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RATING RESOURCES CONSUMPTION AT LOCAL SCALE FOR GETTING SUSTAINABILITY

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ABSTRACT: *Our human life has always been based on more or less resources consumption, being actually a "sine-qua-non" condition for carrying out different human activities. With the goal of assuring sustainability of our human society there is a need to assess economic activities, especially industrial processes not only from economic and technical points of view but from environmental and social ones as well. Human economic activities, especially industrial ones have the set aim to facilitate maintaining and if possible the growth of the quality of life of humanity. However these can have beside desired positive impacts also undesired negative and sometimes unthinkable ones on environment and society. Many tryings have underlined that for successful sustainability operationalisation there is a need to consider different scales, global, national, regional as well as local scale. Regarding getting sustainability at a local scale there is a need to make the connection to urban resources consumption, not at least in the effort of finding future options for renewable resources, based on water, wind, and solar energy to be applied in urban areas. Existing odds to assure adequate urban resources consumption for getting sustainability at local scale will be emphasized by taking into consideration minimal unwanted environmental and social impacts. Connected to this idea, developing a kind of a "general methodology" to be applied for real concrete situations by considering regional differences would represent a major advance in this field.*

Keywords: *rating resources consumption; sustainability; local scale; consumption patterns; environmental impact;*

1. Introduction

About half-century before the world started to understand in a holistic way potential impacts of human activities, especially of industrial ones. After the release of the first report to the Club of Rome, "The Limits to Growth" in 1972 [5] and after taking place, in the same year, the Conference for Environment in Stockholm, the mankind has finally started to understand that besides wanted effects of technological advance, undesired effects can appear. As a consequence the environmental awareness in the Western world began to change [3]. Created regional and global problems in environmental field started to be recognised as being stringent and implicitly as needing to be debated and in the end solved.

The issue regarding availability of different resources on a global level is nowadays a very debated topic on scientific and technical level, as well as on socio-political one [1, 3]. Renewable resources represent a source of unpolluting and inexhaustible energy. Due to their diversity and potential to be used anywhere on the planet, where they are available, their usage is steadily increasing, transforming

them in a competitive resource from an economic and environmental point of view, needed by humam beings.

Having the aim of assuring sustainability of our human society there is a need to evaluate economic activities, especially industrial ones from economic and technical points of view but also from environmental and social ones as well. Discussions related to regional and local environmental quality are currently in connection to the concept of sustainable development. Actually the environmental awareness began in the last time changing, presently being a debate about sustainability awareness [3, 8]. The concept of sustainable development, defined for the first time 1987 in the Brundtland Report and accepted as a possible solution for the global complex economic, environmental and social challenges, has had its main contribution to this transition towards sustainability awareness [2]. The sustainability concept was widely discussed 1992 during the Conference for Environment and Development in Rio de Janeiro, so-called "Rio" - Conference, and clearly stated in the closing document „Agenda 21", as well as debated 2012 during the "Rio+20" – Conference [9, 11]. Several events after this time have pointed out that technical, social and environmental systems has to be analyzed in their development in interconnected synergetic relation, in order to get a successful sustainability operationalization on different levels, on global, national, regional as well as on a local level [3, 8, 9].

As a member of the European Union, Romania has started to assume several goals, one of them being the responsible usage of needed energy and material resources [1, 3, 11]. This means that national and regional strategies of using material and energy resources are required to be established by respecting general aims on European level. In this way, certain regions will become sustainable regions, at least from the point of view of covering the increasing energy and resources demand without supplementary negative environmental impact [3, 8].

In order to assess on regional or local level possible environmental impacts of local development strategies regarding water supply, several assessment methods by certain calculation procedures have to be applied [9]. Assessment methods in this field are tools and instruments for collecting information to determine the extent to which certain water supply strategies demonstrate desired outcomes for assuring sustainability. Several methods should be used to assess respective outcome, the assessment becoming pretty difficult when several interdisciplinary assessment criteria have to be coonsidered, some of them coming from environmental and social field and being hardly quantifiable [3, 8].

In order to optimise technological applications from different aspects the discipline called Technology Assessment is to be used [9]. Technology Assessment has been firstly defined and used in the United States. Thereafter it became well known in Western Europe as well, especially in the process of assessing innovative technologies in energy and resources supply or in the mobility field. The discipline is basing on several instruments and methods to carry out specific technology assessment studies. Currently its specific evaluation methods are used on a worldwide level.

