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SCOPE AND AIMS

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EDITORIAL

Dear readers,

The papers published in this issue of International Journal „Spatium" come from two sources. The majority of papers have been selected from the contributions to the 2nd International Scientific Conference „REGIONAL DEVELOPMENT, SPATIAL PLANNING AND STRATEGIC GOVERNANCE – RESPAG", which took place in Belgrade, 22nd–25th May 2013, organised by the Institute of Architecture and Urban & Spatial Planning of Serbia. More than 200 participants, from over 20 countries worldwide, presented papers at the Conference. The remaining selection of papers from the Conference will be published in the next issue of „Spatium" (No. 30, December 2013).

The other, smaller group of papers in this issue of „Spatium", covers a variety of thematic fields, viz., landscape planning, the use of GIS in water management, and architectural education and communication.

Also, two errata for the issue No. 28 of „Spatium" are enclosed at the end of this issue.

Editor-in-Chief

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THE EXTRACTIVE INDUSTRIES AND 'SHARED, INCLUSIVE AND SUSTAINABLE DEVELOPMENT' IN SOUTH AFRICA

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In the 140-odd years after the first diamond was found in South Africa in 1866, mining catapulted the country from a predominantly agrarian society into a modern industrial nation. For the biggest part of this period, mining drove and human development followed. This 'order of importance' was largely the result of the huge wealth and influence of the mining houses, the (perceived) importance of the sector for the development of the country, and the broader skewed power dynamics of colonial and apartheid rule.

Over the last decade, national government enacted new legislation by which it attempted to ensure that mining is made more serviceable to the post-1994 objectives of (1) broad-based societal reconstruction; (2) shared and inclusive growth; and (3) regional and rural development. A key component of this new legislation has been a provision to ensure that mining companies make tangible contributions to regional and rural development and human settlement in 'mining areas'.

Recent events, such as widespread strikes, the tragic loss of many lives, and continuing harsh living conditions, have raised, what has been a nagging question since the introduction of the new legislation, i.e.: Has the new legal framework (really) assisted in (1) ensuring that communities in mining areas enjoy a greater of the wealth created by the industry; (2) enhancing regional and rural development in mining areas; and (3) establishing a more symbiotic relationship between mining, regional and rural development planning and human development?

In this paper, research in a mining area during the course of 2011 and 2012 is used to explore this question. Use is made of documented evidence and interviews with key role-players in the mining industry, municipal and provincial government, the private sector, traditional leadership structures and communities.

***Key words:** mining, inclusive growth, societal reconstruction, sustainable regional and rural development, South Africa.*

INTRODUCTION

In the 140-odd years after the first diamond was found in South Africa in 1866, mining catapulted the country from a predominantly agrarian society into a modern industrial nation. Even today, mining remains a key driver of South Africa's economic development. This situation is also set to undergo little change, for, after more than a century of intensive extraction, South Africa is (still) regarded as one of the richest countries in the world in terms of mineral reserves, and one of a handful of countries with mines with more than 100 years of remaining service at current exploitation levels (Leon, 2012).

The exploitation of the country's mineral wealth has, however, since its earliest days been a highly contested activity. Largely as a result of the huge wealth and influence of the mining houses, the (perceived) importance of the sector for the development of the country, and the broader skewed power dynamics of colonial and apartheid rule, mining drove and planning law and human development followed for the biggest part of the country's modern history and mining extraction period. Key questions that have been raised in this contestation revolve around issues of benefit, cost and ownership – i.e. who owns the resource, who gains from its exploitation and who carries the cost? Of major concern in these regards has been the impact of the activity on its host community and the manmade and natural environments in which it is located. While there have been significant direct and indirect economic benefits for many such communities, there have also been high costs in the form of (1) pollution and mining-related diseases; (2) environmental degradation; and (3) the introduction of value-systems and human interactions that challenge norms, values and traditional practices.

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This paper was presented at the 2nd International Scientific Conference „REGIONAL DEVELOPMENT, SPATIAL PLANNING AND STRATEGIC GOVERNANCE – RESPAG", Belgrade, 22nd-25th May 2013, organised by the Institute of Architecture and Urban & Spatial Planning of Serbia.

Over the last two decades, the mining sector of its own accord, both locally and abroad, has made enormous strides in cleaning up its act and setting up a guiding framework of what is regarded as good practice in (1) the protection and enhancement of human rights and (2) co-development of host communities in mining areas (see International Council on Mining and Metals, 2003; 2009; 2011 and Ruggie, 2011). From its side, the South African government has introduced a new progressive legal framework by which it has attempted to ensure that mining is made more serviceable to broader societal reconstruction and development (see Republic of South Africa, 2002; 2004; 2008). A key component of this new legislation has been a provision to ensure that mining companies make tangible contributions to socio-economic development and human settlement in 'mining areas'. At the same time, significant amendments have since the late 1990s been made to municipal governance and development planning legislation with the aim of ensuring progressive, assertive strategic planning by municipalities.

Notwithstanding the many positive changes the mining sector has made in the wake of the new voluntary and legally-binding codes of conduct, the industry is often still treated as if it has not changed its ways, is a super-exploiter and is not complying with stated legal provisions. At the same time, the persisting levels of deep poverty and the slow pace of broad-based economic transformation in the country, coupled with the seemingly extraordinary profits made in the mining sector, has seen the activity becoming a key discussion point in debates about the future of the South African economy. A strong theme in these discussions has been that of nationalisation of the industry, and if not that, then ways of securing a greater tax income from the activity.

Despite (1) the introduction of the legal and voluntary steps to 'set the balance right'; (2) the importance of the industry for the South African and regional economy; and (3) the prominence of the debates out the future of the sector in the political arena, public debates and the popular media, very little actual, empirical research has been done to establish what the outcomes 'on the ground' have been and to what extent the actual interface of mining companies with planning law, socio-economic development and human settlements has changed as envisaged.

In this exploratory study, the extent to which the changes in the legal framework have actually assisted in ensuring (1) a greater degree of balance, and (2) a more symbiotic relationship between mining, planning and human development, is explored in a predominantly rural district with a long mining history. The questions that are explored are: How do mining companies interact with municipal planning and planners, spatial planning law and sustainable human development and settlement reconstruction? How is this different from pre-1994 kinds of engagement and interaction? Is there *real* change, or is it just a case of legal compliance? It is hoped, that in undertaking research that considers the sector from a more multi-pronged angle, a contribution will be made towards moving the debate beyond disdain, rhetoric and critique, and into an arena where more informed debates and decisions about the future of the sector and the communities that are closely tied to its prospects, can, and will be had.

The structure of the paper is as follows: The next section provides a brief overview of the changes in the legal framework in the mining-community-municipality interface in South Africa post-1994. This is followed by a short discussion of (1) the district in which the research was conducted and the reason for its selection as the area in which to do the study, and (2) the methodology that was used in the study. The next section provides the data, which is followed by a discussion of the findings in terms of the three questions that the research sought to answer. This is followed by a series of concluding thoughts.

CHANGES IN THE LEGAL FRAMEWORK GOVERNING MINING AND MUNICIPAL PLANNING POST-1994

The most significant change in the legal framework governing mining activities, has been the introduction of the *Mineral and Petroleum Resources Development Act, Act 28 of 2002,* which, in accordance with its preamble, seeks to *'…make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources'* (Republic of South Africa, 2002: 2). Key objectives of the Act in pursuit of this goal are *inter alia* (1) the protection and management of the environment and the management of the country's mineral and petroleum resources through environmentally-responsible exploitation, so as to ensure economic and social development for current and future generations; (2) the promotion of local and rural development in the areas where mines are active, and the social upliftment of communities hosting, affected by mining and that supply labour to mining operations; and (3) far greater participation in and ownership of, and receipt of benefits from the mining industry by historically disadvantaged persons, i.e. Black South Africans, women and persons with disabilities.

In order to achieve the stated objectives, the Act, Amendments to the Act and Regulations passed in terms of the Act *inter alia* make provision for:

- The severing of the mineral rights from the owner of the land and placing these in the hands of the State and the introduction of detailed legal procedures to apply for prospecting and exploitation rights;
- The prescription of regulatory and progressive compliance measures, including conducting an environmental impact assessment and the preparation of an environmental management programme or plan by those seeking to acquire a prospecting, mineral, exploration and production right;
- The development and setting of a *'housing and living conditions standard for the minerals industry'*;
- The development of a broad-based socio-economic empowerment Charter to set the framework, targets and time-table for ensuring that previously disadvantaged South Africans enter and benefit from the mining industry;
- The provision of assistance to historically disadvantaged persons to conduct prospecting or mining operations;
- The making of provision for communities to lodge applications for mining rights on land that they own or will receive ownership of; and
- The placing of a requirement on successful applicants for mineral rights to (1) contribute to the socio-economic development of the areas in which they are located, as well as the communities hosting, affected by and/or supplying labour to their mining operations, *inter alia* by the preparation of and reporting on the implementation of *Social and Labour Plans* (SLPs); (2) assist with the realisation of the objective of ensuring active participation in, and drawing of benefits from mining and beneficiation operations by members from historically disadvantaged groups prior to embarking on mining operations; and (3) ensure community participation in mining operations by affected communities (Republic of South Africa, 2002; 2004; 2008; Department of Minerals and Energy, 2004; Leon, 2009; Booysen *et al*., undated.).

In accordance with Guidelines prepared in support of the Act, the SLPs that have to be prepared must include (1) comprehensive Human Resources Development Programmes that include Employment Equity Plans; and (2) Local Economic Development Programmes that will ensure poverty eradication and upliftment of the

communities living in the areas where mining is undertaken (Department of Minerals and Energy, 2004: pp. 4). This is *inter alia* to be ensured through the involvement of these communities in mining and beneficiation actions, and by setting out processes to save jobs in the case of the downscaling of operations and/or mine closure (Department of Minerals and Energy, 2004: pp. 4). The Guidelines also clearly indicate that SLPs must ensure consultation and cooperation of the mining company with (1) the municipalities in the areas in which they are located, as well as (2) municipalities in the *'major labour-sending areas'*, in their planning and development activities, notably in the preparation and implementation of their Integrated Development Plans (see the discussion on these plans in the next paragraph below) (Department of Minerals and Energy, 2004: 8; 2007: 16; Mabuza *et al*, 2010). A later set of Guidelines (Department of Mineral Resources, 2010: pp. 17) go further and specify that, *'The mine or production operation must furthermore consult with other economic development frameworks like Provincial Growth and Development Strategy (PGDS), National Spatial Development Strategy (NSDS), National Priorities and any other relevant stakeholders. The Mine or Production Operation must, through consultation with communities and relevant authorities provide a plan. The plan should be in line with the IDPs of the mine communities'.*

In addition to the Mineral and Petroleum Resources Development Act, Act 28 of 2002, the post-1994 government passed the *Local Government: Municipal Systems Act, Act 33 of 2000 and* a set of *Regulations* in 2001 in terms of the Act, which *inter alia* provide for the preparation of a strategic five-year plan by every municipality in the country, called the *Integrated Development Plan* (IDP) (Republic of South Africa, 2000; 2001). This Plan, which includes a *Spatial Development Framework* (SDF) that is meant to both reflect the spatial outcomes as envisaged by the IDP, is also meant to provide strategic guidance in the preparation and implementation of the municipality's land use management system. Both the IDP and the SDF have to, in terms of the Municipal Systems Act, 2000, be prepared in a highly participatory way involving all stakeholders and seek to align and integrate the plans, strategies, investment and spending proposals of (1) all spheres and sectors of government active in the municipality, as well as (2) all the major private sector actors in the municipality (Republic of South Africa, 2000; 2001). As such, this Act, mandates the involvement of mining companies in the preparation of municipal IDPs and SDFs, and binds them to locating and programming their infrastructure investment and spending plans in accordance with these plans.

