and very satisfied, with a level of satisfaction of 77% in 2011, registered a decrease from one year to the next; a significant decrease can be noticed in 2013 compared to 2012, by more than 10 percent; however, the number of the satisfied remains significant (about 60%); the number of those who rated satisfactory increased; and among those whose satisfaction is poor or very poor, there is an increase, their number reaching about 17% in 2015 as compared to about 9% in 2011. The degree of satisfaction with pressure and delivery schedule for domestic hot water follows the same declining trend from one year to the next, with the observation that, in this case, the decreasing rate is lower, the number the discontented being found mainly among those who have a satisfactory degree of satisfaction and, to a lesser extent, among the dissatisfied. Dissatisfaction with pressure occurs in particular to consumers living on the upper floors where hot water arrives late and the meter records cold water

as hot water. That is why more and more customers are asking for hot water recirculation installations to be constructed. As regards the domestic hot water supply schedule, the number of very satisfied consumers dropped by about 17% in 2015 compared to 2011, percents which we find almost uniformly distributed among the other ratings.



	2011	2012	2013	2014	2015
Foarte bună	34,8	29,4	22,3	20,2	17,7
Bună	47,3	52,4	54,2	51,5	53,8
Satisfăcător	11,7	13	15,8	18	17,4
Slab	4	3,1	3,9	6,7	7,4
Foarte slab	2,2	2,1	3,8	3,6	3,7

Figure 4. Customer satisfaction with domestic hot water delivery schedule
Source: adapted from (RADET, 2016)

In the light of the above, we can consider, however, that the service of domestic hot water supply is of good quality, as 60-70% of customers are satisfied with the domestic hot water parameters. Instead, the quality of hot water does not meet the standards, which is an important reason for dissatisfaction among approximately 22% of customers. These are dissatisfied with the fact that water does not have the expected properties, often having impurities or inappropriate odor. For these reasons, there is still a low degree of satisfaction (48.6%). This parameter does not show a significant decrease over the period under review but continues to be a problem frequently reported by customers. As a rule, the above mentioned inconveniences arise from accidental (unscheduled) interventions on the network pipelines. That is why it is necessary to rehabilitate RADET pipelines as well as the facilities in the basement of the blocks of apartments. The degree of satisfaction with the supply of heat has shown a downward trend in recent years both for heating as well as for domestic hot water. The service of heat supply for heating is still greatly appreciated, thus over 60% of customers appreciate the delivery temperature as good and very good, and over 70% appreciate the delivery program as being suitable. Based on the responses recorded during the surveys carried out by RADET, a series of recommendations has also been identified in order to improve the quality of the service of heat supply for domestic hot water and heating, such as:

- adjusting the temperature of thermal energy to outside temperature;
- permanent adjustment of hot water and heating parameters;
- provision of domestic hot water without impurities;
- solving the problem of hot water by placing into service recirculation pipelines;
- rehabilitation of RADET pipelines which crossing the basement of the blocks by works executed by specialized staff and quality materials;
- disconnection constraints.

All these activities require investments to correct these deficiency.

4.2. Priority Assessment Methodology

The criteria and related scoring of this hierarchy were established/set by the team of experts from the Bucharest RADET norm considering the provisions on the design and execution of centralized heat supply NP 058-02 and the principles listed in Annex GEO (Government Emergency Ordinance) no. 88/2013 concerning the adoption of fiscal measures to meet commitments agreed by international bodies, and also for amending and supplementing certain legislative framework.
The criteria established are as follows and are described:

- Safe operation of the system;
- Section network age (in years);
- Mass loss (water added to an t / h);
- Consumers affected (number of subscribers);
- Number of interventions per year;
- The degree of impact on consumers;
- Accessibility area of intervention;
- Distance from source to consumer;
- No. of stairs rehabilitated/ section;
- Laying depth (m).

The criteria were scored with coefficients of 1 to 5 according to the scale set forth.For the laying depth was considered an average interval ends mentioned as departure date.
Was identified the analysis value of each entry by summing coefficients corresponding to the 10 criteria.
The recordings were ranked based on the value determined, from the largest value (the largest degree of intervention necessary) to the smallest value (the smaller the degree of necessity of intervention), the results of prioritization can be found in Table 1.

