

Interactions Between the Society and the Environment in Ecological Engineering of Croatian Water and Waste Management Sector

Lidija RUNKO LUTTENBERGER
Komunalac d.o.o. Opatija, St. Lipovica 2,
HR – 51410 Opatija
Republic of Croatia

lidija.luttenberger@komunalac-opatija.hr

Keywords

*ecological engineering
waste and water management
DPSIR framework
environmental protection
municipal utility services*

Ključne riječi

*ekološko inženjerstvo
gospodarenje otpadom i vodom
pokretači-pritisci-stanje-utjecaji-odgovori
zaštita okoliša
komunalne usluge*

Primljeno (Received): 2011-01-12

Prihvaćeno (Accepted): 2011-04-23

Subject review

Abstract: The paper gives an analysis of water and waste management sector in the Republic of Croatia based on principles of ecological engineering. It evaluates the public utilities service sector which has a long tradition in Croatia and it outlines the future reform with the aim of increasing its efficiency. Particularly, it assesses the role of the company Croatian Waters, a specific entity the counterpart of which could hardly be found in other countries. The author is urging for innovative and environmentally-friendly decentralized solutions for wastewater treatment owing to low share of urban population, the need to protect groundwaters, surface waters and the sea, affordable cost and feasibility of phased construction, with small-scale plants for reuse of material and energy value from waste. The author identifies present responses in DPSIR framework and proposes a set of responses that would be more sustainable. Utilities services should be perceived within wider environmental protection context and waste management should be looked upon as economic development engine and not disposal services.

Međudjelovanja društva i okoliša u ekološkom inženjerstvu djelatnosti gospodarenja vodom i otpadom u Hrvatskoj

Pregledni rad

Sažetak: Rad daje analizu djelatnosti gospodarenja vodom i otpadom u Republici Hrvatskoj utemeljenu na načelima ekološkog inženjerstva. Razmatra se komunalni sektor koji ima dugu tradiciju u Hrvatskoj, te se daje prikaz buduće reforme s ciljem povećanja njegove učinkovitosti. Posebno se ocjenjuje uloga tvrtke Hrvatske vode, specifične tvorevine čija inačica se ne može pronaći u drugim državama. Autor se zalaže za inovativna i za okoliš prihvatljiva decentralizirana rješenja u obradi otpadnih voda zbog niskog udjela gradskog stanovništva, potreba za zaštitom podzemnih voda, površinskih voda i mora, niže cijene i mogućnosti etapne izgradnje, sa malim postrojenjima za ponovno korištenje materijalne i energetske vrijednosti iz otpada. Autor utvrđuje sadašnje odgovore u DPSIR okviru i predlaže skupinu odgovora koji bi bili održiviji. Komunalne usluge treba sagledati unutar šireg okvira zaštite okoliša, a na gospodarenje otpadom treba gledati kao na pokretač gospodarskog razvoja, a ne uslugu zbrinjavanja.

1. Introduction

Water and waste management has particular significance in environmental protection. There are numerous ownership, management and technical models being applied that more or less fit into associated surroundings. Croatia is a country with accentuated tourist potential that should be developed and upgraded also by improving the municipal utilities service provision. There are policies, strategies and legislative frameworks that are primarily oriented to fulfilling the criteria for accession of Croatia into the European Union. The issue is whether and which changes should

be made in the utility services sector in order to improve the environmental protection, the quality of living for citizens and stay for tourists.

2. Country data

Croatia is a country in Central Europe and in South-eastern Europe, at the crossroads of the Pannonian Plain, the Balkans, and the Adriatic Sea. The country is a candidate for European Union membership. Croatia is classified as an emerging Europe economy by the International Monetary Fund [1] and a high income economy by the World Bank [2]. Thanks to its position

and relatively good state of ecosystem conservation, Croatia holds, at European scale, a very high value of biodiversity. Known flora and fauna species exceed 30,000 and it is estimated that they count even more (from 50,000 to 120,000). Croatia excels in the number of endemic and relict species and subspecies, mostly related to karst and karst subsoil – globally significant feature of this part of Europe [3].

Croatia has 4,437,460 population (2001 census) or 78.5 inhabitants per km² and it is classified as sparsely populated European country. The population scatter is pronouncedly uneven. Smaller communities and population dispersion prevail, that being evidenced by 657 inhabitants per settlement. There are four big urban centres: the capital – City of Zagreb, Split, Rijeka and Osijek populated by one fourth of total population. There is a «shortage» of medium, smaller and small cities and communities (2,000 to 30,000 inhabitants) having the role of local and regional centres. Croatia is a less urbanized country, with share of urban population that barely exceeds one half of overall population [3].

The income from tourism per inhabitant in 2007 was 1,519 EUR [4]. According to WTTC for Croatia [5], the contribution of travel & tourism to GDP in 2010 is 24.8%, to employment is 27.3%, and to visitor exports¹ 44.8%. Its world ranking out of 181 countries is 44 in absolute, and 21 in relative terms (considering its contribution to national economy). As for Central and Eastern Europe out of 14 countries its ranking is 2 in absolute and 1 in relative terms.

On the Forbes list of the world's cleanest countries published in 2009 [6], based on indicator EPI², Croatia, one of the transition countries, held twentieth place among the mainly rich nations and scored better than any other Eastern European and Central Asian country. In 2010 it fell to 35th place [7]. It must be pointed out that owing to changes in methodologies and underlying data, 2010 EPI scores and ranks cannot be directly compared to 2008 scores and ranks [8].

3. Public utility services sector in Croatia

Croatian legislation generally defines local public utilities sector as one of the activities within the scope of local self government units serving for direct fulfilment of citizens' needs. Local public utility service sector within the meaning of the Utilities Services Act implies the following: a) performing local public utility services, b) providing local public utility services of interest for natural and legal persons, c) financing the construction and maintenance of communal

infrastructure facilities and equipment as an integral system on the territory of municipalities and cities as well as the counties where stipulated by law [9].

Local public local utilities sector in the Republic of Croatia holds a significant share in overall economy as it employs about 4 % of total active population, earns total revenue of abt. 2 % of total proceeds of the economy, while value of the assets amounts to abt. 4 % of total asset value of the economy. Croatian local utilities sector is almost entirely owned by and placed within the competence of local self-government units [10].

The Republic of Croatia is in terms of water resources one of the richer European countries although the non-uniform territorial distribution of its groundwaters results in local water shortages, especially in summer season, see also [11]. Karst region is characterized by great variations in terms of quantity and quality of water. Groundwaters from fissures are commonly used as sources when the underground flow encounters an obstacle.

Only 75 % population has connection to the water supply network, and 40 % to the sewerage [12]. About 25 % of wastewater is treated at some level, of which only 4,4 % undergoes secondary treatment and there is no reuse of treated water [3]. The fact that very small portion of wastewaters is treated [13,14] poses particular threat to karst soil in coastal region, and thus to groundwaters, surface waters, and coastal sea of urbanized and tourist areas.

The water utilities are publicly owned in the form of communal company, communal institution, or individual facility owned by the local government. Croatia has a long tradition of communal companies in the water sector. The responsibility for managing water is centralised under public company, Croatian Waters (Hrvatske vode), which is the agency of State Water Directorate, the relevant authority for all activities related to water management. It plans, monitors and coordinates the development of the water management system. Croatian Waters pass administrative and other acts and bring decisions on issues important for water management. These include preparation of water management plans, maintenance of infrastructure, flood and pollution control, etc. Croatian Waters is responsible for conducting integrated management of Croatian water resources for the country's 4 river basin districts and operate through five water management departments [15].

Current Water Act [16] excludes privatization of water resources and reforms municipal utilities sector in the sense that the activity of public water supply and sewerage and wastewater treatment (supracommunal activities) are transferred under the competence of water management. Namely, such systems operating within the service area are integrated at the technically, technologically and economically sustainable level, the limits of which are stipulated by the Government of the Republic of Croatia. The Act sets out the transitional

¹ Expenditure by international visitors on goods and services within the economy.