2. Methodology for Implementing Local Sustainability

In order to correctly operationalize sustainability on various levels, debates in different circles have brought opportunities to be followed in this direction [3, 8, 11]. Going into details, the vision of achieving in the future local sustainability by considering regional differences is presently worldwide a pretty debated topic in various occasions. In this context this issue has also started to be intensively debated in some Eastern European countries [10, 11].

Without doubt, the vision of getting in the future sustainable cities on a global level is in the meantime an important part of national and local development strategies in different countries all over the world [3, 4, 11]. In this context debates in this field have already started also in Romania, firstly on scientific level, then also on adminsitrative level with regard to needed frameworks for getting local sustainability, as for instance in the city of Alba Iulia [1].

It is to be mentioned that these several examples in Romania together with other ones in other countries in Europe and worldwide have encouraged the vision regarding the development of a general methodology for assuring local sustainability [10]. Such a methodology should be in accordance to already developed and applied methodologies in other European countries by considering specific differences among analysed societies especially on social and cultural level [3, 10, 11].

By applying sustainability systemic analysis on a local level can be obtained in this context a general methodology for getting local sustainability strategies when trying to follow the corresponding development path, as presented in fig. 1 [10, 11].

As it is to be remarked, different types of aspects have to be individually considered, as economic, ecological as well as social aspects.

Such a methodology for local sustainability could be materialised in the following steps [10]:

- defining sustainability challenge on a local level;
- establishing specific space and time scales;
- establishing concrete aims for the considered case;
- systemic approach of the region by modelling corresponding interactions, especially in the field of using urban resources;
- developing concepts and measures by establishing priorities;
- developing evaluation and control instruments by Sustainable Development Indicators applied on local level;
- verifying possible results, which could be got after introducing proposed measures for getting sustainable urban resources consumption, by developing some appropriate scenarios;
- applying into the practice the developed concept.

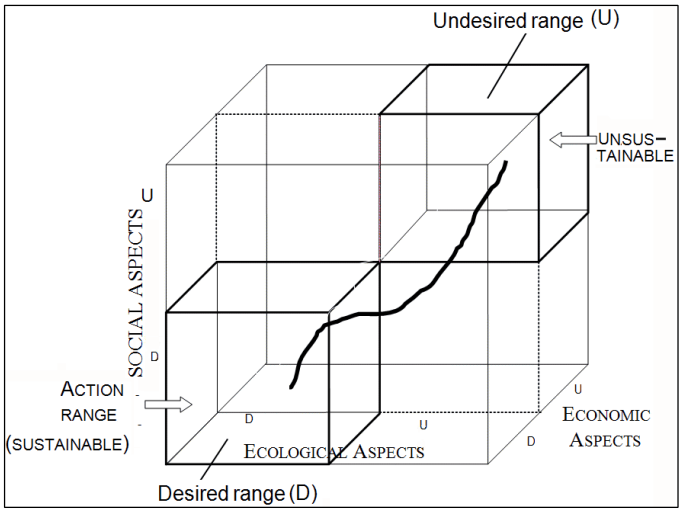

Fig. 1: Local sustainability management in the context of a potential local developing path

When studying given methodology for getting local sustainability strategies, one can understand that urban sustainability means actually a transformation process under changeable frame conditions from a given state to another sustainable one.

This means that the debate about sustainability operationalisation is implying considering economic, ecological as well as social aspects and defining a so-called action range, as one [1, 3, 11]. Recognizing existing possibilities for local sustainability management means actually to point out the development direction on local level [3, 10, 11]. This fact is possible to be carried out by simultaneously considering economic, ecological and social aspects by using relevant indicators for each considered aspect, as to be recognised in Figure 1 [3, 8]. Evaluating different possible development paths is possible, recognising desired (D) or undesired (U) ranges for each considered aspect [10]. If the obtained development by applying proposed strategies is situated in the "sustainable action range", means that Local Sustainability will be achieved in the future by implementing proposed measures. If the development is situated in the "unsustainable range", the vision is to try making necessary corrections by introducing specific measures in order to finally get Local Sustainability [1, 3, 10, 11]. Concretely such an attempt means to develop and apply local strategies, not only in technological and economic fields, but also in environmental and social ones, by considering sustainability requirements [3, 8]. From these explanations is clearly following the conclusion that by using and applying such a Systems Engineering based methodology is possible to gain most appropriate strategies for implementing Local Sustainability [7. 8, 9].