THE JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY: OVERVIEW AND REASON FOR INCLUSION IN THE STUDY[2]

The John Taolo Gaetsewe District Municipality is one of five District Municipalities in the Northern Cape Province, and is located on the northern border of the South Africa with Botswana. The district, which is 27,293 km² in size, comprises three Local Municipalities, the Gamagara, Ga-Segonaya and Joe Morolong Local Municipalities. According to the 2007-Statistics South Africa Community Survey, the district is home to 172 454 persons, which put it in the 47th place out of the then 52 District Municipalities in the country in terms of population size. The density of settlement is very low by national and international comparison (7 persons per km² in 2011). Other than sizeable population concentrations in one large regional town (Kuruman) and six smaller towns (Mothibistad, Bathlaros, Moropeng, Kathu, Olifantshoek and Dibeng), the bulk of population (more than 50%) is spread across a vast landscape dotted with approximately 185 rural villages and medium to large farms. Nearly 44% of the population live in deeply impoverished conditions in the Joe Morolong Local Municipality, primarily on land which once formed part of the former apartheid-era Bantustan of Bophuthatswana. The district is marked by a harsh semi-dessert climate with annual temperatures ranging between 8ºC and 28ºC, and an annual rainfall ranging from 500mm in the south-eastern part of the district to 200 mm in the north-western part.

The district was for many decades home to large asbestos mining activities, which came to an end in the early 1980s. Large iron ore and manganese reserves and deposits of a range of semi-precious stones in the area, coupled with the commodities boom of the last decade, has seen a resurgence and massive expansion of mining in the area. Most of the mines are open-cast, with the district also being home to one of the largest open-cast iron ore mines in the world (Sishen), from where iron ore is carried by train on one of the longest iron ore railway lines in the world to the port of Saldanha, 861 km away on the south-western coast of South Africa. The last decade has also seen the arrival of several multi-national mining companies in the area, largely in pursuit of the manganese reserves in the area. In addition to the mining industry, and its associated transport and logistics sectors, the two other, far smaller economic activities in the area are extensive agriculture in the form of cattle and game farming, and subsistence agriculture.

The *reason for selecting this district as area in which to do the study* is as follows: The author was part of a team that undertook a review of the Spatial Development Framework (SDF) in the John Taolo Gaetsewe District Municipality, 2011. This appointment provided the ideal opportunity to not only get access to (1) an area that is not only far removed from the major urban complexes of the country, but also (2) to the many stakeholders that would need to be interviewed in the kind of study that was envisaged. In order to ensure sound research ethics, the author (1) obtained informed consent from the project manager in the municipality to undertake the study, and (2) throughout the study, explained the dual-focused nature of his questions, interviews and requests for data to all interviewees. Given the emphasis in the preparation of the Spatial Development Framework on producing something that would be to the benefit of all that live and work in the district, which is also the reason for undertaking this research, no clashes of interest were encountered.

METHODOLOGY

Use was made of two sources: (1) documents and (2) semi-structured interviews. The former consisted of (1) planning documents, notably plans, policies, strategies and development frameworks prepared by the John Taolo Gaetsewe District Municipality, the Local Municipalities that fall within the area of the jurisdiction of the district and the Northern Cape Provincial Government; and (2) information on the activities of mining companies as provided on the websites of mining companies. The *interviews* entailed (1) one-on-one interviews; and (2) focus group sessions with representatives of the mining companies active in the area, municipal and provincial officials, consultants, local politicians and traditional leaders. These interviews were informed and enriched with information gained from a series of public participation meetings, conducted as part of the review of the SDF of the John Taolo Gaetsewe District Municipality. All the interviews and public participation meetings were undertaken in the period March 2011 - June 2012.

While the documents and interviews provided a wide and a rich source of information on a myriad of issues and aspects surrounding the mining industry, the emphasis throughout the data-gathering and analysis session fell on exploring *the way in which mining companies interfaced with the State, communities and*

[2]The information discussed in this section was obtained from the *Spatial Development Framework* of the John Taolo Gaetsewe District Municipality (John Taolo Gaetsewe District Municipality, 2012).

each other in response to, and in accordance with the legal requirements for involvement with and support of: (1) the integrated development planning and implementation activities by municipalities and provincial governments; (2) the Local Economic Development plans, projects and programmes of municipalities and communities; and (3) the sustainable long-term development of the district. As such, the data gathered was both (1) quantitative (i.e. dealing with economic growth, human settlement formation and change and environmental indicators); and (2) qualitative (i.e. the views, opinions, concerns, aspirations, hopes and dreams of those interviewed) in nature.

FINDINGS

The findings are structured under four themes: (1) views of the representatives of the mining companies active in the district; (2) views of representatives of provincial and municipal government officials and municipal councillors in the district; (3) views of community and traditional leaders and community members; and (4) documented evidence of investments by mining companies in the district.

Engagements with representatives of the mining companies

All of the representatives that were interviewed were fully aware of the (new) legal requirements on mining companies and specifically, their own operations. In in a number of cases, interviewees indicated that they had good working relationships with (1) officials and councillors in municipalities, and (2) traditional and community leaders in the area. References were also made to stakeholder-structures on which they served and the involvement of the mines in (1) initiatives by organs of state and communities to initiate and support local economic activities and to increase job creation in the areas in why were located; (2) the provision of bursaries for learners in the area; (3) the construction and maintenance of infrastructure in the region, including the very costly maintenance and upgrading of local and regional roads; (4) the provision and support with the provision of housing; and (5) the construction of community facilities, such as clinics, class rooms and sporting facilities. While the level of enthusiasm for this involvement in the area and its people varied from very keen to mere compliance, there was not a single interviewee who expressed the view that such investments and contributions, while sizeable, should not be made.

What did, however, emerge in a number of interviews, was a distinct irritation, which in some cases was closer to a real frustration with a number of aspects around the way in which the public/State sector worked. These included (1) the perceivably far more laid-back approach and much slower speed at which 'things moved along' in the public sector; (2) the lack of adequately trained and committed officials to give full and real expression to the requirements of the new laws; and (3) the lack of integration and implementation in the plans, decisions and funding decisions in the three spheres of government.

In a number of the interviews, respondents from the mining sector would explain their frustration by explaining where they were coming from. What these explanations emphasised was the enormous difference between the nature and scale of a mining operation and the public sector and the way one had to function to survive in the very competitive mining sector. This business environment included (1) 300-plus carriage-iron ore trains of more than 3.2 km long; (2) hundreds of iron ore and manganese trucks running 24/7, all year-long; and (3) huge amounts of capital that had to be invested in the construction and maintenance of mining infrastructure (i.e. ground preparation, erection of structures, machinery and training and relocation of workers), while being super-exposed to a very dynamic business climate and erratic fluctuations in supply and demand on a global scale. This harsh business and operational climate, it was argued, meant that miners that wanted to 'make it', and flourish in the sector had to (1) show enormous dedication to task; (2) work very hard and very long hours; (3) have an astute focus on what matters for the company and the mining operation; (4) have a pragmatic, can do, no-nonsense approach; and (5) have an acute awareness of the bottom line. This meant that there was no room for error or any waste of time, which it was argued, meant that it was often very hard to fathom the very different work environment, lack of plan implementation and seemingly very different work ethos in some areas of the public sector.

On another note, a concern was expressed that (1) the enormity of the costs involved in setting up a new mine, and (2) the investments and contributions required in terms of the new mining laws, meant that older, larger, capital-rich companies were at a huge advantage relative to smaller, emerging, start-up companies who had not yet built up such reserves or access to such funds. This, it was argued, ran counter the government's objective of boosting small and medium-sized companies and new, start-up Black-owned enterprises. Coming to the same question from another perspective, it was argued by an interviewee that it is for this reason that it would not be the larger, established, in most cases global, companies that would contravene the legal requirements, but rather the smaller ones. A number of interviewees argued along similar lines that (1) the huge financial and reputational risk for global mining companies associated with contravening human rights and environmental regulations, and (2) the far longer period of exposure to both the world of mining and the rules and regulations that go with it, meant that these companies were far better than the newer, younger companies at ensuring legal compliance (see also Mabuza *et al.*, 2010 for a similar finding).

With regards to the recent court cases that had the effect of requiring mining companies to ensure that their surface activities complied with the land use rights on the properties on which they were located, there were no qualms. In most cases, representatives from the mining companies had met with municipal officials and appointed town planning firms to undertake the necessary steps to ensure that they complied with the relevant land-use controls. In others, the mining companies had instructed their legal sections/representatives to undertake the necessary steps to ensure that they were legally compliant with regards to the relevant land use regulations.

Finally, and somewhat unexpectedly, and even though prompted on the matter, none of the interviewees indicated that there was any form of corruption or bribery in the interface between mining companies and officials and leaders in the public sector or community leaders or members that they were aware of. This does of course not mean that it does not take place; it may simply mean that the mining companies have no interest in stirring controversy or engaging in debates and issues that have no direct, positive outcomes for their operations, and that could land them in costly litigations.

Engagements with government officials and councillors in the district

In the case of these role-players, the views regarding the mining industry were more mixed. While there was a generally positive view towards the industry, and a real appreciation for the endeavours of the mining companies in complying with the legal requirements, there was a clearly expressed wish for the municipality and the community to benefit more from mining activities. In addition to this, a number of interviewees expressed frustration with the way in which mining companies disposed of their legal

requirements. This frustration revolved around mining companies, while spending the required components of their turn-over in the area, doing so (1) in an *ad hoc* way, and (2) in accordance with the commitments and timing of the mining company, and not necessarily in terms of what the municipality wanted to see done/invested at a particular point in time and space/place. While the Municipalities in the district (the District and the three Local Municipalities) had at various points set up economic development forums consisting of the mining companies, community members and other stakeholders in the district, these often only lasted for a short while and/or did not integrate their actions with those of other structures, especially so the planning units in the Local Municipalities in which they were located.

Officials tasked with preparing the legally required Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs) for their municipalities, also complained about the lack of disclosure on the side of the mining companies as to their envisaged and planned future activities/operations. This not only made the 'forward planning' by municipalities difficult, but also meant that the identification and/or setting aside of land for especially housing for workers in the mines and the planning for massive infrastructure investments, could not be done, or where it was done, was done on a hunch, and not based on 'real figures'. The result of this was (1) housing shortages when new mining operations were initiated; (2) a mushrooming of informal settlements and contraventions of land use rights; and (3) shortages in key municipal services – refuse removal, water and sanitation and electricity. As for compliance with land use regulations, while officials expressed the view that mining companies cooperated very well in this regard, the concern was expressed that it does require from the municipality to take a strong position that 'the law will be enforced' and to actually do so. The situation according to one of the officials was simply that, *'while mining companies will in most cases comply with what the law requires, they in some cases needed to be reminded of this obligation'*.

An area in which a high level of unhappiness was expressed by not only municipal, but also provincial officials was the impact of the mining operations on the roads in the district and the wider region. The key challenge here was that the roads were planned for 'normal rural use', not for hundreds of heavy, fully loaded mining trucks moving across them on a daily base. Given the high costs associated with road construction and maintenance, and the huge investments required in social investment in the country post-1994, and especially so in some parts of the district, the State simply did not have the funds to keep roads in a running order by themselves. While it was indicated by officials, both in the provincial and municipal spheres of government that the mining companies often assisted with the upgrading of roads, this, they argued, was generally done in an *ad hoc* way and not based on, or driven by a comprehensive roads master plan. In addition to this, the view was expressed that the mining trucks were working to the detriment of other economic activities in the area by often causing long delays on the roads to and from, and in the district, and by taking huge trucks through the central business district of the major town in the area (i.e. Kuruman), in the process hurting this retail, education and administrative hub. Finally, the trucking industry was said to have led to a massive increase in prostitution and associated social ills in the central business district of Kuruman, as well as increased levels of air pollution in the region.

As for the question of improper behaviour or corruption in the dealings between the mining companies and officials, again, while it was stated in a number of interviews, that it may happen, not a single interviewee indicated that they themselves were aware of such activities in their areas of work. One of the officials wagered the opinion that, due to the urgency of mining companies to get their operations up and running, and the slow pace at which decisions sometimes moved in the public sector, it may be that mining companies may be tempted to nudge the process along in improper ways. The official was, however, quick to add that there were no such cases that he was aware of.

In a number of cases, it was mentioned by officials that long-standing and unresolved tensions (1) amongst councillors and (2) between councillors and traditional leaders around the economic development and (future) spatial development pattern of the district, which in themselves made planning for the district difficult, was not made any easier by mining companies speaking to, and seeking to address the needs of individual leaders with their often very different views about 'the future'.