² Environmental Performance Index developed by the Columbia University's Centre for International Earth Science Information Network and Yale University's Centre for Environmental Law and Policy. It is the indicator of environmental health, measuring the effects of pollution on human health, and of the ecosystem vitality, measuring the health of fisheries, the amount of greenhouse gases a country pumps into the air and how well it preserves the diversity of its plants and animals.

period of three years for adaptation. It is claimed that the reform of municipal water utilities sector will result in uniform and elevated quality of the service and quality and efficient management of the systems of public water supply, sewerage and wastewater treatment on the entire territory of the Republic of Croatia. However, none of the relevant authorities has extended more detailed explanation as regards the method of implementation of this provision a year after its adoption and one may question whether we are copying someone's practice which must not necessarily be the best for us.

Croatia is a country with the highest GDP in the region and its 93% coverage of municipal solid waste collection service is by far the highest [17]. It is estimated that about 2,97 tons of waste is produced per inhabitant per annum [18]. In Croatia, 92 % of collected municipal waste is landfilled, 1 % is incinerated, and only 7% is reused and recycled [13]. Solid waste management significantly lags behind the standards of the European Union in organizational and financial terms. The National environmental protection strategy of the Republic of Croatia [19] states that inappropriate waste management represents the major environmental problem in the Republic of Croatia. Out of about 60 major landfills storing about 85% of waste with 72% of population gravitating thereto, most waste is disposed at Zagreb, Split and Rijeka landfills. The number of illegal landfills is significant, but it is not established precisely. As for landfill improvement works for the existing or preparation for constructing the new county landfills, characteristic feature is poor preparation, lack of integrated approach, isolated initiatives that start quickly and vanish still faster [20].

Significant problem for Croatia is also the waste from ships (13,000 m³ of solid waste and 24,000 m³ of oily and bilge water per annum) that should be collected in organized manner on land. Waste management financing not even roughly suits the needs. «Black spots» are locations with high waste load following protracted inappropriate industrial waste management. The bulk of industrial waste produced (inert and hazardous) is landfilled on municipal landfills, within industrial zones and facilities, where high-risk pots, depressions, excavation pits and others [18] stand out in particular. The waste from tourism is not particularly significant in terms of its total quantity, but as it is for the most part generated during short summer period, mainly at restricted coastal territory, it burdens the municipalities, cities and counties involved [21].

4. The challenges and search of appropriate approach in ecological engineering

The Water management strategy (hereinafter: the Strategy) [3] is based on centralization both technically and management-wise. The Strategy emphasizes the problem of minutization of service areas for sustainable

provision of water utilities services, and accentuates the need of their concentration. Similar opinions prevail in some international circles as well [22]. At the same time it is pointed out that the fact that municipal utility companies provide not only water supply services, but also operate their own construction executi represents a problem owing to alleged non-designated use of revenues from the price of utility service of water supply and covering expenses from alleged inefficient operations when the state invests in municipal utilities infrastructure³. The author holds that concentration option should be contemplated on case-to-case basis, but for a completely different reason, that being costly sale of water from the source located in one service area to utilities company of another service area [23]. The case against such decision is the advantage of performing various activities within the municipal utilities company servicing smaller communities.

Apart from stipulating that supracommunal operators must be legal entities separated from entities undertaking other municipal services activities (public areas maintenance, unclassified road maintenance, municipal waste landfilling, public lighting, etc.), the Strategy prescribes stimulating the redundancy programme in supracommunal water sector, and banning that supracommunal operators undertake commercial activities (construction, trade, etc.). The author however holds that environmentally friendly natural resources management is a labour-intense activity, so that the citation concerning redundant employees is very problematic and will not result in rationalization of costs in water management and economy in general, better environmental protection or greater environmental protection or polluter-pays principle.

The experiences of other countries and Croatian experience with loans for upgrading and achieving high-quality infrastructure setup stir up fear that such action could pave the way to speculative capital for privatization of major waterworks, that would then definitely not care for water supply of „minute“ communities, such as for instance Croatian islands [24]. The Strategy defines economic water price by preserving present components of the price of water, the level of collection, obligation of operators to collect the fees on behalf and on account of Croatian Waters, as well as the mechanism of managing funds. Since the Strategy was drafted by Croatian Waters, they thus tend to maintain status quo in funds management. Croatian Waters go so far as to designate supracommunal operator as payer of water use fee on account of

³ Water supply and wastewater collection companies today in majority cases provide other municipal utilities services. Of 189 municipal utilities operators operating in all utilities services, 36% provide a single, while 16 utility service providers are registered and provide six or more types of utility services. Part of utility companies, apart from providing public service, also undertake commercial activity and are permanently operating in construction sectors, as a rule for own needs (source: Water management strategy).

concern for reducing losses in networks and rationalization of water consumption, more precisely on the basis of captured quantity of water, subject to the following correctives: a) acceptable loss in the system and b) acceptable recovery of liabilities. Here the role of Croatian Waters in municipal sector is yet less clear, as arbitrating on acceptability of losses and non-recovery may only result in still greater arbitrariness and disorder. Otherwise the system of charges related to Croatian Waters remains the same, and thus mentioned institution preserves or even strengthens its role.

The Strategy states that future reduction in demand for water in public water supply systems will be affected by reducing water losses and rationalisation of consumption as a result of introducing economic price water price. In no way is reuse of use of stormwater use mentioned at all. Similarly, decentralized sewerage systems are almost not mentioned at all. It is only stated that efficient method of upgrading the service will among other things be the establishing of service-distribution area that would also encompass rural areas with individual systems with that individual household wastewater systems should be placed within the framework of service/distribution area and thus it will become point source of pollution that will be resolved by conventional and alternative treatment methods.

Croatian Waters are in itself a specific entity the counterpart of which could hardly be found in other countries. Namely, in former system there were public water management enterprises as service providers that jointly with service users constituted the self-management water management interest associations. Those have in new Croatian state transformed themselves into Hrvatska vodoprivreda (Croatian Water Management) and public water management enterprises for catchment area [25]. By virtue of the 1995 Act [26] the Croatian Water Management is transformed into Croatian Waters, while water management enterprises for catchment area then owned by local and regional self-governments must undergo privatisation involving 51% of share capital of the company. The 2005 Amendments to the Act [27] further specify privatisation deadline of a year.

In this way, as was communicated by one local green party in Zagreb, [28] the flood protection system that was being created and built for 40 years collapsed, while few private operators managed to get heavy machinery belonging to water management companies and then made money on road and highways construction instead of dealing with flood protection that is a public asset that should fall within responsibility of the state in collaboration with local and regional self-government. The concern for public and general asset such as dykes, retentions, dams, stormwater runoff or channels may not yield profit to private companies, and they will thus not deal therewith. The necessary and inevitable major investments in infrastructure necessary for viability and development of the city do not ensure quick returns on investments.

There was no financial, legal and business study that would indicate what is to be privatised under the name of Zagreb Water Management [29].

By such acquisitions the companies also got control of practically unlimited quantity of gravel laying under water surfaces, that being precious property necessary for performing construction works, that would increase even more the profit for their owners, and in case of Zagreb also of share in the company Zagreb wastewaters that is the investor and concessionaire of the project of Central wastewater treatment plant worth about 260 mil EUR and for which until 2028 the inhabitants of Zagreb will set apart the amount that is several fold the basic investment value, and also in the Company Zagreb wastewaters-management and operation, often without any estimated value of shares [30].

The officials in Croatian Waters are at the same time the owners of water management companies who contract the works for the account of Croatian Waters. Such companies are holders of Administrative decision on compliance with special requirements for performing the tasks of particular significance for water management. The companies are granted such licences by State Water Directorate [31]. Thereby national water administration awards the contracts to private companies that are associated with present or former officials of Croatian Waters [32,33].