3. Local Sustainability by Assessing Urban Resources Consumption

Finding and applying most appropriate strategies for assuring the sustainability of our society, by taking into account a range of aspects related to economic and social activities is representing the final attempt of this study. In the meantime there is a general belief that sustainability of our human society cannot be got without assuring a satisfactory living standard and a satisfactory environmental quality.

Sustainability operationalisation on a local level means getting appropriate strategies for economic, environmental and social developments to be applied in the future in the considered city. In this context a big importance has the field of resources consumption on a local level. This issue is important to be studied and assessed in the effort of gaining future alternatives for using renewable resources, based on water, wind, and solar energy [3, 6]. The attempt is to develop strategies to be used on urban areas and actually not only, as the application example presented by the European Environment Agency, EEA with regard to getting urban sustainability by shaping a resource-efficient city [13].

The endeavour is to prematurely analyse potential negative impacts on environment and society because of using various needed resources, as fossil fuels and renewable energy resources. In this context several options concerning urban resources consumption, their art and their availability, can be analysed, developed and debated for supporting the sustainability assessment process [4]. The relevance of urban resources consumption has been recognized since a while, as these resources could be renewable but also non-renewable ones. Just to mention here electric power plants based especially on fossil fuels which are the main part of the electrical energy supply systems delivering especially electrical energy. Or mentioning water supply systems used in urban areas, which are assuring clean and drinkable water, necessary in different daily human activities [4].

Gaining strategies on local level for sustainable urban resources consumption means actually developing strategies for

urban sustainability in cities [1, 4]. The vision of having in the future sustainable cities, by taking into account regional differences, is currently worldwide a pretty discussed topic [1, 3]. Nowadays there is still no general agreement regarding a general definition for a sustainable city or there is no complete agreement upon paradigm for what components should be included in this concept [3, 10]. In this context a major progress is nowadays represented by the attempt of developing a kind of general methodology to be applied into the practice for real concrete situations by taking into consideration regional differences [3, 10]. Assuring proper urban resources consumption for getting local sustainability means actually to apply the developed methodology for real situations in order to assure minimal unwanted environmental and social impacts [13].

It can be concluded that Technology Assessment can be used for Sustainability operationalisation, what finally means to analyse the stability of complex dynamic environmental, economic and social systems in order to discover developments which lead to instabilities [3, 8]. Such an analysis can be carried out by graphical representations as shown in Figure 1. In this context it is to be mentioned that there are many fields where research is needed; after [3] these fields are:

- state description by using Sustainable Development Indicators (SDI);
- dealing with uncertain, unclear knowledge or non-existent knowledge;
- improvement of methods and instruments;
- orientation with values and considering value conflicts;
- developing sustainability assessment criteria;
- modelling and simulation of dynamic systems.

The concept of Technology Assessment equally how it is named, namely Technology Evaluation, Innovation Research, Systems Analysis or others, brings together almost several scientific disciplines with the question of how sustainability can be applied by using instruments of Technology Assessment, tools for rating environmental impacts of technological applications, as mentioned in the international norm ISO 14000 [12], such as:

- Environmental Impact Assessment;
- Eco-Audit;
- Life Cycle Assessment, LCA.

4. Sustainable Urban Development in Romania

It is known that currently in Romania there are carried out several activities in the field of shaping sustainable cities. A proper example can be given by considering the Alba Iulia Association for Intercommunity Development (AIDA) [14], which is a Romanian NGO, representing the interest of several communities, 3 urban and 8 rural communities with more than 120 000 inhabitants. It is to be mentioned that AIDA has the goal to get a socio-economic development on a regional level, based on different actions [1].

The most important city of the association is Alba Iulia, having about 66000 inhabitants, a city which constitutes a hystorical symbol for Romania. The city Alba Iulia has an individual Development Strategy that aims to acknowledge the urban mechanisms as a positive force in especially improving housing standards, as well as equity and sustainability standards [14].

The Strategic Development Plan of the city of Alba Iulia is addressing several tasks related to improving pedestrian areas quality and public space areas and also to improving accessibility in the historical part of the city [14]. Environmental policy of Alba Iulia is targeting transport issues as well as tourism activities, which are pretty developed in this city [1].