Engagements with the community and traditional leaders and community members

In the case of these interviewees, while the views were generally still more located on the positive side, they were far more mixed. While nobody complained about the economic activities and jobs that the mining industry had brought to the area, there was a high degree of unease at the fact that only some benefitted and not more or all of the community members. While some community members expressed the view that they lacked the skills to be employed in the industry, and that special education programmes needed to be put in place to ensure this, there was a also a view that the companies *'brought in their own workers from elsewhere'* and were not interested in employing local labour in especially the better paying positions, irrespective of how well they were trained. Rather than wait to be employed by mining companies coming in from outside, a number of local community members and traditional leaders indicated that they were interested in undertaking their own mining operations.

A number of community members indicated that they were not necessarily interested in working in or on a mine, but saw secondary economic opportunities in the prevalence of the mines and their workers in the area, notably in the areas of agriculture (food production), housing provision and road construction. Making use of these opportunities, many of these community members argued, however required capacity building and financial support, which they believed should be provided by the State and/or the mining companies. At the same time, they indicated that preferential procurement practices should be put in place to assist local small-scale, start-up companies.

A number of community members expressed concerns about the levels of pollution caused by the mining industry in the area, notably the dust from the mining dumps. In addition to this, many references were made to the damage caused by the asbestos mining in years gone by, which has, despite rehabilitation activities, rendered many parts of the district inhabitable, and also led to respiratory diseases (asbestosis) and numerous deaths. It was especially the combination of having to suffer the negatives of the industry (pollution), while not being offset by receiving greater benefits from the activities that many felt to be *'just wrong'*.

In a few cases, the view was expressed that while the mining companies were involved in (1) the construction, upgrading and maintenance of municipal infrastructure provision (notably water and sanitation services) and roads, and (2) the building of class rooms, community halls and clinics, more should be done in the deeply deprived rural areas in the district with the funds generated in the mining industry. On this score, it was stated that the dominance of the

mining industry meant that many members of rural communities, especially the youth, yearned for a high-paying job in the mines and were no longer interested in doing what they had done for generations, i.e. agriculture. The high levels of water-usage by the mines, and the pollution of the mining activities of especially the groundwater reserves in the district, were seen as further aggravating the situation, and leading to a growing reliance on the mining sector for jobs and an ever-greater loss of connection to earlier ways of making a living with their associated traditions and indigenous cultural practises.

In the case of the community members, there were clear signs of suspicion amongst a number of interviewees regarding the interactions between mining companies and government. It was often grimaced that corruption and unfair advantaging does happen, but again no one single case could be mentioned as to where it had actually happened. In one of the community meetings, it was very vocally argued that there is not enough transparency in the interactions between community representatives and mining companies, notably in the local economic development forums on which both groups served, and that this had to be addressed by at least making the minutes of forum meetings available to the public.

Investments by mining companies in the district

This analysis revealed that mining companies active in the district have made social investments in the area[3], *inter alia* in the following: (1) the construction and upgrading of schools, class rooms and hostels at schools; (2) the provision of support for early childhood centres; (3) the provision of bursaries for learners in the district to study at tertiary institutions; (4) he provision of support to libraries; (5) assisting with the establishment of a higher education institution in the province; (6) putting in place internship and mentoring programmes in the mining industry for youths from the district; (7) the provision of one-stop business support services; (8) the sponsoring of sport activities and events and the upgrading of sport facilities; (9) the construction, upgrading and maintenance of municipal infrastructure, especially water provision and sanitation services in the district; (10) the provision of mobile health units and support with the construction of clinics and the provision of primary health care services; (11) the setting up and support of community farming activities; (12) the provision of assistance with the establishment and development of new small-scale, local enterprises; and (13) the making available of technical expertise (e.g. engineering services) to under-capacitated municipalities; (BHP Billiton Development Trust, undated and Kumba Iron Ore, 2010; 2011a; 2011b).

[3] Unofficially a figure of more than 500 million South African rands (R) (about $56 million or €42 million) being invested by mining companies in the district over the last ten decade (2000-2010) was mentioned in an interview with a manager of a mine in the district. Officially, Kumba, the largest mining operation in the area, invested R134 million (about $15 million or €11 million) in 2010 and R73.6 million (about $8 million or €6 million) in 2011 respectively on the implementation of social and community development projects, and a total of R264.6 million (about $56 million or €42 million) on the implementation of its Social and Labour Plan commitments and enterprise development in the period 2006-2011 (Kumba Iron Ore, 2011a: 47 and 2010: 13).

DISCUSSION

The study sought to explore the way in which mining companies interface with the State, and communities in response to, and in accordance with the legal requirements for involvement with and support of: (1) the integrated development planning and implementation activities by municipalities and provincial governments; (2) the local economic development plans, projects and programmes of municipalities and communities; and (3) the sustainable long-term development of the areas in which their operations are located.

The findings suggest that in the district that was studied, the interface, while not perfect, is far removed from the negative image that the often down-beat headlines around the sector may suggest. By and large, the interface is approached and experienced in a positive way. In addition to this, the mining industry was found to be (1) providing thousands of employment opportunities and livelihoods in an area with otherwise very little other economic activities; and (2) making a significant contribution towards the provision and maintenance of municipal services, local economic and community development ventures, education, bursaries and sport facilities and socially beneficial activities in communities. As for the law, mining companies did what the law prescribes in what could be described as an 'engineering efficiency-mode'. There is just way too much to lose by not doing so in terms of retraction of the mining licence (the right to mine) and the danger of reputational risk. It is, however, in this careful pursuit of legal compliance that a major concern lies, *viz. that in meticulously doing what the law prescribes and not more or less than that, the spirit of the legislation and the real reason for its introduction, i.e. that of ensuring a joint, collective approach towards planning and development in an area, may not be served (as well as it could be).* It can very easily become a case of the individual pursuit of different mining companies of admittedly socially and economically very beneficial objectives, but without the 'bigger bang' that collaboration between these mining companies could have achieved.

In addition to this, while the investment by the mining companies is crucial, it is only one part of the story – the other parts lie with the public sector and the community. Should the public sector, especially in cases where communities are deeply impoverished and hence not be able to contribute little else but their time and labour, not deliver what and when they can, the input by the mining sector will have far less of an impact than it could have had. Relating this to the Integrated Development Plans and Spatial Development Frameworks that municipalities have to prepare to (1) plan and (2) guide the future development of their municipal areas, the reality is simply this: *should a municipality not have a very well-directed implementation strategy, and take a strong stand as to where investment has to be made, mining companies could invest anywhere, in no specific order, and with no specific cumulative impact in mind*. In such cases, a mining company could be fully legally compliant by constructing a road segment in an impoverished rural part of the district, and assisting the movement in that segment of the district, but not necessarily be (1) serving the collective, (2) contributing towards progressive objectives, or (3) assisting the longer-term sustainable and equitable development of the district or the wider region. Associated with this issue is that of capacity-building of officials and community members about the mining sector, how it works and how to engage it to ensure optimal outcomes for all concerned (see also Mabuza *et al.*, 2010: 4). At the same time, there is a need to ensure that mining companies are familiar with (1) the objectives and enabling, regulatory and supportive legal and policy framework of government, notably in the municipal sphere, and (2) constructive and effective ways of supporting this sphere.

While the piecemeal, *ad hoc*, compliance-driven un-integrated, unsynchronised investment by mining companies may over the short to medium-term result in the municipality not succeeding with the implementation of its plans as envisaged, the result may over the longer term be that (1) living conditions on the ground and (2) economic prospects for communities do

not change for the better. Given the widely shared view amongst communities that they are not benefitting enough from the mining activities, this may lead to growing levels of unhappiness with the mining industry and even hostility towards the industry. Clearly this would not be in anyone's interest, and could, given the limited investment in other sectors of the economy in the district, leave the district highly vulnerable, should mining companies either be forced to suspend or close their operations.

While the new legal framework for mining and municipal planning has put in place a series of measures to ensure greater involvement by mining companies in the preparation and implementation of development plans and proposals of government and investment in the communities and places in which they are active, the successful implementation of 'the law' requires leadership on the side of the representatives of the State and affected communities to provide the public voice, direction and vision in response to the very strong voice and intent of the private sector, as presented by the mining companies. One way in which this could be done is through the introduction of a governance model/structure in which the public, community and private interests are all represented in a structure that is focused on (1) the long-term planning for the district; (2) the programming of investment and spending in support of this plan; and (3) the preparation, implementation, monitoring and review of this investment and spending programme. Such a proposal, however, falls outside the ambit of this study, and will, as such, be left at that for now.

CONCLUDING THOUGHTS

While there are without doubt real, negative externalities to the mining industry, this exploratory study has indicated that mining companies operating in the district that was studied are not mute to these, and have approached the new legal requirements placed on the mining industry in a positive way and are complying with these requirements. What the study, however, does suggest, is that while the new laws are a good start, more will have to be done, with a view to 'up-scaling' the legal regime and capacity of the State, to ensure (1) greater synergy in the investment by the State and individual mining companies in mining areas, and (2) that communities living in mining areas, enjoy a greater share of the benefits of these activities. Far more research in mining areas, such as that undertaken in the study, should however be done before such steps are taken.

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The author would like to acknowledge with sincere thanks (1) the community members, municipal and provincial officials and councillors who, often with great enthusiasm, shared their views and opinions during meetings and interviews; and (2) the representatives from the mining industry, who gave their time and shared their views, experiences and insights on the mining sector.

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COMPARATIVE ANALYSIS OF DIFFERENT METHODS AND OBTAINED RESULTS FOR DELINEATION OF FUNCTIONAL URBAN AREAS

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European Spatial Planning Observation Network (ESPON) recognizes Potential Urban Strategic Horizons (PUSH) and Potential Polycentric Integration Areas (PIA) as territory of one or more neighboring Functional Urban Areas (FUA).

Delineation of FUA territory can be done by using general ESPON methodology, based on a 45-minute car travel time from the center of respective FUAs. This approach is based on network proximity by using shortest path in road network between two nodes. Later, results are approximated on administrative or statistical territorial units, so that PUSH areas are determined. However, other methods for delineation of FUA territory can be used.

This paper deals with other methods that can be used for delineation of FUA territory. Some of those methods are based on machine learning, a branch of artificial intelligence which develops algorithms that take as input empirical data, such as that from sensors or databases. Created algorithms identify complex relationships thought to be features of the underlying mechanism that generated the data, and engage these identified patterns to make predictions based on new data. Clustering and artificial neural networks are some of approaches that can be undoubtedly used for delineation of FUAs territory, based on unsupervised learning and statistical data analysis. This is statistical approach, which clusters administrative or statistical territorial units based on statistical data, and not by network proximity. Such methods involve usage of Self Organizing Maps (SOM) which implies usage of neighborhood function to preserve the topological properties, or using k-means clustering, which partition observations into clusters by dividing space into Voronoi cells. Results obtained from both approaches will be analyzed in order to define the most appropriate method for FUAs territory delineation in Serbia.

Key words: ***Functional Urban Areas (FUA), Potential Urban Strategic Horizons (PUSH), Self Organizing Maps (SOM), k-means clustering, Serbia.***

INTRODUCTION

Functional urban areas (FUA) represent basic building blocks of polycentrism – a principle of organization of a region around several political, social or financial centres (Wikipedia, 2013). The concept of polycentrism has been introduced as a basis for spatial development through European Spatial Development Perspective (ESDP), where it has been highlighted as key goal of spatial development which would contribute to more balanced regional development, increase of competitiveness, more complete regional integration and sustainable development (ESPON, 2005). Polycentrism has two aspects determining number and size of FUA: morphology, which deals with distribution of urban cores – cities and their hierarchy, and networking, which deals with relations between cities.