On top of that, in the present water management setup with Croatian Waters structured as they are, concreting (over-development) also applies to rivers themselves, and not only to construction land. For that reason the World Wildlife Fund, Euronatur and Croatian civil associations denounced the Republic of Croatia to the European Commission on occasion of brutal plans for regulating the mouth of Mura River flowing into Drava River [34]. The works are in contrast with the European, and thereby also national legislation – Water Framework Directive. Environmental groups caution [35,36,37] that Croatian Waters in said area, being Croatian Amazon in its own kind as dubbed by many environmentalists and nature lovers, intend to establish a new flow, of geometrically perfect shape that would completely redraw present state of the space. The banks would be walled with stones or concrete. Access roads for heavy machinery would be constructed and strictly protected area would become the building site. This facilitates the „turnover of capital“ of tax payers in the most expensive way possible. Croatia has for years been flooded owing to old-fashioned protection concept of canalizing rivers. As much as 20,000 km of watercourses in Croatia have been canalized. These floods will unfortunately be an excuse (a bad one) for further regulation of rivers and further money squandering on obsolete technical facilities that will end causing still more problems [38]. Environmental NGOs further state that backwaters, sandbanks and anything precious in the river has been destroyed pitilessly. The taxpayers' money was spent on unnecessary works. The

alternatives having less environmental impact were rarely applied. Packing Drava River into a narrow bed without backwaters led to entrenchment of the river and lowering of the level of groundwaters that in an agricultural area leaves far-reaching consequences. For Croatian Waters the works are an excuse for profit-making. Croatian Waters declared themselves as sole experts for waters and they are writing the regulations in the field. Conversely, the environmentalists have diplomas and doctor's degrees from Croatian and prestigious international universities and strive for sustainable development of people and the environment. That is the siting of the most beautiful beach in continental part of Croatia – the place of pilgrimage, fishing, launching crafts, a natural treasure. On the other hand IPA EU strategy views ecological tourism as the leading tourist activity on Drava. At the same time the budget of Croatian Waters is 10-fold that of the Ministry of Tourism for 2010.

No country in Europe has so diverse and conserved rivers, from low-land to those karst with unique travertine phenomenon. Such rivers in their natural state represent enormous tourist asset, but also the resource of potable water and also have their useful economic role such as water treatment, and by their wide natural bed with associated backwaters, shallows and sandbanks they constitute inexpensive defence from high waters or catastrophic floods [39].

Elaborating further the treatment of natural assets, the author further cites an example of the Golf Act adopted in 2008 stipulating that the Republic of Croatia or the units of local and regional self-government must sell to investors up to 30% of area of land necessary for establishing the undeveloped building plot at market price and with no open call for tenders. Apart from that the investor or the owner of major portion of land for golf course may seize from land owners up to 20% of total area of the course, meaning that the investor may hold only 50% of land area, while he may obtain the remaining area at more favourable price with no open call for tenders and by expropriation procedure [40]. Thus golf legislation [41] under the guise of golf courses in reality facilitates intense “apartmentization”, over-development of land and endangers sensitive natural areas and protected species [42]. It is notorious that golf course is another pressure coming from leisure and tourism industry. The construction of numerous golf courses along the coast and the associated urban development exacerbates property speculation. Golf courses are important consumers of herbicides, nitrates and water. They represent a simplification of the ecosystem except in the case where local vegetation is respected. These areas lose local identity and become standardised, artificial spaces for service provision [43]. Focusing again on Croatian water sector, back in 2003 the World Wildlife Fund stated [44] that water management decision-making is very centralised and that a very narrow range of national sectors are

normally consulted, that there is little cooperation between the relevant authorities which employ mostly expert engineers and very few environmental specialists and that integration of the needs of certain sectors, in particular nature protection, into water management policies, is yet to be achieved. In spite of the fact that Croatia is one of the most water-rich countries in Europe, problems do occur both due to municipal and agricultural use during droughts, or due to five-fold increase of people during the summer tourism season along the Adriatic coast and on the islands. Some Dalmatian streams have been diverted to increase water availability for tourism, leading to the loss of coastal brackish-water habitats. While some regulatory mechanisms exist, there are little to no financial or voluntary instruments encouraging water saving. It also states that financial or voluntary instruments to reduce pollution at the source are not sufficient.

Author is of the opinion that innovative environmentally-friendly decentralized wastewater solutions should be appropriate for wastewater treatment in Croatia owing to low share of urban population, the need to protect groundwaters, surface waters and the sea, their cost, and possibility of phased construction. However, the management of such decentralized technical solutions should be centralized, see also [45]. Furthermore, when designing water supply and wastewater treatment plants, it is not only the investment costs that should be taken in consideration, but also the operation and maintenance costs. Presently, the know-how for wastewater solutions is mostly outsourced from consultants associated with commercial groups imposing their interests and are not guided by sustainability principles. Author thinks that own, in-house expertise should be used in creation and control of municipal utilities projects [46].

This opinion is also shared by recent EU Twinning project report [47] which among other things also states that

- In Croatian Waters there is a plenty of know-how with regard to water use, but only limited consideration of water protection. Non-state actors (primarily private consultants) had been contracted to deal with practical application of EU water policy, while the Ministry is clearly understaffed and not able to supervise the work of Croatian Waters in implementing the EU water acquis sufficiently.
- River renaturation measures in hydro morphologically degraded rivers have neither been planned nor carried out⁴ while Croatian Water assessment of hydro morphological degradation

⁴ Croatia's water administration is not really aware of the paradigm shift that took place in Member States where in the field of renaturation of rivers enormous efforts are made in Member States showing that ecology and flood protection can go hand in hand, and proving that integrated flood management concepts are more cost-effective than traditional technical solutions.

stated that 95% of rivers in Croatia are either in a good or a very good status⁵. Regulated rivers, especially in the Pannonian part, were considered as artificial waters, although they had been changed from originally natural rivers by straightening. Croatian Waters should apply soft engineering techniques and follow the „give space to the rivers“ approach.

- A clear cut has to be made between the commercial oriented sector and the public administration sector of Croatian Waters.
- For achieving the „good status“ the Croatian water administration assumed that focusing on urban wastewater treatment might be enough in most cases. This assumption was made without monitoring biological parameters.
- In order to make use of the exemptions, strict conditions have to be met and a justification needs to be included in the river basin management plan.
- Monitoring of groundwater for environmental aspects is absent, monitoring in karst areas was considered problematic, there is no systematic overview available on sources from point and diffuse pollution
- Although a river basin management plan requires interacting between scientists, policy makers and stakeholders, Croatia's water administration does not perform this kind of interactive processes on a regular basis.
- HV uses its web site to present its organisation, announce opening of tender procedures for World Bank projects, while there is no information available on actual activities undertaken or activities foreseen or the results of water quality monitoring, which are public data.

As regards waste management, current byword in Croatia is not «no landfill» but «landfill all» type of waste management [48]. Current pay-back arrangements involving packaging waste certainly contributed to less plastic and glass bottles ending up at the landfill, but the problem is that it concerns a narrow range of products, the activity of scavengers often reduces efficiency of regular waste collection system and jeopardizes their own health, and the overall financial arrangement with packaging waste as implemented by the Energy Efficiency Fund is criticized. As for metal waste, its separate collection is undertaken by individuals and irrespective of any current and legally valid arrangements. Prevailing philosophy is that as long as landfilling fee is charged at few sites only, and waste treatment plants are not in place, it is not worthwhile to introduce advanced waste selection systems as

commodities prices of selective collection do not cover the salaries of additional persons hired for waste selecting jobs [49].

Under the pressure of approaching and accessing the EU, the regulations in the Republic of Croatia are being adopted on «assembly line basis», by copying EU laws, with no prior quality analysis of problems occurring in implementation [50]. Only few local self-government units adopted the price lists charging the fees based on quantity of waste, while others charge the fee as a form of property tax (based on the residential/work premise area size translated to quantity of waste. The transparent and stimulative price would be a necessary starting point for reducing the quantity of waste to be landfilled permanently [51]. The Republic of Croatia should pursue avoiding waste and landfilling of waste, and not just copying blindly the EU rules.