The Association AIDA has set up several Strategic Objectives with the vision of

improving all human life aspects. From the mentioned tasks most relevant ones are in the field of developing local and regional infrastructure, economic advance by developing new jobs, promoting "green energies", promoting local cultural values and traditions, improving educational, social and health infrastructure as well as building partnerships [14].

The sustainable development strategy of Alba Iulia, AIDA is mainly emphasising following issues [14]:

a. Need of Transnational Cooperation for getting Urban Sustainability, what actually was recognised since long on a global level. By carrying out such cooperations, especially projects in educational field can be carried out;

b. Holistic Education for Urban Sustainability. This field has the goal to change people mentalities. In his book "Continuity, Innovation and Change", HRH Prince Hassan, former President of the Club of Rome, pointed out the need for education as a key issue for achieving the three human goals: continuity, innovation, and change, which actually are the basics of sustainable development;

c. Establishing accurate sustainable urban development requirements in Romania. This is a main aspect because actually sustainability has to be defined for each concrete situation. By applying this concept there is a need to assess systems in an integrated way. Actually different challenges regarding urban sustainability can be remarked in different parts of the world, each case has its specific regional specificities [1].

Made presentation for this concrete situation regarding the city of Alba Iulia is actually emphasising the need to develop a Romanian general profile for Local Sustainability, by taking into account specific frameworks [1, 10].

In the following it should be pointed out that among resources needed for sustainable urban development water supply is a relevant task. In this context is necessary to provide an appropriate water supply system in order to assure necessary urban water consumption. Corresponding calculations are generally conducted for 25 years time period by considering different developing scenarios. Such scenarios are developed by mainly considering population number, industrial development, services, environmental quality regarding water resources etc.

The water need in the future can be assessed with these considered different scenarios, thereafter the technological flow for water distribution from water supply to consumers can be established. In this regard main component elements of water supply systems can be recognised, such as at water collection, conduit pipes, needed pumps, water treatment points, water supply dams, water distribution pipes, equipments for water pressure assurance. These elements can be dimensioned according to necessary urban water flows.

Design of water supply networks is implying the usage of knowledge and basic relations from hydraulics in order to be able to develop appropriate urban water supply systems. Such a system is actually composed of several pipes and hydraulic elements, calculated by using different equations, most relevant being the continuity and Bernoulli equations as well as Torricelli formula [9]. The continuity equation, (1), being actually a mass balance equation, is used for determing the necessary volume flow rate, Q or the flow velocity, u, when the density of used fluid, ρ, and the pipe surface, A are known:

$$Q=\frac{\Delta m}{\Delta t}=\frac{\Delta(V\cdot\rho)}{\Delta t}=\frac{\rho\cdot\Delta V}{\Delta t}=\frac{\rho\cdot A\cdot\Delta l}{\Delta t}=\rho\cdot A\cdot u \quad (1)$$

Bernoulli equation, (2) is an energy balance equation, pointing out that the sum of all energy types during fluid flow, dynamic energy, pressure energy and potential energy, is constant.

$$\frac{u^2}{2} + \frac{p}{\rho} + gz = konst \quad (2)$$

where: u is the flow velocity
p –pressure
ρ – correspunding density

The desire is to try estimating in the future urban resources consumption on local level by using hydraulics background, concretely mentioned equations, together with urban sustainability strategies for gaining sustainable strategies in the field of resources consumption.

5. Outlook

From the made survey results the most relevant conclusion that currently is not clear established which are general requirements for getting a sustainable urban development or there is no complete agreement regarding what components should be included. There is generally accepted that respecting sustainability requirements on a local level, a sustainable city should meet the needs of the present without compromising the ability of future generations to meet their own needs, as mentioned in the Brundtland definition of sustainable development. However, a sustainable city should be able to feed itself with minimal reliance on surrounding available resources, should mostly use renewable energy resources and should provide a sustainable water supply system. Presently recognized goal is represented by generally promoting sustainable urban development, by assuring a sustainable water supply system considering technical, economic, social and environmental aspects. For shaping a sustainable city the field of adequate living conditions and housing space has to be considered, together with adequate resource use. To gain best results there is a need for interdisciplinary work among economists, engineers and social scientists. A real advance in this field is assured by developing a kind of ”general methodology” to be applied for real concrete situation by considering regional differences. On the other side the main objective is represented by finding appropriate ways to establish strategies for sustainable urban development in Romania. With this goal existing ways for sustainable urban resources consumption, especially considering water supply systems are to be especially considered.

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