Based on these two aspects, FUA can be defined as an area consisting of urban core(s) and surrounding area that is economically integrated with core. European Spatial Planning Observation Network (ESPON) defines FUA as urban core with population size of at least 15,000 inhabitants and more than 50,000 inhabitants in total population size of and country with more than 10 million inhabitants, while for countries with smaller population size, FUA has to have urban core of at least 15,000 inhabitants and area with more than 0.5% of population size of country, and functions of national or regional importance as well. To analyze territorial context of cities, ESPON uses two additional aspects (ESPON, 2005):

- Potential Urban Strategic Horizon (PUSH) – it encompasses all territorial units (such as municipalities or settlements) which have at least 10% of their territory available with 45 minute travel by car from center of FUA, so number of PUSH actually is number of FUA, while neighboring PUSH can overlap;
- Potential Polycentric Integration Areas (PIA) – they represent join of neighboring PUSH areas, if cities smaller in population share at least 1/3 of

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their PUSH area with neighboring larger city.

Each PUSH area participates in one PIA area, and if there are multiple overlaps, the largest city is chosen as center of belonging. PUSH area actually represents functional border of city.

Determination of PUSH area includes delineation of 45 minutes isochrone of car travel from center of FUA towards periphery via street and road network. This approach is based on network connection and proximity, usage of the shortest paths in road network between two nodes. One of most often used algorithms is algorithm of Edsger Dijsktra (Wikipedia, 2013).

However, different European countries have different definitions of FUA. Some examples include identification of FUA with area of daily migrations, commuter areas, etc. (Korcelli, 2008)

Beside ESPON standard method for delineation of FUA, this paper deals with other methods which can be used for this problem. Such methods are based on machine learning – branch of artificial intelligence which develops algorithms which use empirical data as input, such as sensor data or databases (Wikipedia, 2013). Created algorithm identifies complex relations which consider being part of mechanism which have created data, and then uses identified patterns for prediction based on new data. Clustering and artificial neural networks are representative approaches (Wikipedia, 2013), which can be used for delineation of FUA: both the urban core and PUSH area. These approaches are based on unsupervised learning and statistical data analysis. Clustering is performed on administrative or statistical territorial units based on statistical data, and not on network connections and proximity. Self-Organizing Maps (SOM) and *k*-means clustering are some of unsupervised learning methods which will be discussed in this paper, and whose results will be compared with standard ESPON method.

METHODS OF MACHINE LEARNING AS BASIS FOR DELINEATION OF FUNCTIONAL URBAN AREAS

Machine learning is defined as area of exploration which gives possibility to computers to learn without explicit programming (Samuel, 1959). More complete and more formal definition of machine learning was given by Tom M. Mithcell, in which he supposes that computer program is told to learn from experience E with respect to some classes of task T and measured performances P, if performances from task T, measured through P, are improving with experience E. Such definition enables that famous Alan Turing's question "Can machines think?" (Turing, 1950) can be replaced with question "Can machines do what we (as thinking entities) can do?" (Harnad, 2008)

Machine learning is based on two concepts, from which one focuses on prediction based on known characteristics learned from samples, while other known as data mining is based on discovering previously unknown characteristics of data. These two concepts overlap in many areas, so it is hard to divide them in practical usage, although in research communities distinct division between these two concepts exists (Wikipedia, 2013). Algorithm types that are used in machine learning can be divided into categories based on wanted output or input learning data, so we have categories of supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning and learning to learn.

Unsupervised learning implies finding hidden structures in unlabeled data. Some of approaches in unsupervised learning are: clustering, neural networks, principal component analysis, independent component analysis, etc.

In this paper, two methods of unsupervised learning will be used: *k*-means clustering and self-organizing maps.

K-means clustering

K-means clustering represents one of the simplest algorithms of unsupervised learning (MacQueen, 1967), whose goal is to divide n observations into k clusters, where each observation belongs to cluster with values closest to mean. Each cluster has its own center, which is called centroid. As a result, division of space between centroids into Voronoi cells is achieved. Algorithm is expressed through following objective function (1):

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2 \quad (1)$$

where

$$\left\| x_i^{(j)} - c_j \right\|^2 \quad (2)$$

represents chosen distance between point xi(j) and centroid of cluster cj. Function is actual indicator of distance of n points from centroid of cluster they belong to (Matteucci, 2012). Standard algorithm performs in such manner so centroid for k number of points in space is determined, and each cluster receives attribute of belonging to closest centroid. When each point gets its own attribute of belonging, the recalculation of centroid position is performed for each cluster until new centroid is determined. This step is repeated until convergence is achieved and centroids become fixed (Figure 1).

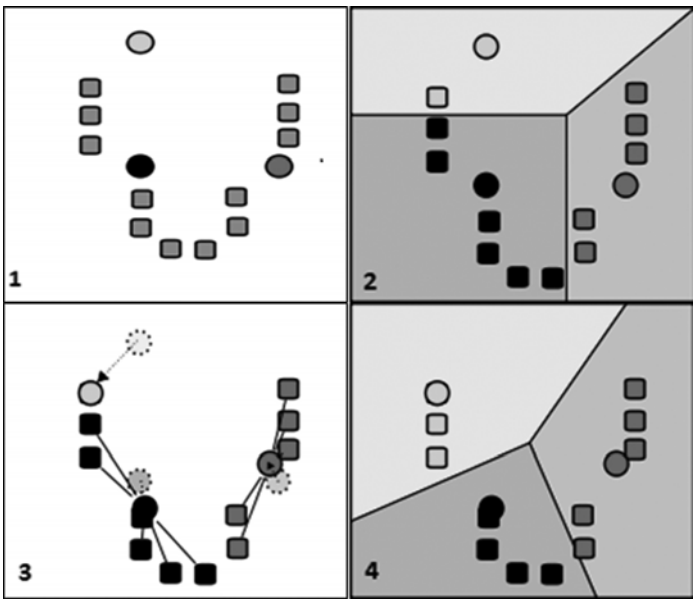

Figure 1. Functioning of k-means algorithm with goal to create 3 clusters:
1) initial determination of centroids based on spatial domain;
2) cluster creation with Voronoi cells while associating each point to closest centroid;
3) each clusters centroid becomes new centroid, so re-clustering performs based on distance;
4) steps 2 and 3 repeat until achieving convergence – centroid inaction.

K-means is most popular clustering algorithm. It has its own strengths and weaknesses. Strength is seen in simplicity in understanding and application, and in efficiency as well. However, basic components, initial centroids, distances and cluster numbers, are its greatest weaknesses. Initial centroids have massive influence on results, so large number of pre-application analysis must be performed to determine best initial centroids. Users must choose predefined number of clusters, which limits research on chosen number. Distance is represented by Euclidean distance between two points, while variance is used as a measure of dispersal. There is also problem of sensitivity of algorithm on points which are isolated form other points, which can influence spatial disposition and size of clusters. Algorithm is not recommended for clustering of points which do not have hyper-ellipsoidal or hyper-spherical dispersion (Liu, 2007). Modern tools which execute *k*-means algorithm can reduce the influence of these weaknesses. One is Grouping Analysis tool within Esri ArcGIS for Desktop software package, which has ability to use user's defined initial centroids, or software can find optimal centroids, or centroids are defined by random sampling (Esri ArcGIS Resources, 2013). Algorithm can be executed multiple times with different combination of inputs, so different results can be expected. Other tool is CrimeStat (Levin, 2008), primarily used as statistical program for spatial analysis of crime, and which can perform *k*-means clustering with user's defined initial centroids.

Algorithm has been executed within CrimeStat version 3.0, on point representation of settlements in Serbia, in two iterations (Figure 2): in first one, the software alone has determined most optimal initial centroids, while in second one initial centroids are represented by 25 centers for settlements which are significant urban cores of administrative importance. For weight factor, level or urbanity calculated on model of Tošić (2012) has been used, while as intensity number of inhabitants according to 2002 census has been used.

Self-Organizing Maps (SOM)

Self-Organizing Maps (SOM), known also as Kohonen network, represents a method for visualization and analysis of multi-dimensional data, especially those which are experimentally collected (Kohonen, 1982; Kohonen, 2001). In addition, they can be used for clustering (Vesanto and Alhoniemi, 2000), reduction of dimensionality, classification, sampling, vector quantization and data mining (Kohonen, 2001).

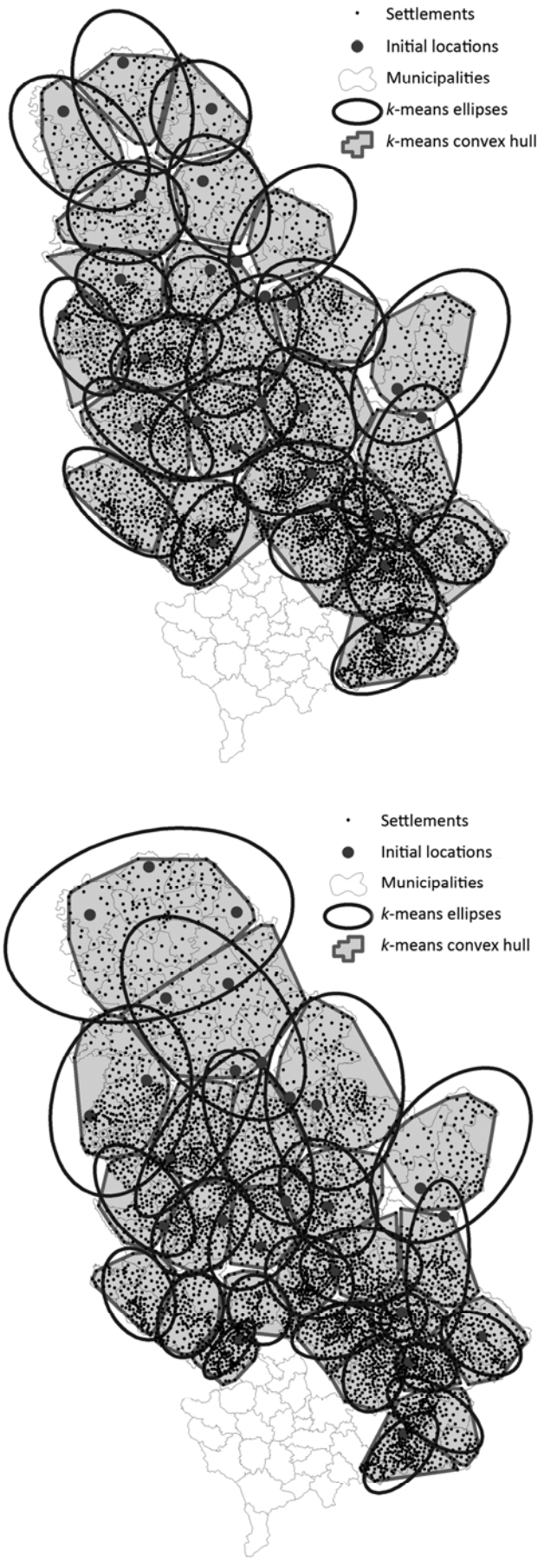

Figure 2: Results of k-means clustering with CrimeStat 3.0 – upper with initial centroids defined by user, lower with initial centroids defined by software

SOM is defined as projection of data on regular, usually two-dimensional grid of nodes, while data are mapped on node whose model has been calculated through SOM algorithm and whose model is most similar to data (Figure 3), for example it is closest to data in some measures (Scholarpedia, 2013).

Model usually represents mean arithmetic value of data in space, while SOM algorithm groups similar models on neighboring nodes. SOM was originally developed for visualization of distribution of vectors with some values. It grew out of earlier models of neural networks developed by Kohonen (Kohonen, 1984). Kohonen introduced systematic model which is consisted of at least two interactive subsystems of different nature. One of them is competitive neural network which is executed with function „winner takes it all", while other subsystem is controlled by neural network and it changes local synaptic plastics of neurons while learning. Learning itself is limited by space to neighborhood of most active neurons (Scholarpedia, 2013).

SOM can be explained mathematically in purely abstract form, without any kind of reference to neural or other components that it is made of. Learning is executed through series of iteration based on formula (1):

$$m_i(t+1) = m_i + \alpha(t)h_{ci}(t)\left[x(t) - m_i(t)\right] \quad (1)$$

where $m_i(t+1)$ represents new value iteratively originated from old value $m_i(t)$ and new data $x(t)$; $\alpha(t)$ is scalar factor that defines size of correction and whose values decrease with step t. Index i is model for sub processing, while c is index of model which is closest to $x(t)$ by Euclidean distance. Factor $h_{ci}(t)$ is function of neighborhood, and it decreases when distance between models grows (Kohonen and Honkela, 2011). Mathematical theory of SOM is very complex and complicated, and only one-dimensional case has been analyzed entirely (Fort, 2006). Algorithm is being executed by following steps:

1. Calculation of distance between data and all neurons of SOM;
2. Choosing the closest neuron as winner;
3. Refreshment of each neuron by iterations;
4. Repeat steps 1, 2 and 3 and refreshment of parameters of learning, while certain criteria for stopping algorithm is achieved.