The manner in which the preparations for construction of county landfills characterized by constant postponements proceed will simply result in waste disposal (in fact landfilling) at another site. Local units will not be able to pay high price for landfilling, but they will have no alternative solution for disposal as they are not making arrangements therefor in proper manner and the waste will end up at unauthorized dumps. The cities expect that basic infrastructure envisaged at future county waste management centres will fully resolve their problem and thus they do not engage sufficiently in providing solution for their own territory and developing own waste management models.

Environmental organizations claim that politicians not only ignore citizens' will to increase the use of renewable energy sources and reduce the consumption of fossil fuels, but they also abuse such citizens' concern and collect significant funds on account of «stimulating and use of renewable energy sources» and then redirect such funds that could prompt great reduction of fossil fuels use to obscure construction firms for alleged environmental projects [52].

Furthermore, in their recent communication [53] the environmental organizations claim that

- within the common ministry responsible for environment, physical planning and construction (the Ministry of Environmental Protection, Physical Planning and Construction), the interests are clearly opposed as the construction lobby is not guided by environmental interests. Said Ministry most often takes side of major polluters and not that of the local community and environmental protection (cases of INA, Sisak refinery, Salonit, Rockwool, Pliva, and Kvasac).
- policy of the Ministry regarding climate change inflicted further damage on international reputation of the Republic of Croatia in the field of environmental protection as Croatia was awarded a "Fossil of the Day" award" at the 2009 UN Climate Change Conference in Copenhagen. Croatia shares

⁵ In 2009 the typology of rivers had been revised as a result of a scientific project conducted by the University of Zagreb. This led to the enormous number of 52 stream types which can be regarded as neither pragmatic nor necessary for the purposes of the water management in Croatia, this high number of types not being comparable with other Member States and accession countries in the EU.

first place with Canada as countries that are doing the most to delay and disrupt negotiations on a global agreement to reduce greenhouse-gas emissions. The author points out that Croatia for unknown reason abstained from voting for UN Resolution recognizing access to clean water, sanitation as human right which was adopted by the UN General Assembly on 28 July 2010 [54].

- the Ministry which approves physical plans and is directly responsible for adoption, implementation and control of the Building Act did not block apartmentization of the coast or devastation of green spaces in cities, rendering possible in this way making the modifications in physical planning documents, and selective application of the Act.
- the minister supported the Golf Course Act that is globally unique and that facilitates building and sale of apartments and villas under the cover of golf, and currently there are as much as 90 golf courses planned covering total area of about 10,000 ha, that being the area of about 13,000 soccer fields.
- the minister is held responsible that environmental impact assessment procedures of interventions associated with development projects are reduced to fulfilling formally the statutory procedure in which the environmental protection targets may only be defeated against investment appetites where mighty economic actors in current setup finance the environmental impact studies produced for their projects.
- situation in the waste management sector is catastrophic as Croatia recycles multifold less municipal waste compared to EU Member States average. The planned waste management centres are unfortunately based on wrong technology and at sites that are harmful for the environment. In managing hazardous waste the situation is still worse. Namely, according to most recent assessments, as much as 78% of hazardous waste a year ends up in the environment or at inappropriate landfills. Recently the government attempted to create storage of radioactive material in the middle of Zagreb, the city with one million inhabitants [55].

A representative from environmental group from Kvarner (North Adriatic) claims that national environmental protection system in fact crumbled and we are facing the situation in which everything seems to be regular on paper with the European Commission also according similar treatment thereto, while actually it is a perfect Photoshop. Under the cover the system is completely rotten, that being particularly evident in the cases of environmental impact assessment studies which justify whatever needed as the assessments are made by investors and their consultants [56].

5. DPSIR framework

The author systematizes environmental interactions based on water and waste municipal utilities management in specific case of Croatia, coastal country in transition, using DPSIR, the causal framework for describing the interactions between society and the environment adopted by the European Environment Agency: driving forces, pressures, state, impacts, responses⁶, see Fig. 1.

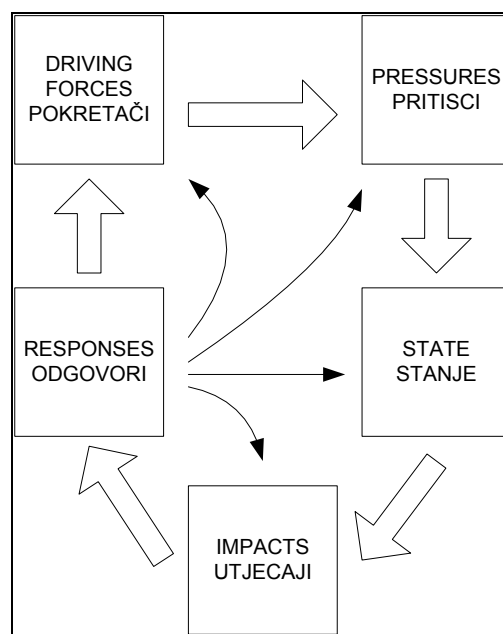


Figure 1. DPSIR framework for reporting on the state of environment (source: Global International Water Assessment, 2001, EEA, Copenhagen)

Slika 1. DPSIR okvir za izvještavanje o stanju okoliša (izvor: Global International Water Assessment, 2001, EEA, Copenhagen)

DPSIR framework in itself implies derivation of indicators. However, once in the sphere of their quantification, multiple problems may arise, especially as a result of hardly measurable elements, and possible pitfalls in derivation of indicators⁷. Therefore the author

⁶ <http://glossary.eea.europe.eu>

⁷ Pitfalls in indicator development and use are as follows:

- Using what is measurable rather than what is important to measure as it is easier to use existing data than to collect new data, easier to do what others have done even if it is not necessarily relevant.
- Putting too much faith in the indicator. Indicators can not describe all the complexities of ecosystems and economic systems. We do not understand all the relationships between drivers, pressures, states, impacts, and what our responses will do to enhance the quality and quantity of natural capital. Indicators can be a helpful tool. They are only as good as the data from which they are derived and our state of knowledge about what this data means.
- Intentional misrepresentation and choosing indicators to support a pre-determined particular result rather than letting the indicators tell an unbiased story. (source: Olewiler, N., Environmental sustainability for urban areas: The role of natural capital indicators, Cities, Vol. 23, No. 3, p. 183-195, 2006).

uses DPSIR framework primarily for identifying present responses to current drivers, pressures, state and impacts. At the end of the paper the author suggests a set of responses that he finds would be beneficial for the environment. Furthermore, the author is of the opinion that drivers and pressures should be considered in a wider environmental context, involving not only natural resources, but also the people and their standard to the extent that guarantees sustainability, the cultural heritage and other aspects that all constitute an environment whose sustainability should be pursued.

Table 1 presents drivers in DPSIR framework applied to the municipal utilities sector. Many drivers are not only induced by human activity and need, but also by the economic interests and political processes. It also describes the administrative, social, political and cultural context in specified drivers act as context itself determines the character and intensity of pressures induced by the drivers.

Table 2 elaborates the pressures or stresses that human activities and poor performance by relevant institutions place on the environment, the state and impacts. Table 3 specifies current responses.

6. Highlights of experiences in other European countries

EU states exhibit a wide variety of policies of the treatment of waste [57] reflecting the Member States' need to design waste management systems that build on existing institutional structures and tradition. Viewed together, this suggests that totally harmonising waste management system across Europe would not be the most appropriate solution [58].