Table 1. The results of prioritization necessity of intervention

Nr. puncte acumulate	Magistrala CET	Delimitare camine	Justificare	Lungime traseu (ml)
63	M1S	CM11' - CP3 - CV5/4		5,931
61	M123V	Camin CCFM5 - Camin CM12 -		4920
58	M23Groz	C15/20 - CS12		5,544
58	M1S	Lot 9 - CP3 - CI1		4,882
58	M2S	CM43 - CO2		4,988
58	Mber	CS1 (CET) - CS10 - CB6		6038
57	M1S	CP3 - CG9		5,693
57	M1S	CG9 - CC14 - CFT3		2,735
57	M2S	C4MB - CM43		5,460
57	M2S	CO2 - CC3' - CS6 (Stefan cel Mare)		2,600

Source: (RADET, 2016)

Depending on the position of the heating system if there is damage to the primary network departing from CHP is affected both operating safety of the heating system, and operational safety of the CET. For example, if the connections substations failures, operational safety is not seriously affected.
According to the GD. no. 2139/2004 - Catalog on classification and normal useful life of fixed assets
1.9.2. Heating pipes –
1.9.2.1.– air or protection visitable channels 20 – 30 years

1.9.2.2. – in non-visitable channels 16 – 24 years

The amount of additional water that CET - sites inserts into the system. Number of consumption in sub-stations, affected by the close section of primary network segment The number of interventions on the primary network segment/close section for remedying damage Shows the impact that an intervention on the primary network section affects the operation to the ends of the primary network. Accessibility area for intervention, ie: the place of homes and channel heat from the road axis, in which it takes to fill a lane; visited channel or not. The distance from the source to the consumer: the score is directly proportional to the length of the route networks of the past heating so that consumers benefit from last functioning parameters of hot water (G, t, p). "R" represents rays concentric circles centered on the source, that separates intervals consumers. Number of rehabilitated stairs, related to sub-stations from the primary network segment. It is the depth of the pipeline are systematized line to ground level.

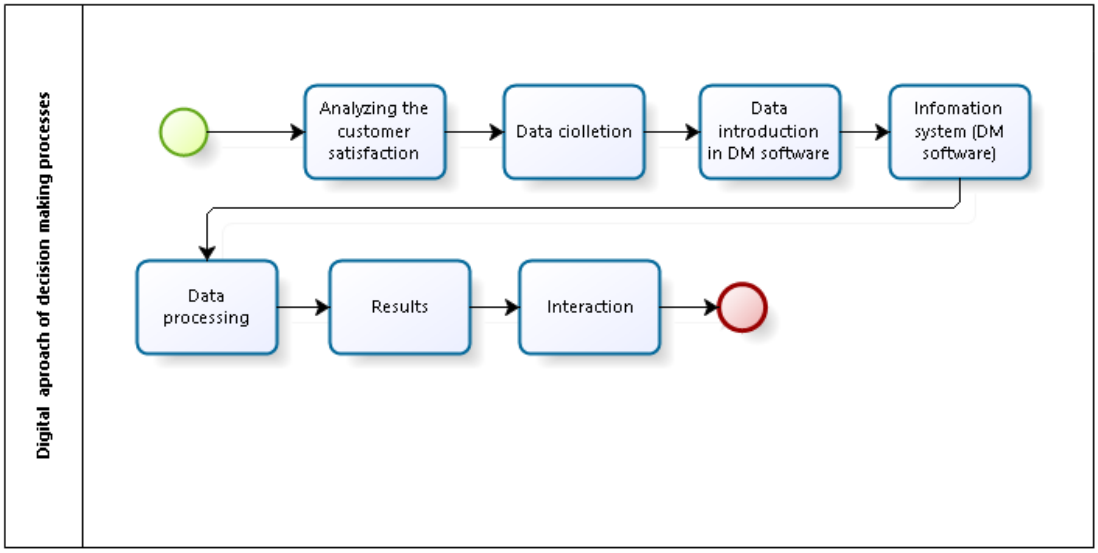


Figure 5. Decision making process diagram
Source: authors

As we have shown in figure 5 we are proposing a model that can be used for decision making process. First of all we are starting by analyzing the customer satisfaction of our services, the second step is collecting data and analyzing it with the already existing BI software's. In the third step we introduce the results from the data collected (criteria and alternatives to identifying the problem for consumer dissatisfaction) after which the informational system is calculating the data introduced in DM software and offer the optimal decision.

5. CONCLUSIONS

The whole process of identifying and calculating the data with fuzzy method, took approximately one week, for calculating and collecting data. What we are trying to present in this paper is automation of decision making process, with proposing a model established with a combination of Business Intelligence and Cloud Computing technology, which can improve this decision making process, to save the money, time and resources. As we have presented above you don't need to create a software and use it once per month or more, you can pay as you go and pay only for the usage of Decision Making cloud software and Business Intelligence software OLAP, for this process you don't need to hire programmers or to buy resources for that platform. The competition

is growing very fast and we must keep a step with it, if not exceed it. This combination of IT&C technologies can be used not only for public sector but also in the private sector.

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