There is large number of SOM variants. Some of them represent basic SOM algorithm with some small changes, while others suffered great changes and do not have same characteristics of mapping and visualization (Lobo *et al.*, 2004). Some include geographical characteristics of data. Introduction of Tobler's first law of geography "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970) into learning of SOM would imply search for best neuron inside SOM for specific data set, while only geographically close neurons would have been searched. Close to this approach are Hypermaps (Kohonen, 1991), where only part of input data are used for finding best neurons, or Kangas architecture (Kangas, 1992), where only small number of neurons close to best previous neuron are being searched. Combination of these two ideas led to Spatio-Temporal Feature Map (Chandrasekaran and Palaniswami, 1995), which use function of spatial gates, together with similar function of time gates, to choose next neuron (Lobo *et al.*, 2004). There are also hierarchical SOM, which instead of one SOM use larger number of different SOMs, while each of them uses part of data. Results of each of these lower level SOMs are projected on higher lever SOM. This enables each lower level SOM to specialize for specific aspect of data, delivering more intuitive interpretation of data (Lobo *et al.*, 2004). With georeferenced data it is wise to use geographical coordinates as direct input to SOM of highest level together with summarized information of lower level SOMs.

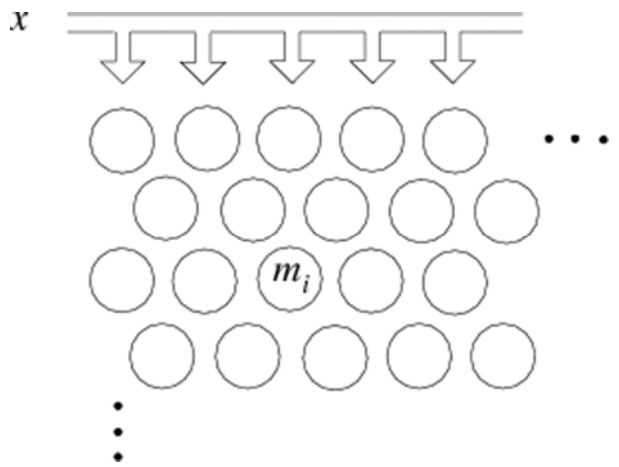

Figure 3: Grid of nodes in two-dimensional SOM, where x are data projected onto models mi, where each model is associated to one node

Idea of using geography with SOM is not brand new. There are several examples of SOM algorithms that introduce geography as basic characteristic of data. One of successful ones is work of scientists from School of Statistics and Information Management of New University of Lisbon (Portugal). Bação, Lobo and Painho engaged with possibilities of using SOM for determination of homogenous regions and detection of spatial patterns (Bação *et al.*, 2008). They have explored idea of creating tool that enables user to explore spatial data, with emphasis on fuzzy nature of most classification methods. Tool would enable „What if?" types of analysis and would have visualization of results. Based on these settings, they developed GeoSOM (Bação *et al.*, 2008), tool that have several variants of basic SOM algorithm incorporated: classical SOM, hierarchical SOM and GeoSOM, adjusted for processing of spatial data.

Problem of determination of regions opened both problematic and opportunistic questions in geography. On one hand, bad effects of strict regionalization with administrative and statistical regions are great ballast for geographic research (Openshaw 1984; Fotheringham and Wong 1991; Amrhein 1995), while on the other hand possibilities have opened to use them for the development and evolution of informatics and math, and transformation of problem into significant tool for spatial analysis (Openshaw 1984; Wise *et al.* 1997; Guo *et al.* 2003). Basic premise for definition of homogenous regions is typology of regions. Hagget *et al.* (1977) suggest three types of regions: uniform regions, nodal regions and planning regions. Planning regions are designed in advance, with defined purpose, such as census tracts, or planning regions etc., while uniform and nodal regions are of more explorative nature (Bação *et al.*, 2008). Differences between regions can have significant influence on development of algorithms, because algorithms for uniform and nodal regions must enable larger interaction on researcher-system relation (Bação *et al.*, 2008).

The most important step of SOM training algorithm in establishing the system to define which samples are grouped, is the one where Best Matching Units (BMU) are being chosen (Bação *et al.*, 2008). In basic SOM it is accomplished by comparison of all components of input data with all components of each unit, while GeoSOM can include spatial coordinates. The importance of spatial coordinates is defined with parameter k, which represents geographic tolerance of processing neighboring data. If k=0, algorithm will recognize the closest geographical location as BMU. If k is equal to size of map, space does not play role in execution of algorithm, so the result is the same as result of basic SOM.

For experiment of delineation of functional urban areas in Serbia with GeoSOM algorithm, software called GeoSOM 2.1 was used. It was developed on School of Statistics and Information Management of New University of Lisbon (Portugal). GeoSOM is capable of executing algorithm of basic SOM, GeoSOM and hierarchical SOM. For input data, polygons of settlements NUTS5 level were used, with attributes from 2002 census for each settlement: total population, active population, active population that is employed, agricultural population, population that is employed in primary, secondary and tertiary sector of economy. Matrix of 8000 neurons has been chosen in system where x=20 and y=40. For geographic component, spatial coordinates of polygon centroid were used. Execution was performed in three iterations: in first basic SOM algorithm was executed (Figure 4), in second GeoSOM algorithm with geographical tolerance k=0 was executed (Figure 5), and in third GeoSOM algorithm with geographical tolerance k=2 was executed (Figure 6). Finally, hierarchical SOM which combines results of first and second iteration was executed (Figure 7)

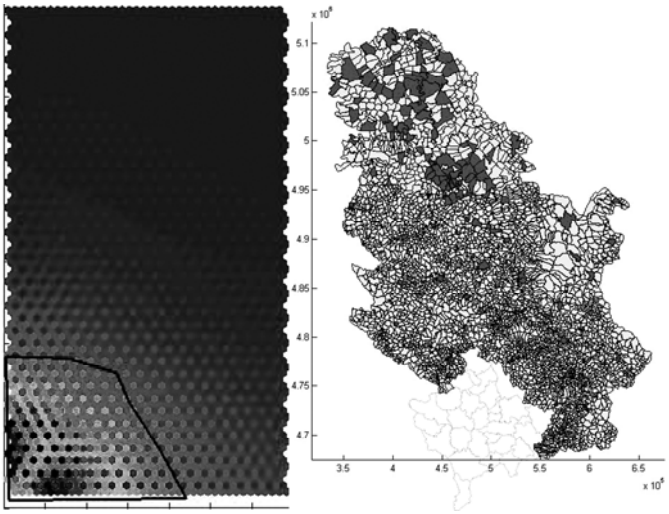

Figure 4: SOM matrix of neurons and resulting cluster pointing to urban centers of Serbia (light grey – processed data, dark grey – results, white – no data)

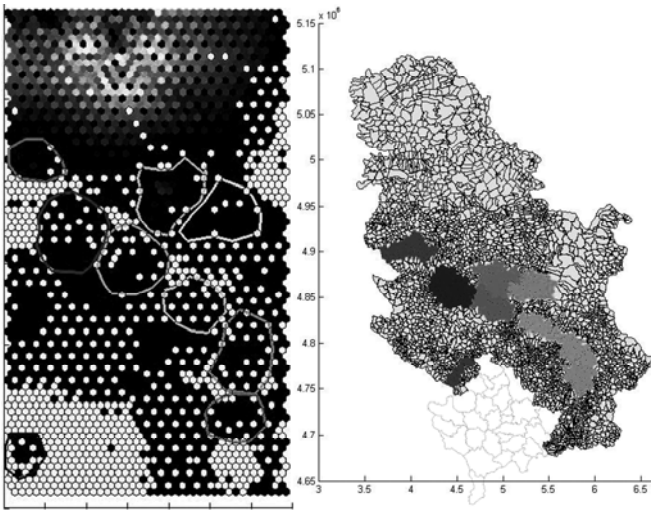

Figure 5: GeoSOM matrix of neurons and some chosen clusters for k=0 – full respect of geographical neighborhood, so clusters are spatial continuous in all directions (light grey – processed data, darker shades of grey – results, white – no data)

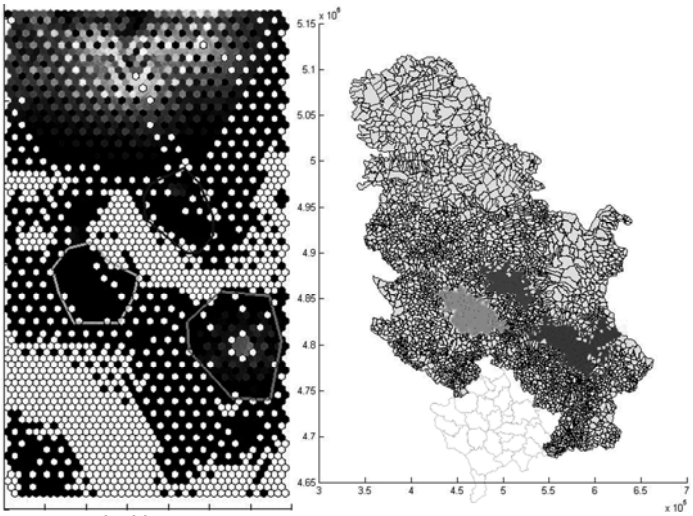

Figure 6: GeoSOM matrix of neurons and some chosen clusters for k=2 – less respect to geographical neighborhood, so clusters are dispersed (light grey – processed data, darker shades of grey – results, white – no data)

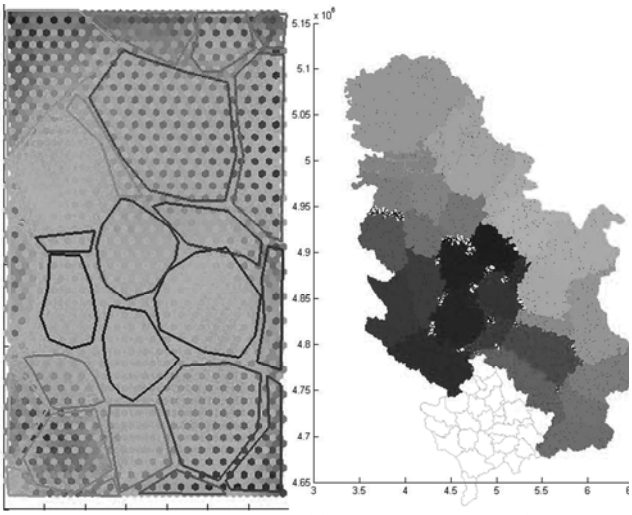

Figure 7: Matrix of neurons for hierarchical SOM which is result of basic SOM - Figure 4 and GeoSOM with k=0 - Figure 5 (light grey – processed data, darker shades of grey – results, white – no data)

COMPARATIVE ANALYSIS OF MACHINE LEARNING METHODS AND RESULTS AGAINST ESPON METHOD FOR DELINEATION OF FUNCTIONAL URBAN AREAS

Analysis of *k*-means clustering method

K-means clustering method implies clustering of points around centroid of respective cluster. It represents the most famous and most commonly used algorithm for clustering. Its strength is in its own simplicity and efficiency, while weaknesses are represented through its basis: initial centroids. They can have great impact on results, and it is the essential problem to choose them correctly. The number of initial centroids defines the number of clusters to be created, so the results are limited to that number. Problem is, also, geographical isolation of certain points, which can have impact on size and shape of clusters.