A massive increase of the share of materials recovered from waste is necessary. This would enhance material supply and save lots of energy (CO₂-emissions) too. Resource recovery means climate protection. Concepts of material recovery from landfills have come back on the agenda. Currently, landfill mining is still too expensive in Europe but with increasing prices of raw materials this might change in a medium range of time. Concerning the conservation of resources, waste incinerators are energy and resource destruction plants (calorific value vs. energy equivalent) [59]. The production of RDF acts against maximising recycling, leads to polluting emissions and therefore makes no sense in climate terms. Mechanical-biological treatment (MBT) has advantage that it can be built on a small scale and waste needs not be gathered from large surrounding area. Potential disadvantages occur when MBT is intended to meet recycling rates without the need for the separate collection of recyclables. Dry recyclables separated out during the process are of poor quality compared to those collected by kerbside or bring-back schemes. Large scale MBT plants draw in waste from a wide area, contradicting the proximity principle and competing with recycling. The waste

management sites should be located so as to reduce the distance that waste is transported. Furthermore, MBT may have long-term contracts that may demand a fixed tonnage of waste that could undermine recycling and waste minimisation efforts. Residual waste technologies should be flexible enough to be able to accommodate future changes in waste arisings as recycling rates and waste prevention increase [60].

This proves the importance of not exclusively profit-oriented public control of waste management facilities striving for maximum recycling and not for preserving high calorific value of waste for producing gas to be supplied to cement kilns or other privately-owned gas consumers.

On the other hand, production of biogas by anaerobic digestion of biodegradable material has great environmental benefits as it is considered neutral with regard to CO₂, reducing the quantity of fossil fuel necessary for producing equivalent quantity of energy and thus also the emission of CO₂. Reducing the quantity of landfilled biodegradable organic waste reduces CH₄ emissions that would result from anaerobic degradation of waste. Anaerobic digestion contributes to minimum amount of waste disposed [61].

As regards water management, in many countries, the local governments have created autonomous operators, which have varied structures and responsibilities, to provide the services. These vary from Austrian and Danish cooperatives to the Belgian Inter-Municipal Companies, the Dutch Water Boards, and the French private companies, among others [15]. Even among the 15 Member State of the EU, there are not two having the same institutional set-up for managing their water resources, although some basic functions or rules need to be guaranteed in spite of the myriad of ways that are adopted to achieve them [62].

French Agencies de l'eau created by the 1964 water law levy taxes voted by the boards of users on all the users (abstractors and polluters) so as to recover the subsidies and grant low interest loans to those who participate in the collective effort predetermined on 5-year basis program. They have developed to a sort of cooperative bank. The model that French water administrators were trying to set up was a combination of British, American and German experiences of integrated river management – mutualist system with cost recovery principles – close to Dutch Waterschappen or the Ruhr Genossenschaften, where the users get together and vote both on action programme and the levies they will have to pay to implement this program. The difference with the above mentioned institutions is that the Agences do not do any implementation themselves: at the time, government and local water actors did not want to set

Table 1. Drivers in DPSIR framework for municipal utilities sector set in administrative, social, political and cultural context.**Tablica 1.** Pokretači u DPSIR okviru komunalne djelatnosti u administrativnom, društvenom, političkom i kulturnom okruženju.

Drivers / Pokretači	
Hygiene in living and working environment / <i>Higijena unutar životnog i radnog prostora</i>	
Climate change- and demand-induced water stresses / <i>Problemi s vodom uslijed klimatskih promjena i potražnje</i>	
Tourism-related development / <i>Turistički razvoj</i>	
EU accession alignment / <i>Usklađivanje povodom pristupanja EU</i>	
Speculative transactions involving valuable real estate / <i>Špekulativni poslovi s vrijednim nekretninama</i>	
Greed and corruption / <i>Pohlepa i korupcija</i>	
Context/Okruženje	
Administrative <i>Administrativno</i>	Powers vested with local self-government for imposing sanctions on polluters are insufficient <i>Nedovoljno ovlaštenje lokalne samouprave u smislu sankcioniranja onečišćivača</i>
	Unsystematical and interest-based physical planning <i>Nesustavno i interesno prostorno planiranje</i>
	Inefficiency of environmental inspection services <i>Neučinkovitost službi inspekcije zaštite okoliša</i>
	Copy-paste method in drawing up national legislation resulting in awkward solutions in Croatian setup <i>Metoda kopiranja tuđih rješenja kod izrade nacionalnog zakonodavstva što ima za posljedicu neprimjerena rješenja za hrvatske uvjete</i>
	No prior analysis of potential implementation problems <i>Nepostojanje prethodne analize mogućih problema u primjeni</i>
	Consultants engaged in tasks that should be inherent to public entities <i>Konzultanti rade na poslovima koje bi trebale samostalno obavljati javne tvrtke</i>
	Inadequate organization of government bodies and lines of responsibility <i>Neprimjeren ustroj vladinih tijela i linija odgovornosti</i>
Economic <i>Ekonomski</i>	Initiatives and interests of international financial institutions <i>Poticaj i interesi međunarodnih financijskih institucija</i>
	Unscrutinized investment from the part of international financial institutions and failure to implement the control of implementation <i>Nekritično ulaganje od strane međunarodnih financijskih institucija i neprovođenje kontrole izvršenja</i>
	Influence from the part of industrial lobbies on design of the systems that should serve for environmental protection <i>Utjecaj proizvođačkih lobija na projektiranje sustava koji bi trebali služiti zaštiti okoliša</i>
	Only one solution with no alternatives provided when making investments <i>Prilikom investiranja ne nudi se više alternativnih rješenja</i>
	Lack of effective control of major public works <i>Nepostojanje stvarne kontrole velikih javnih nabava</i>
	Failure to apply polluter pays principle when investing in municipal utilities infrastructure <i>Izostanak primjene načela onečišćivač plaća kod ulaganja u komunalnu infrastrukturu</i>
	Lack of best value for money criterion <i>Izostanak kriterija najbolje vrijednosti za novac</i>
	Poor control of public spending <i>Slaba kontrola javnih rashoda</i>
	Environmental impact studies always favour developers and investors, however unsustainable their projects are <i>Studije utjecaja na okoliš se uvijek izrađuju u korist investitora, bez obzira koliko su njihovi projekti neodrživi</i>
	Accent on investing instead of maintenance <i>Naglasak na investiranje umjesto na održavanje</i>
Social <i>Društveni</i>	Environmental facilities have no priority in personal expenditure of population <i>Ekološki uređaji ne spadaju u prioritete trošenja stanovnika</i>
	Standard of major part of population that does not ensure major investment in environmental protection <i>Standard većine stanovništva ne omogućava veća ulaganja u zaštitu okoliša</i>
	Insufficiently qualified human resources at the level of policy creation and implementation <i>Nestručnost kadrova na razini kreiranja politike i provedbe</i>
	Common interest is not essential factor in decision making <i>Interes zajednice ne predstavlja bitan faktor u odlučivanju</i>
Political <i>Politički</i>	No long-term strategy of and unsteady sustainable development at local level <i>Nepostojanje dugoročne strategije i nepostojanost održivog razvoja na lokalnoj razini</i>
	No tourism development strategy produced <i>Nepostojanje strategije turističkog razvoja</i>
	Experts in government institutions mainly abide to traditional mainstream technical solutions <i>Stručnjaci u vladinim institucijama se uglavnom drže tradicionalnih tehničkih rješenja</i>
Cultural and educational <i>Kulturni</i>	No planning habit <i>Nepostojanje kulture planiranja</i>
	Environmental impact assessment is considered as necessary evil only <i>Procjena utjecaja na okoliš se shvaća isključivo kao nužno zlo</i>
	Insufficient environmental awareness of decision makers <i>Nedovoljna ekološka svijest donositelja odluka</i>
	Nature has advocates in environmental NGOs only <i>Priroda ima svoje branitelje samo u ekološkim nevladinim organizacijama</i>
	Environmental specialists concentrated in NGO's <i>Stručnjaci za zaštitu okoliša su koncentrirani u nevladinim organizacijama</i>
	Green education at universities only sporadic <i>Ekološko obrazovanje na sveučilištima sporadično</i>

Table 2. Pressures, state and impact in DPSIR framework in municipal utilities sector.**Tablica 2.** Pritisci, stanje i utjecaji u DPSIR okviru u komunalnoj djelatnosti.

Pressures – stresses that human activities place on the environment /Pritisci – opterećenja kojima ljudska aktivnost opterećuje okoliš
Cyclical character of tourism and unbalanced load thereof during a short tourism season <i>Ciklička narav turizma i njegovo neujednačeno opterećivanje okoliša tijekom kratke turističke sezone</i>
Transport of wastewater over large distances – transferring pollution and water as medium for transporting pollutants, wasting natural resources for generating energy <i>Transport otpadnih voda na velike udaljenosti – premiještanje onečišćenja i vode koja medija za transport onečišćenja, uz trošenje prirodnih resursa za proizvodnju energije</i>
Taking wastewaters from suburbs into urban centre – unnecessary centralization of sewerage system, degradation of natural and cultural heritage <i>Dovođenje otpadnih voda iz periferije u urbani centar – nepotrebno centraliziranje sustava odvodnje, degradacija prirodne i kulturne baštine</i>
Apartmanization and overdevelopment <i>Apartmanizacija i betonizacija</i>
Interventions in vulnerable karst and coastal ecosystems <i>Zahvati u ranjivim kraškim i obalnim ekosustavima</i>
Discharging sewage in storm sewers <i>Ispuštanje fekalne vode u oborinske kanale</i>
Landfilling sewage sludge on the municipal landfills <i>Odlaganje kanalizacijskog mulja na deponij</i>
Discharging wastewater directly into the sea through bypasses <i>Ispuštanje otpadne vode izravno u more putem preljeva</i>
Permeable septic systems providing no treatment <i>Propusni septički sustavi bez ikakve obrade</i>
Supplying high-quality potable water from local sources for water use of any kind <i>Korištenje kvalitetne pitke vode iz lokalnih izvora za sve potrebe</i>
Inappropriate price of connection owing to badly laid main collectors – unsustainable for the user <i>Neprikladna cijena za priključenje zbog loše izvedbe glavnih kolektora- neodrživost za korisnika</i>
Failure to perform waste selection at source <i>Neodvajanje otpada na izvoru</i>
Disposing all waste at landfills <i>Odlaganje svekolikog otpada na deponij</i>
State /stanje
Surface impermeability owing to over-development <i>Nepropusnost površina zbog betonizacije</i>
Pollution of the sea by storm runoff and sewage <i>Onečišćenje mora oborinskim i fekalnim vodama</i>
Disposing waste on existing landfills and opening new ones <i>Opterećenje postojećih deponija krutog otpada i otvaranje novih</i>
Hazardous waste disposed on municipal landfills <i>Opasni otpad odložen na gradske deponije</i>
Contaminated soil, water, air, and the sea <i>Zagađenje tla, vode, zraka i mora</i>
Poorly managed waste from other coastal countries bordering the Adriatic degrade Croatian coasts <i>Otpad iz drugih jadranskih zemalja s lošim sustavom gospodarenja onečišćuje hrvatsku obalu</i>
Unaesthetic aspect of beaches <i>Neestetski izgled plaža</i>
Stench <i>Smrad</i>
Impacts / utjecaji
Public health <i>Zdravlje ljudi</i>
Increased energy consumption <i>Povećana potrošnja energije</i>
Degradation of marine flora and fauna <i>Propadanje morske flore i faune</i>
Places becoming less attractive <i>Atraktivnost prostora pada</i>
Recreational value drops <i>Smanjenje rekreacije</i>
Significant funds invested in unusable and expensive technology <i>Značajna sredstva uložena u neupotrebljivu i skupu tehnologiju</i>
Less funds for environmental protection available <i>Manje raspoloživih sredstava za zaštitu okoliša</i>
Poor maintenance of environmental technology owing to insufficient funds <i>Neodržavanje ekološke tehnologije zbog nedostatka novca</i>

Table 3. Responses in current DPSIR framework in municipal utilities sector.**Tablica 3.** Odgovori u sadašnjem DPSIR okviru u komunalnoj djelatnosti.

Responses / odgovori
Investing further in inefficient and expensive wastewater and solid waste management systems <i>Daljnje ulaganje u neučinkovit i skup sustav odvodnje i gospodarenja otpadom</i>
Increased price of utilities services as a result of inefficiency of investment projects <i>Povećanje cijene komunalnih usluga zbog neučinkovitosti investicijskih projekata</i>
Resorting to precipitated privatization and public-private partnerships <i>Pribjegavanje ishitrenoj privatizaciji i javno-privatnim partnerstvima</i>
Investing in new environmentally unfriendly infrastructure by resorting to damage control measures <i>Ulaganje u novu neekološku infrastrukturu pribjegavanjem vatrogasnim mjerama</i>
Investing in disposal systems that are new polluters themselves <i>Ulaganje u sustave zbrinjavanja koji su i sami novi onečišćivači</i>
Increasing indebtedness of the overindebted <i>Daljnje zaduživanje prezaduženih</i>

up institutions which would be redundant and would compete with traditional authorities in charge of building dams, sewers or treatment plants. Agencies do not manage any investments directly; they just fund those who are willing to make investment to improve the environment. They do not issue permits, but may only persuade water users to increase level of their efforts through investments they subsidize. This has resulted in funding depollution or summer flow increases rather than stopping discharges or water demands [63].

In the early 1990s in Netherlands, problem pressure from serious river floods triggered the development of a new policy approach. The adoption of the 'space for water' approach in 1995 is considered as the most recent transition in Dutch water management. This transition was not only impelled by incidental river floods, but also by the international alarm over climate change, including the expectation that river floods will happen more often and will be more severe in the future,. The 1995 transition definitely changed the classical 'dyke and drainage' approach in Dutch water management. Integration between water use and other land uses is now an integrative challenge for the country. Sudden events or calamities, like floods and draughts, have been stronger triggers than the gradual degradation of a resource, like surface or groundwater pollution. It also matters which user is affected by problem pressure. It seems that problem pressure as a trigger is stronger if it affects the general population (the public health) or some economic use or user (like agriculture). If problem pressure is a matter of loss of natural values or deterioration of ecosystems and economically strong rival uses or use functions are at stake (hydropower generation or agricultural irrigation or drainage), it seems that problem pressure has less effect or regime change. In both the Netherlands and France participation of users is institutionalized in water boards and river basin committees [64].

The sewage system needs to be considered in conjunction with other systems, including, as a minimum, the rest of the water system as well as the energy system e.g. energy recovery, the solid waste system e.g. co-digestion with organic solid waste, and

the nutrient system e.g. recovery of phosphorus because of looming shortage, and nitrogen because of energy intensity associated with fertiliser production. Integrated Resource Management is a commitment to use solid and liquid waste to create energy, reduce greenhouse gas emissions, conserve water, and recover nutrients that requires a conceptual total resource recovery design within an ecological engineered framework. The key concept there is a value-based approach, rather than cost-based approach – that is, framing the question as what would it take to create the most value from this resource, rather than how do we minimise the cost of treating this waste [65]? The sanitation regime is therefore not only providing the societal function of wastewater management but also water supply for reuse, blurring the distinction between the water and sanitation regime [66].

Traditionally, water and sanitation – popularly known as watsan – has tended to focus on water issues and neglected the sanitation aspects. It was far easier to shore up political support for investments in drinking water infrastructure; when not totally ignored, sanitation tended to be dominated by top-down approaches and ready-made, standardised technologies. Moreover, water and sanitation have historically been rather strictly separated from water resources management, i.e. water for productive uses such as agriculture, industry and energy. Managing water for productive uses has often been framed as being mainly a question of infrastructure – of building dams and reservoirs and distribution systems that would store and make water available for productive purposes when needed. More recently sanitation has moved from being the last taboo to gaining more attention from policy makers and politicians. Year 2008 was the international year of sanitation, and in 2007 the British Medical Journal voted for sanitation as the greatest medical advance in the last 166 years. However, many problematic narratives persist despite growing global and national importance of both water and sanitation [67].