In two iterations of CrimeStat 3.0 software with earlier described settings, results of 25 clusters were generated, for each iteration respectively: one with user-defined initial centroids and other with software's initial centroids. Level of urbanity according to model of Tošić (2012) was used as weight, while 2002 population size was used as intensity. Resulting clusters (Figure 2) from both iterations are different in size and shape, but also in resulting centroid which varies from initial centroid. This is the result of repeating of the algorithm steps until state of convergence is achieved. The result of iteration with user's predefined initial centroids is that those centroids can belong to one or more clusters. Spatially, they can be located on the edge of cluster or in its center, while there are cases that some clusters do not have any of 25 predefined initial centroids – urban cores. The weakness of this method is also in limited amount of features attributes that can be used in algorithm. CrimeStat 3.0 can use only 2 attributes, in this case level of urbanity and population size, while other tools can use more feature attributes, but results become unclear.

Analysis of Self-Organizing Maps method

Self-Organizing Maps (SOM) project data on regular, usually two-dimensional matrix of nodes – neurons, where data are mapped to neuron whose model is calculated with SOM algorithm and is most similar to data, e.g. is closest to data in some measure. Numerous variants of SOM algorithm exist, with small or large changes against basic algorithm. Some variants include geographical characteristics of statistical data, based on first law of geography. This is how GeoSOM tools have been made, and which were used in this experiment. There are also hierarchical SOM algorithms, which combine results of multiple SOM and those results are being projected to higher level SOM, so lower level SOMs can be specialized for different aspect of data, enabling more intuitive interpretation of data. If georeferenced data are used, it is wise to use geographical coordinates as direct input for highest level SOM together with summarized information of lower level SOM.

Such method has been implemented through GeoSOM 2.1 software. Input data were polygons of settlements with attributes from 2002 census. Several iterations were performed. The first iteration was with basic SOM algorithm, and results were clusters which present statistical characteristics of data, but not geographical. This is how urban centers of Serbia were determined through first cluster, while other settlements were grouped into 6 other clusters, according to statistical data. Second iteration included GeoSOM algorithm: geography has been used as input. Algorithm has been executed against same data with variations of *k* parameter from values 0 to 2. This parameter explains the extent to which the principle of geographical neighborhood will be used, so when value is 0, the principle is absolutely important, and resulting clusters are continuous in all directions. With value of 2, this principle becomes less important and resulting clusters become more dispersed. Finally, hierarchical SOM algorithm has been executed against results of basic SOM (Figure 4) and GeoSOM with $k=0$ (Figure 5). The results are homogenous regions in Serbia, clearly determined in neuron matrix. Using this method, 27 homogenous regions of Serbia were determined. Advantage of this method is that there is no limit in number of attributes used and also more intuitive analysis of specific data in different SOM algorithm, which can ultimately be combined and projected into hierarchical SOM.

ESPON method

ESPON methodology (ESPON, 2005) implies existence of urban core with at least 15,000 inhabitants and area with at least 0.5% of population of a country, with functions of national or regional importance. Isochrone of 45 minutes of car travel through road network is calculated from urban core towards periphery. Resulting isochrone area is approximated on NUTS5 level, so at least 10% of territory of respective settlement must be under isochrone area to be considered as part of FUA. As a final result there is PUSH area, which can be overlapped with neighboring PUSH areas.

There were 49 FUA identified with this method (Figure 8), whose areas do overlap. Population size and isochrone have great impact on results, but usage of other data should be examined, such as daily migration or settlement typologies. Also, reduction of input parameters of population and isochrone should be examined, e.g. increasing the population size of urban core to 20,000 inhabitants and usage of 30 minute isochrone.

Comparative analysis

Analysis of used methods and results points out significant differences in basic premises of each method. Although each of them treats the same space and data, results are different. Results represent regions whose area and shape are predisposed by spatial component of central places; such is with *k*-means and ESPON method. On the other hand, SOM uses principles of analysis of statistical data with spatial component, without predefined central place as initial core around which delineation of city limits should be done. Example is city of Kraljevo (Figure 9), where results of each method are being shown. SOM method gives area of 3,020 km^2 and population of 266,000 inhabitants, while k-means gives area of 2,145 km^2 and population of 346,000 inhabitants. ESPON method gives area of 3,415 km^2 and population of 515,000 inhabitants. These results should be taken into account with reserve, because PUSH area of Kraljevo includes two neighboring large urban centers, Čačak and Kragujevac, and smaller ones - Vrnjačka Banja and Trstenik, so population size is significantly enlarged. *K*-means also includes territory and population size of neighboring centers, while SOM gives the most realistic results, since principle used determines homogenous regions, in this case nodal ones.

Comparison of results shows that methods give different output, but surely there is place for combining methods. This is especially case with SOM and ESPON, since there is a possibility of combining multiple statistical data for same territorial unit– NUTS5 level, and intuitive analysis of data over multiple dimensions can be used. Also, different principles of spatial analysis can be combined: first law of geography, and principles of mobility and accessibility. It is necessary to continue research in area of Self-Organizing

Maps and determination of homogenous regions with focus on enlargement of used attributes and fine tuning of algorithm, and in combination with other methods of spatial statistics and artificial intelligence.

CONCLUSION

Functional urban areas as basic blocks of polycentrism in EU space are determined by using different methods from country to country. ESPON gave standard method which presumes existence of urban core with 15,000 inhabitants at least and important functions, around which isochrone of 45 minutes travelling by car is delineated. Resulting area is approximated to NUTS5 level, where the principle where at least 10% of NUTS5 unit must be covered by 45 minute isochrones, so it can belong to respective PUSH area. Neighboring PUSH areas can overlap and that overlap represents area with high potential for integration.

In addition to this method, there are other methods that can be used for delineation of FUA. Some of them originate from artificial intelligence, grouped into machine learning tools. The best known are clustering algorithms and artificial neural networks.

K-means clustering algorithm is one of most famous, which works on principle of grouping points around centroid of respective cluster. Its strength is in simplicity and efficiency, but weakness is in its basis: initial centroids which have great impact on results, so they must be chosen well. Number of initial centroids defines the number of resulting clusters, so method is limited to that number. Also, position of geographically isolated points can impact shape and size of clusters. *K*-means algorithm was executed within CrimeStat 3.0 software on centroids of settlements of Serbia with integrated data of 2002 census and some calculated indexes, such level or urbanity is. Two iterations have been performed: one with 25 user predefined initial centroids of settlements with important administrative functions, and second one where software calculated initial centroids. Results gave 25 clusters – polygons of different size and shape, which in most cases do not take into account the importance of statistical data, but just principle of proximity.

From group of neural networks, algorithm of Self-Organizing Maps (SOM) was explored. It performs projection of data on matrix of nodes-neurons, while data are mapped to neuron whose model is calculated with SOM algorithm and is most similar to data, e.g. is closest to data in some measures. There are numerous

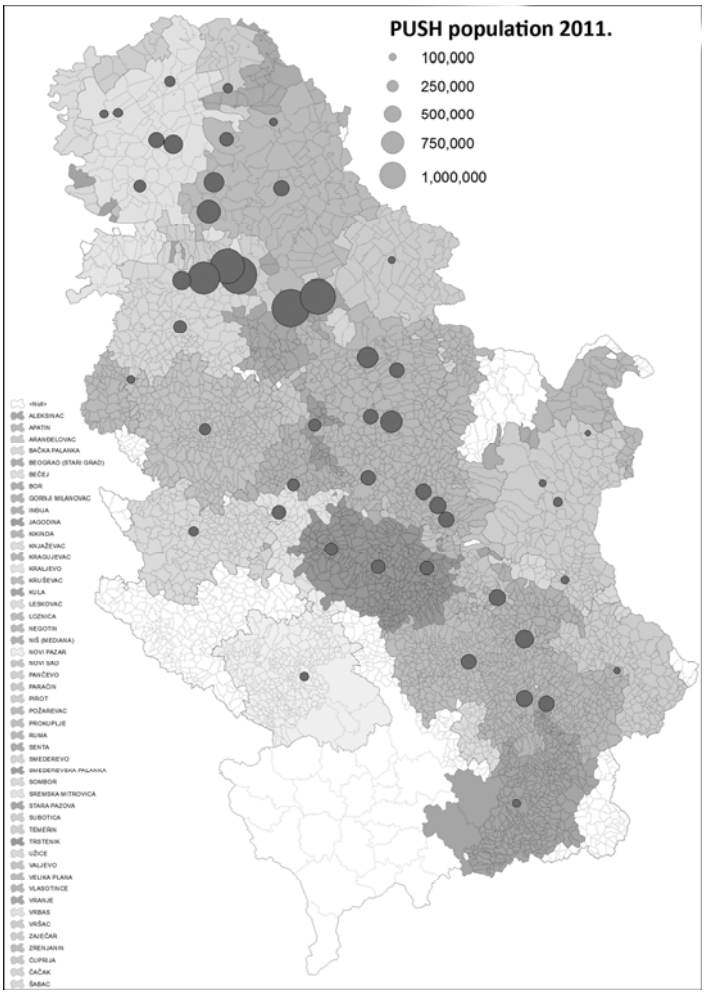

Figure 8: PUSH areas of Serbia and population size according to 2011. Census

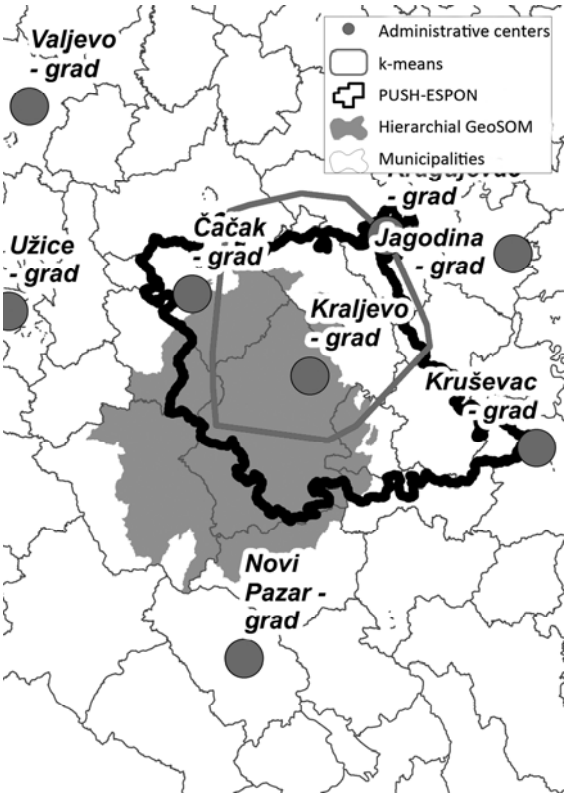

Figure 9: Comparation of FUA Kraljevo gained with methods ESPON, k-means clustering and GeoSOM

variants of SOM, with smaller or greater changes of basic algorithm. Variant which includes geographical characteristics of statistical data based on first law of geography was used in this paper. Those are called GeoSOM tools. There are also hierarchical SOM algorithms, which combine results of multiple different SOMs, so resulting data are projected on higher level SOM, which enables that each lower level SOM can be specialized of specific aspect of data, and give more intuitive interpretation of data. If input is represented with georeferenced data, it is wise and recommended to use geographical coordinates as direct input to higher level SOM together with summarized information of lower level SOMs. SOM has been executed through variant of basic SOM algorithm with input of settlement polygons (NUTS5 level) with 2002 census data incorporated. Then, data were projected onto GeoSOM where variance of parameter k between values 0 and 2 has been used to define level of importance of geographical neighborhood. Results from both iterations were then executed within hierarchical GeoSOM, which gave output of 27 homogenous nodal regions.

Used methods and respective results were compared, and conclusion is that neither method gives exclusively good results. *K*-means should not be applied for purpose of delineation of functional urban areas, since it is limited to attribute data that can be used and is simple expression of proximity of points in space, while central point is moveable. SOM algorithms represent excellent basis for purpose of delineation of FUA, especially if they are combined into hierarchical GeoSOM, where it is possible to specialize multiple different SOM algorithms for specific sets of spatial and statistical data. Research in this direction will be continued, together with fine tuning and change of algorithm, and combination with other methods of spatial and statistical analysis.

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SUPPORT OF LOCAL ENTREPRENEURSHIP: AN EMPIRICAL INVESTIGATION FOR SERRES-GREECE

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This paper is divided into two parts, one theoretical and one empirical. The research deals with entrepreneurs that received loans from National Fund for Entrepreneurship and Development (ETEAN in Greek language). ETEAN provided enterprises with non interest or low interest loans based on state guarantees. The main objective of this research is to examine the project\'s effectiveness and its contribution into local development on Regional Unity of Serres, Central Macedonia, Greece.

The first part is divided into two sections. A comparative analysis of guarantees to small and medium enterprises (SME's) is presented in the first part referring to the European Union and in the second part to Greece. Particularly, in the first section of our paper presented data concerning guarantees provided in the EU. At the second section presented data which indicate the role of ETEAN's programs into the contribution of local development in Greece and the moral hazards due to state provided guarantees. Furthermore, obstacles that entrepreneurs face when they applied for guarantee loans are analysed in this part. Our data were extracted during the last three years by the extensive use of web links on the internet. Most data were taken from the websites of above mentioned ETEAN, the Pan-European Gateway to Business and Innovation Financing, the Gateway to European Research and Development and B.I.S.

At the second part presented the results of our research based on 200 entrepreneurs in Serres who receive loans from ETEAN. The results analysed with the use of descriptive statistical methods and correlations.

It is noticeable that businessmen's answers are similar to those deduced from the results of the researches that have been referred to in bibliography.

In the final part of this paper the main conclusion is pointed out and that is that those programs which provide enterprises low interest or non interest loans support local development.

Key words: ***loan providing funds, state guarantees, local entrepreneurship, regional development, Regional Unity of Serres.***

INTRODUCTION

It is common ground that Small and Medium Enterprises (SME's) constitute the main employment provider sector in the Greek economy and have a major contribution to the formation of the development potential of the Greek economy. The development of the enterprises depends heavily on the existence of loan able funds. Taking under consideration to the fact that the survival and the development of almost every enterprise is critically determined by the fund availability, this research deals with entrepreneurs that received loans from Greek Guarantee Fund for Small and Very Small Enterprises (TEMPME in Greek language). TEMPME provided to enterprises non interest or low interest loans based on state guarantees.

This paper is divided into two parts, one theoretical and one empirical and attempts to examine the project's effectiveness and its contribution into local development on Regional Unity of Serres, Central Macedonia, Greece.

At the theoretical first part of our paper which is divided into two sections, we will present a comparative analysis of guarantees to small and medium enterprises (SME's) to the European Union and to Greece. Particularly, in the first section of our paper presented data concerning guarantees provided in the E.U. and at the second section presented data which indicate the role of TEMPME's programs into the contribution of regional development in Greece. European Union supports SME's through various programs aiming simultaneously at the increase of total employment and competiveness of European economy. In Greece during the time passage the existing developmental back up laws did not succeed in the creation and

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maintenance of a balance between country growth and development, and the substantial fostering of major innovation projects.

Our data were extracted during the last three years with the extensive use of web links on the internet. Most data were taken from the websites of above mentioned TEMPME, the Pan-European Gateway to Business and Innovation Financing, the Gateway to European Research and Development and B.I.S. Furthermore, obstacles that entrepreneurs face when they applied for guarantee loans are analysed in this part. According to Piperopoulos (2007:118-121) "The main obstacle for the 13% of SME's is access to funds".

At the empirical second part are presented the results of the questionnaire-based research from 186 local entrepreneurs at Serres. We focused only on these enterprises which received loans from Greek Guarantee Fund for Small and Very Small Enterprises (TEMPME). We will analyse the results using statistical methods and calculate the average, the standard deviation, the coefficient of variation and the coefficient of correlation. We will also refer to crisis in poor regions.

It is worth referring to the fact that entrepreneurs' answers are similar to researches that have been referred to in bibliography.

Finally, the main conclusion is pointed out and that is that programs which provide enterprises with non-interest or low interest loans support regional development.

GUARANTEES FOR SME'S

Guarantees for SME's on EU

European Union recognizes the significant role of Small and Medium Enterprises. Furthermore, EU takes under consideration the fact that access to funds is vital not only for a new entrance but also for a mature business's expansion. Thus EU provides financing to SME's either using direct subsidises, either providing low or non-interesting loans or even providing state guarantees. EU also finances specific projects. The financing of the EU can be divided into two categories:

1) The Direct financing through subsidies is implemented primarily by through European Structural Funds. The European Regional Development Fund (ERDF) supports the development and structural adjustment of regional economies by helping small businesses and promoting the entrepreneurial spirit. The initiative called JEREMIE (Joint European Resources for Micro-to-Medium Enterprises) aims to improve access to finance for SMEs in less developed regions contributing to the creation of new businesses, especially in innovative sectors of activity. JEREMIE proposes guarantee loans together with own resourcing funding and venture capitals. The funds are provided through financial intermediaries, banks and investment funds, in particular through the European Investment Fund and the European Investment Bank (EIB). Furthermore, another special support instrument is the so-called programme JESSICA (Joint European Support for Sustainable Investment in City Areas), that is an initiative of the European Commission developed in co-operation with the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). It supports sustainable urban development and regeneration through financial engineering mechanisms. EU countries can choose to invest some of their EU structural fund allocations in revolving funds to help recycle financial resources to accelerate investment in Europe's urban areas.

2) The Indirect financing provides enterprises better access to funds through financial intermediaries. The European Investment Fund (EIF) ensures the proper management of the resources on behalf of the Commission and EIF interventions through financial intermediaries, banks and investment funds, thereby reassures the proximity of funding. The main function of the EIF is to facilitate SME's access to finance through borrowing, i.e. through loans and leasing. Among others, IEF guarantees loans for developments which are considered to have an increased risk, (for onstance loans for information and communication technologies - ICTs). Finally, IEF also offers guarantees for micro loans (less than EUR 25,000), overcoming the fact that such loans present a high risk and low profitability.

It is worth referring on this point to the venture capitals which provide funds to companies which are either in the early stage of development of new products or services or in the expansion stage. For investments in venture capitals, the EU uses financial instruments created specifically for this purpose. E.U. provides risk capitals through a mechanism called GIF (Gateway for Bussiness and Innovation Financing) which is funded by the Framework Programme for Competitiveness and Innovation. GIF manages the funds on behalf of the European Commission by using the European Investment Fund (EIF), a financial institution in the EU with significant experience in venture capital investments. Finally, at the list of funds that EU supports, Greece does not have any presence.

The role of National Fund for Entrepreneurship and Development

During last years (1-1-2009 up to 7-4-2010) enterprises in Greece have been supported by the Greek Guarantee Fund for Small and Very Small Enterprises (TEMPME in Greek language) which provided enterprises with non interest loans (at the first Cycle of the program) or low-interest loans (at the second Cycle of the program) loans. Since February 2011, TEMPME has been substituted by the National Fund for Entrepreneurship and Development (ETEAN SA in Greek language). TEMPME was an a form of anonym society. The share capital rose up to €1.712,885,700. According to the low 3066/2002 TEMPME's basic aim was to support Small and Micro enterprises when they struggle for loans. TEMPME provided to enterprises state guarantees up to 80% of the amount of credit. Thus, banks could undertake loans which could be characterized as high risk ones. Furthermore, TEMPME supported innovated activities. The great majority of the enterprises which have been benefited from TEMPME are located at Athens (Attica) or Thessaloniki (Central Macedonia).

As we presented in Table 1, the great majority of the enterprises (92.55%) have been benefited from the TEMPME programmes (or ETEAN) Therefore, our research focused on those enterprises which took loans from TEMPME.

In Table 2 we present the total amount of credit, the total amount of guarantees, the number of loans, the loan average and the number of employees who occupied by the two phases of the TEMPME programmes.

The main condition at the first Cycle is that every enterprise should have achieved 3 profitable financial years in succession during last three years at their profit and loss accounts. As a result of the previous strict condition, micro and new enterprises were excluded from the benefit of the non-interest funds. The condition at the second Cycle that every enterprise should succeed in achieving a positive profit mean of its last three financial years in succession (especially the years 2005, 2006, 2007), in their profit and loss accounts, finally allowed more business to benefit from the low-interest loans. In any case new enterprises have been excluded from this programme. Furthermore, according to Porter (1988:223) "As a result of newness, the high level of uncertainty, customer confusion, and erratic quality, the emerging industry's image and credibility with the financial community may be poor". In addition, according to Piperopoulos (2007:118-121) "new entrepreneurs are more likely to suffer from insufficient fund availability". In Table 4 we present the number of TEMPME

loans/ number of employees in the enterprise. We came to the conclusion that the number of the micro enterprises which were benefit from the programme raised from 69.61% at the first cycle to 74.5% at the second cycle of the programme.

In Table 3 we present the number of TEMPME loans per number of employees in the enterprise. At the first cycle of the programme 69.61% of the enterprises occupy less than 5 employees while at the second cycle of the programme 74.5% of the enterprises occupy less than 5 employees.

In Table 4 we present the amount of credit / number of employees in the enterprise. It is obvious that at the first cycle of the programme only 43% of the total amount of credit supported micro enterprises while at the second cycle of the programme the total amount of credit which supported micro enterprises rose up to 61%.

To come to the conclusion that the programs' accession conditions become flexible, microenterprises would be assisted more than the larger ones.

Taking the positive role of state guarantees for a granted, state should not disregard the moral hazard both by businesses and banks. According to the law, banks use the same criteria in order to provide funds for enterprises whether there are guarantees or not. Unfortunately, Greek banks provided state guarantee funds not only to those enterprises which had the ability to repay their debt, (the credible ones) but to almost every enterprise, even those enterprises which were likely to go bankrupt. For example, three years ago (September 2010), Greek government provided state guarantees to tomato-industries in order to repay the tomato-producer farmers for the year 2009 (that is to say tomato-industries owed money to tomato-producer farmers for a period up to a year). In Serres alone, the guarantees raised to 5 million Euros as it was published in local newspapers. In addition, on one hand, businessmen do not meet its obligations as guarantees are existed and on the other hand, as banks having ensure the liquidation of guaranteed loans they do not force enough their clients.

RESEARCH ON LOCAL ENTREPRENEURS

Methodology implementation- Descriptive statistics and correlations

We will analyze the results using either variables 1 and 2 at the questions with 2 choices or the variables 1 - 6 at the questions with more choices. Thus we will calculate the

Table 1. Programmes from 01-01-2004 up to 30-6-2011 (in Euro) (Source: www.tempme.gr)

Programmes	Loan	%	Guarantee	%	Number	%
L01	107,685,436.77	1,87%	72,823,196.78	1,60%	1234	1,92%
L02[1]	175,098,872.88	3,04%	117,766,846.02	2,58%	1651	2,57%
L03[1]	49,138,979.59	0,85%	31,903,255.96	0,70%	281	0,44%
L04[1]	29,004,262.83	0,50%	18,370,185.35	0,40%	1627	2,54%
L05[1]	455,000.00	0,01%	230,000.00	0,01%	3	0,00%
L07[2]	3,234,968,175.48	56,12%	2,587,974,540.38	56,72%	27069	42,18%
L08[3]	2,043,512,795.03	35,45%	1,634,810,236.02	35,83%	30308	47,22%
L09[4]	6,889,182.72	0,12%	5,511,346.18	0,12%	262	0,41%
L10[5]	103,867,166.73	1,80%	83,093,733.38	1,82%	1601	2,49%
M06 (leasing)[6]	14,232,128.95	0,25%	9,962,490.27	0,22%	145	0,23%
total	5,764,852,000.98		4,562,445,830.34		64181	

[1] The L01, L02, L03, L04, L05 and M06 are programs for the years 2004-2008 concerning guarantees for long term loans.
[2] The L07 is the TEPMPE program –A΄ Cycle which started on 1-1-2009 and ended on 8-4-2009
[3] The L08 is the TEPMPE program –B΄ Cycle which started on 9-4-2009 and ended on 31-12-2010
[4] The L09 is a program which started on 01-09-2010 and ended on 31-12-2010 concerning guarantees which de used for repaying taxes.
[5] The L10 is a program which started on 01-09-2010 and ended on 31-12-2010 concerning guarantees which de used for buying commerce.
[6] The M06 is a program for the years 2004-2008 concerning guarantees for leasing.