The carbon footprint of our water use is likely growing for several reasons. Climate change is predicted to have numerous adverse affects on freshwater resources, rendering many available water supplies far less

reliable. With water demand growing and many local, low-energy supplies already tapped, water providers are increasingly looking to more remote or alternative water sources that often carry a far greater energy and carbon cost than existing supplies. Furthermore, the adoption of higher water treatment standards will increase the energy and carbon costs of treating our water and wastewater. Every drop of water conserved reduces energy consumption and associated carbon emissions [68].

Water issues are rising in the agenda of public actions, especially in the context of adaptation to climate change. Questions about the sustainability of current trends in urbanisation, water quality, environmental stress, and the needs of future food production – to name some driving issues – are leading to radical rethinking of water supply, use and disposal systems. The costs of water scarcity and water stress, on the one hand, and the expense and limitations of traditional responses to it, on the other, are key drivers of the new level of interest in recycling. From being an unfashionable and unspoken residual element of the water cycle, wastewater is emerging as a key link in IWRM [69].

Individual actions create externalities – if positive they can lead to abundance, if negative they can lead to «tragedies». On the other hand, commons is the space of all our human and ecosystem interrelationships that we haven't privatized or commodified. Actions of individuals or siloed projects can impose negative impacts (externalities) on the Commons. Similarly, actions of individuals can provide positive impacts (externalities) on the Commons. Nature has become a «sink» for externalities of fragmented, siloed projects (that achieve a goal at least direct cost). Communities and jobs have also been depleted by cost-minimization of single mission projects and the failure to understand the whole. Tragedies occur when externalities become large enough to destroy the natural resource base or community – resilience is lost. The right information is not always provided to aspiring engineers in colleges and universities. We need to create smart, integrated thinkers that can develop solutions and not just solve problems. Many challenged the engineering community to change from the traditional science and engineering approach and provide education and focuses on sustainability and innovation. This integrated future will require a different kind of engineer, who can think and design in a way that promotes sustainability [70].

Speaking of commons, Paris recently remunicipalized its water supply system. They claim that they now have public competitive calls for tender for work that was previously handed out to subsidiaries of the major groups that overcharged for carrying it out. There is no need to pay dividends to shareholders and to set aside part of the profits generated by the water services to pay them. All the revenue from the provision of water services is totally reinvested in the service, and there is complete financial transparency, unlike the previous

situation under the private system, where the lack of financial clarity was repeatedly criticized in financial controls. As the president of Eau de Paris put it, Bolivian Cochabamba⁸ isn't Paris, but the levers are the same: political and citizens' determination to have collective public management of the water supply [71].

7. Proposed responses

As responses in the DPSIR framework affect not only the impacts, but also the drivers, pressures and the state (fig. 1), the author proposes following responses to be considered in the context of the Republic of Croatia by making reference to current responses listed in Table 3:

- Instead of investing further in the inefficient and costly wastewater and solid waste management systems, the decision in force should always be reviewed on the basis of scientific and experience-based knowledge, as it is cheaper to discontinue bad deal than proceed with it. In that context committing oneself by a decision to adopt another decision should be avoided.
- As regards increasing the prices of utilities services as a result of inefficiency of investment projects where owing to failure to consider alternatives and producing the true feasibility study made in the interest of end user and not investor not even final investment costs are known, not to speak of maintenance, it is necessary to focus on the costs of maintenance and not only on initial investment.
- As regards resorting to precipitated privatization and public-private partnerships which often result from negligent and poor management of public services, thus creates prerequisites for developing the perceptions that problems will be resolved through privatization, it should be clear that the environment is immanently public domain and not private interest, and that public interest is relevant for decision making, with all the instruments made available thereto.
- It is necessary to refrain from resolving the problems in partial manner in which one issue is resolved and another one is created, very often exceeding the magnitude of original one.
- It is necessary to avoid uncritical adoption of uniformised systems not applicable in a particular environment and not purchase the polluters.
- Further indebtedness of the over indebted of the over indebted is the pattern of behaviour of the banks that stimulate client's irrational indebtedness to the maximum theoretically possible financial exposure. The least cost solutions incurring least debt should be proposed such as decentralized wastewater systems, green infrastructure, small-scale waste treatment plants with biogas

⁸ The Cochabamba protests of 2000, also known as the "Cochabamba Water Wars," were a series of protests that took place in Cochabamba, Bolivia's third largest city, between January 1999 and April 2000 in response to private sector participation in the infrastructure and management of city's municipal water supply.

production, with treatment and reuse close to the site of generation in order to avoid long transport over great distances [71]. One should not buy „other person's oversized, obsolete and expensive shoes“.

8. Conclusion

The significance of municipal utilities services should be perceived within the wider environmental protection context, and not only as maintaining personal hygiene and that of public spaces. In that sense present institutional framework in Croatia should be improved, particularly as regards Croatian Waters before implementing any proposal made by them as regards restructuring municipal utilities operators in Croatia.

The waste management should be looked upon as economic development engine, and not disposal service. Sustainable future implies no landfilling and small-scale plants for reuse of material and energy value from waste with new workposts for recruiting nearby population that is familiar with local site, state and environment and commutes over lesser distances, thus also facing

less transport problems in the ever more present climate change induced storms and natural disasters.

REFERENCES

- [1] *Regional Economic Outlook*, International Monetary Fund, October 2010, www.imf.org
- [2] *Country Classifications*, The World Bank, data.worldbank.org
- [3] *Strategija upravljanja vodama*, Narodne novine 91/08
- [4] Hrvatska gospodarska komora Sektor za turizam, *Turizam*, Zagreb, travanj 2009., www.hgk.hr
- [5] *Travel & Tourism Economic Impact – Croatia*, World Travel & Tourism Council, 2010, www.wttc.org
- [6] *The World's Cleanest Countries*, Forbes.com, 15.4.2009., <http://www.forbes.com>, 15.4.2009
- [7] *Environmental Performance Index 2010: Country scores*, <http://epi.yale.edu/Countries>, 28.6.2010
- [8] *2010 Environmental Performance Index*, Yale Center for Environmental Law and Policy, International World Information Network of Columbia University, eip.yale.edu, 28.6.2010
- [9] SARVAN, D., *Komunalne usluge de lege ferenda*, Zbornik referata III. konferencije Hrvatski javni sektor u aktualnim gospodarskim uvjetima, Hrvatska zajednica računovođa i financijskih djelatnika, 2009.
- [10] *Analysis of the state in municipal utilities sector*, Croatian Chamber of Economy, www.hgk.hr
- [11] *Environmental trends and perspectives in the Western Balkans: future production and consumption patterns*, EEA Report No 1/2010, European Environment Agency, 2010
- [12] BAJO, A., FILIPOVIĆ, B., *Učinkovitost opskrbe vodom u Hrvatskoj*, Newsletter br. 37, Institut za javne financije, srpanj 2008.
- [13] *Izviješće o stanju okoliša u Republici Hrvatskoj*, Agencija za zaštitu okoliša, 2007.
- [14] RUNKO LUTTENBERGER, L., *Significance of Sanitation and Biodegradable Waste in the Production of Energy, Agriculture and Carbon Sequestration*, International Congress Energy and the Environment 2010, Vol I, pp 335-345
- [15] Eureau – European Federation of National Associations of Water and Wastewater Services, *Statistics overview on water and wastewater in Europe 2008*, www.eureau.org, June 2009
- [16] *Zakon o vodama*, Narodne novine 153/09
- [17] *Speeding up Investments*, A Manual for Waste Utilities in South Eastern Europe, Regional Environment Center for Central and Eastern Europe, Szentendre 2009
- [18] *Strategija gospodarenja otpadom*, Narodne novine 130/2005.
- [19] *Nacionalna strategija zaštite okoliša*, Narodne novine 46/2002.
- [20] *Izviješće o stanju okoliša u Republici Hrvatskoj*, Agencija za zaštitu okoliša, 2007.
- [21] *Turisti ostave 100 tisuća tona smeća*, Novi list, 6.12.2010.
- [22] *Strategies for Reform*, A Manual for Water Utilities in South Eastern Europe, Regional Environmental Center (REC), Szentendre, April 2009
- [23] RUNKO LUTTENBERGER, L., *Problemi uspostave jedinstvenih preduvjeta u upravljanju vodnim resursima*, 2. Hrvatska konferencija o vodama, Dubrovnik 18-22. svibnja 1999., Zbornik radova, str. 629-635
- [24] *Dokument Komisije Hrvatske biskupske konferencije "Iustitia et pax" o pravima i dužnostima prema vodi i moru*, Hrvatski katolički radio, <http://www.hkr.hr/>, 14.7.2008.
- [25] *Zakon o vodama*, Narodne novine 53/90
- [26] *Zakon o vodama*, Narodne novine 107/95
- [27] *Zakon o izmjenama i dopunama Zakona o vodama*, Narodne novine 150/05
- [28] *Kiše dolaze, a gdje je vodoprivreda?*, www.zelena-lista.hr, 20.9.2007.
- [29] *Zar nasipe, brane i kanale – u privatizaciju*, www.zelena-lista.hr, 22.6.2007.
- [30] *Donator HDZ-a uhvaćen u torbarenju*, Nacional br. 644, 17.3.2008.
- [31] *Cerovec: Nije bilo nikakvog nezakonitog namještanja*, Medimurje – Županijske novine, br. 2898, 9.11.2010.
- [32] *Čakovečka Hidrotehnika i Ivan Cerovec prozvani zbog poslova s državnim vodnim gospodarstvom*, www.mnovine.biz, 2.11.2010
- [33] *Čelnici Hrvatskih voda milijunske poslove 'preljevali' u svoje tvrtke*, Slobodna Dalmacija, 23.10.2010.
- [34] *Hrvatska prijavljena Europskoj komisiji*, h-alter, 15.12.2010

- [35] *Spasite hrvatsku Amazonu!*, www.uscemure.org, 10.12.2010.
- [36] *Uništavanje hrvatske Amazone*, Baobab-Ekološko društvo Koprivnica, 12.10.2010., www.h-alter.org
- [37] *I opet isti scenarij – kako nas varaju , pljačkaju i uništavaju prirodu*, 13.10.2010., ww.pikaprijatelji.com
- [38] *Uzroci poplave u Europi su kanalizirane rijeke i uništavanje prirodnih poplavnih područja*, www.udrugabaobab.blog.hr, 20.9.2010.
- [39] *Da li Hrvatske vode izmišljajući radove na Dravi pokušavaju ozakoniti višegodišnje nelegalno kopanje šljunka i enormno bogaćenje pojedinaca?*, udrugabaobab.blog.hr, 20.12.2010.
- [40] *Ne glasujte za Prijedlog zakona o golf igralištima*, Novi list 14.12.2008.
- [41] *Zakon o igralištima za golf*, Narodne novine 80/08, 24.12.2008
- [42] *Brig bezakonja*, h-alter, www.h-alter.org, 17.11.2010
- [43] *The changing faces of Europe's coastal areas*, EEA Report 6/2006
- [44] *WWF Water and Wetland Index – critical issues in water policy across Europe*, November 2003, Results overview for Croatia, assets.panda.org
- [45] RUNKO LUTTENBERGER, L., *Environmental Protection Based on Waste and Water Utility Service Mangement*, Strojarsvo, Vol 52(6)2010
- [46] RUNKO LUTTENBERGER, L., *Model upravljanja zaštitom okoliša utemeljen na komunalnom gospodarenju otpadom i vodom*, Doktorska disertacija, Tehnički fakultet Sveučilišta u Rijeci, veljača 2010.
- [47] *Implementing the Water Framework Directive in the Republic of Croatia*, Project results EU Twinning Project 2007-2009, www.wfd-croatia.eu
- [48] MILANOVIĆ, Z. at al., *Odlagalište komunalnog otpada: grobnica sirovina i energije opasna za okoliš i zdravlje ljudi*, XI. međunarodni simpozij Gospodarenje otpadom Zagreb 2010., 25-26. studenog 2010.
- [49] GALOVIĆ, M. et al., *Razvoj sustava gospodarenja otpadom u Gradu Vrbovcu*, XI. međunarodni simpozij Gospodarenje otpadom Zagreb 2010., 25-26. studenog 2010.
- [50] ĆURIN, A., *Stimulativno selektiranje komunalnog otpada u domaćinstvu*, XI. međunarodni simpozij Gospodarenje otpadom Zagreb 2010., 25-26. studenog 2010.
- [51] AVIROVIĆ, S., NOVAK, M., HREŠČ, M., *Struktura cijene usluge postupanja s otpadom*, Zbornik radova, X. Međunarodnim simpozij gospodarenje otpadom Zagreb 2008., 19.-21.11.2008.
- [52] *Kakva će nam zemlja biti 2050?*, h-alter, www.h-alter.org, 12.12.2010
- [53] *Sedam razloga za smjenu «okolišne» ministrice*, H-Atler Ekologija, 21.12.2010, www.h-alter.org
- [54] *UN Resolution recognizing access to clean water, sanitation as human right*, GA/10967, www.un.org, 28.7.2010
- [55] *Nuklearno kockanje Zagrebom*, Nacional, 19.10.2010.
- [56] *Ministrica zaštite graditeljskog lobija*, H-Atler Ekologija, 21.12.2010, www.h-alter.org
- [57] *Energy, transport and environment indicators 2009 edition*, Eurostat, epp.eurostat.ec.europa.eu
- [58] *Diverting waste from landfill*, European Environment Agency (EEA) Report No 7/2009
- [59] KUEHLE-WEIDERMEIER, G.M., JOFFRE, J., *From waste to resource management. Do we still need incineration?*, XI. međunarodni simpozij Gospodarenje otpadom Zagreb 2010., 25-26. studenog 2010.
- [60] *Mechanical and Biological Treatment (MBT)*, Friends of the Earth, September 2008
- [61] STEFANOVIĆ, G., *Comparative analysis of the waste management possibility on the territories of Serbia and Croatia*, XI. međunarodni simpozij Gospodarenje otpadom Zagreb 2010., 25-26. studenog 2010.
- [62] CORREIA, F.N., *Eurowater Project: Background, objectives and main results*, 4th National Congress on Water Resources, Lisbon, 27. March 1998, www.aprh.pt/congressoagua98/files/com/ew4.pdf, 10.12.2010
- [63] BARRAQUÉ, B., *Assessing the efficiency of economic instruments: the case of the French Agences del'Eau*, Foz do Iguacu 19-23 de Abril de 1999, www.ufrgs.br, 10.12.2010
- [64] KUKS, S.M.M., *The Evolution of National Water Regimes in Europe*, Conference "Sustainable Water Management: Comparing Perspectives from Australia, Europe and the United States", 15-16 September 2005, Canberra, www.anu.edu.au, 10.12.2010
- [65] *Qualitative decentralised system concepts*, Vol 1: Synthesis report of Melbourne Water, Institute for Sustainable Futures, University of Technology Sydney, 2008
- [66] FAM, D. et al., *Distributed wastewater management in Melbourne, Australia: A case study of transition in practice*, 1st European Conference on Sustainability Transitions «Dynamics and governance of transitions to sustainability», Amsterdam 4-6 June 2009
- [67] MOVIK, S., MEHTA, L., *Going with the Flow? Directions of Innovation in the Water and Sanitation Domain*, STEPS Working paper 29, Brighton: STEPS Centre
- [68] GRIFFITHS-SATTENSPIEL, B., WILSON, W., *The Carbon Footprint of Water*, A River Network Report, May 2009
- [69] *The wealth of waste: The economics of wastewater use in agriculture*, FAO Water Reports 35, Roma 2010-12-22
- [70] *Integration: A New Framework and Strategy for Water Management in Towns and Cities*, Meeting Summary Report, WERF, July 2010, www.werf.org
- [71] LE STRAT, A., *Paris: an example of how local authorities can regain control of water management*, www.waterjustice.org, 23.8.2010