Table 2. Total first and second phase, from 30/12/2008 up to 07/04/2010 (in Euro) (Source: www.tempme.gr)

Amount of credit	Amount of guarantees	Number of loans	Loan average (in €)	Total number of employees	Average: employees/ enterprise
5,225,963,391.83	4,180,770,713.46	56,445	92,585.05	231,066	4.09

Table 3. Number of TEMPME loans /number of employees in the enterprise (Sourse: www.tempme.gr)

TEMPME	Number of employees in the enterprise	Number of loans	Percentage of loans
A΄ CYCLE	**A**. 0 - 4	18843	69.61%
	B. 5 - 9	4012	14.82%
	Γ. 10 - 20	2684	9.92%
	Δ. 21 - 49	1530	5.65%
B΄ CYCLE	**A**. 0 - 4	21886	74.5%
	B. 5 - 9	4271	14.54%
	Γ. 10 - 20	2387	8.13%
	Δ. 21 - 49	832	2.83%

Table 4. Amount of credit /number of employees in the enterprise (Sourse: www.tempme.gr)

TEMPME	Number of employees in the enterprise	Total amount of credit	Percentage of loans	Average Amount of credit
A΄ CYCLE	A. 0 - 4	1,391,926,673 €	43.03%	73,869.7 €
	B. 5 - 9	701,847,774 €	21.7%	174,937.13 €
	Γ. 10 - 20	670,863,628 €	20.74%	249,949.19 €
	Δ. 21 - 49	470,330,100 €	14.54%	307,405.29 €
B΄ CYCLE	A. 0 - 4	1,213,743,642 €	60.96%	55,457.54 €
	B. 5 - 9	412,218,191 €	20.7%	96,515.61 €
	Γ. 10 - 20	266,490,463 €	13.38%	111,642.42 €
	Δ. 21 - 49	98,542,920 €	4.95%	118,441.01 €

main descriptive statistical measures, the average, the standard deviation and the coefficient of variation. We will also calculate the statistical moment of distribution, the coefficient correlation.

Data

We addressed only to those enterprises which were benefited from the TEMPME programmes. The participants in the following research were 200 entrepreneurs, but only one hundred eighty six (186) entrepreneurs could give answers to all questions. The research took place from 1-6-2012 to 30-6-2012. Companies administration buildings were situated either in the city of Serres (population 76,000 according to the last census), or in towns seats of the Municipalities, or in small villages (population less than 1,000) or in the national road, or in the Industrial Area. Finally we choose in purpose some entrepreneurs who took loans from bank branches sited at Serres but their administration building is located in another Regional Unity (Local entrepreneurs who invest in a different regional unity like the neighbouring core region Thessaloniki).

Results

The 50% of those companies which participated on this research is located at the city of Serres. In Figure 1 there is depicted the situation of the company's administration buildings.

We have mentioned above to the 2 Cycles of the TEMPME programmes. In Figure 2, we classify the enterprises to the 1st or the 2nd Cycle.

In Figure 3 there is depicted the amount of credit.

Analyzing the results using the variables 1 for amount of credit 5,000-2,0000 €, 2 for amount of credit 20,000-50,000 €, 3 for amount of credit 50,000-100,000 €, 4 for amount of credit 100,000-150,000 €, 5 for amount of credit 150,000-250,000 € and 6 for amount of credit 250,000-250,000 €, at the city of Serres the average is 2.40, standard deviation is 12.25, coefficient of variation is 5.09 and coefficient correlation is 0.99, at towns the average is 2.31, standard deviation is 2.36, coefficient of variation is 1.02 and coefficient correlation is 0.62, at villages the average is 2.02, standard deviation is 5.50, coefficient of variation is 2.71 and coefficient correlation is 0.83, at National Road or Industrial area the average is 3.87, standard deviation is 1.77, coefficient of variation is 0.46 and coefficient correlation is 0.09 and finally at Other Regional Unity the average is 2.80, standard deviation is 1.84, coefficient of variation is 0.56 and coefficient correlation is -0.41. Enterprises sited at villages have the smallest average (2.20) while ones sited at National Road or Industrial area have the smallest average (3.87). There is no correlation between the answers given from entrepreneurs. Taking as a granted that the providing funds are analogue to enterprise's size, we come to conclusion that in villages operate only micro enterprises.

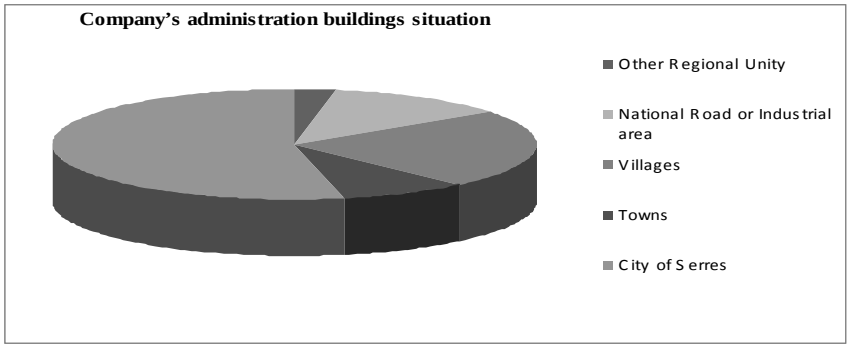

Figure 1. Company's administration buildings situation

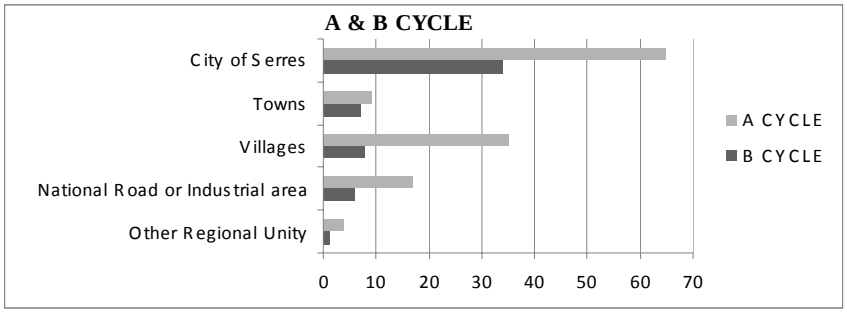

Figure 2. A & B CYCLE

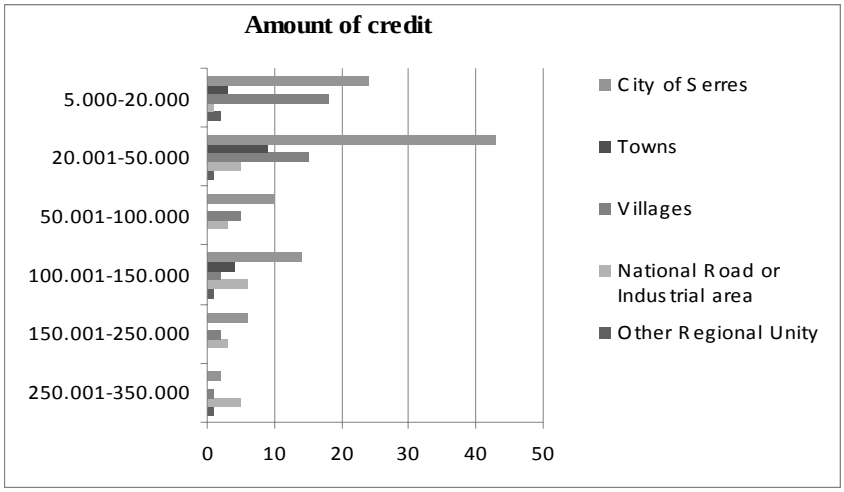

Figure 3. Amount of credit

We pose the question if the loan is performing (PL), no performing (NPL) or bad dept, because our intention was to examine the consequences of the crisis to local entrepreneurs. Taking as a granted that beneficiaries of the TEMPME programme were only profitable enterprises, we consume that crisis is the man reason for the existence of the bad loans. In Figure 4 we present whether the loan is performing, no performing or bad dept.

Analyzing the results using the variables 1 for performing loan (PL), 2 for no performing loan (NPL) and 3 for bad dept (BAD), at city of Serres the average is 1.97, standard deviation is 17.44, coefficient of variation is 8.86 and coefficient correlation is 0.99, at towns the average is 2.44, standard deviation is 3.08, coefficient of variation is 1.27 and coefficient

correlation is 0.63, at villages the average is 1.86, standard deviation is 7.93, coefficient of variation is 4.27 and coefficient correlation is 0.97, at National Road or Industrial area the average is 1.96, standard deviation is 4.71, coefficient of variation is 2.40 and coefficient correlation is 0.87 and finally at Other Regional Unity the average is 1.60, standard deviation is 0.98, coefficient of variation is 0.61 and coefficient correlation is -0.26. It is worth referring to enterprises at towns –seats of the municipalities- which have been more affected from the crisis than other enterprises. To the same conclusion we came with in one of our previous researches in which we wrote 3 years ago: "It is mentionable that crisis affected more the enterprises situated at towns" (Balomenou & Maliari, 2011:108). It is also mentionable that enterprises sited at core regions (as Thessaloniki) have been affected from the crisis less than all. Furthermore, regarding our case study, we observe that crisis is deeper at the poor regions of our Country. Something with that is in reliance to the relevant literature (Konsolas, N. 1997) and (Balomenou. C 2003), (in recession periods, at the great dilemma of regional science "efficiency versus equity" policy makers prefer the criterion of efficiency). Moreover, as it is well known in Regional Science, in periods of recession, the crisis policy responses, focus on more resources in core regions (Konsolas, 1997) and (Coniglio and Prota, 2011) in order, according to Myrdal theory (Balomenou, 2003:132), initially during recession periods, via the procedure of back wash effects (submission of economic resources and mobility of human resources from the periphery to the central / core regions) to straiten the said regions and finally via spread effects (from core/rich central regions to the lagging / poor periphery regions in periods of economical growth to reinforce the lagging areas that are finding it increasingly difficult to cope during economic constructions).

Finally, In Figures 5 and 6 there are presented the starting year of the business and the sectoral activity.

Analyzing the results using the variables 1 for performing loan (PL), 2 for no performing loan (NPL) and 3 for bad dept (BAD), at enterprises which the starting year is up to 1982 (the old ones) the average is 1.67, standard deviation is 2.50, coefficient of variation is 1.48 and coefficient correlation is 0,696, at enterprises which the starting year is between 1983 up to 1992 the average is 1.90, standard deviation is 7.07, coefficient of variation is 3.71 and coefficient correlation is 0.988, at enterprises which the starting year is between 1992 up to 2002 the average is 1.96, standard deviation is 19.13, coefficient of variation is 9.72 and coefficient correlation is 0.976, at enterprises which the starting year is after 2003 (the new ones) the average is 2.12, standard deviation is 5.47, coefficient of variation is 2.47 and coefficient correlation 0.800. In one of our researches 2 years ago which we wrote: "new enterprises not only face difficulties in accessing to funds but in addition they have been more affected by the crisis than the older ones" (Balomenou & Maliari, 2011). Thus both our researches conclude that crisis affected more new enterprises.

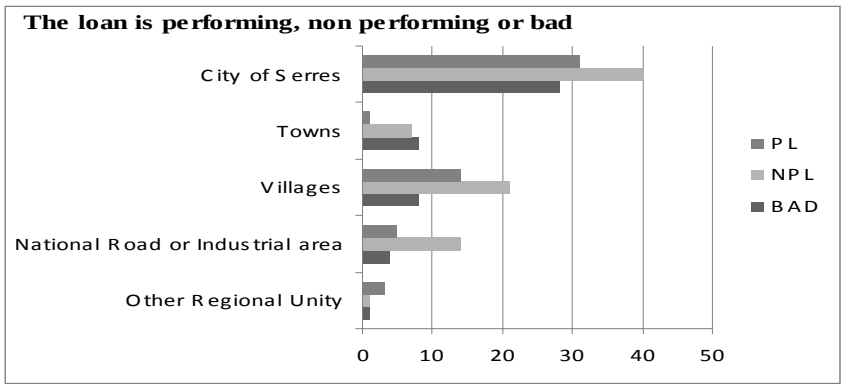

Figure 4. The loan is performing (PL), no performing (NPL) or bad dept

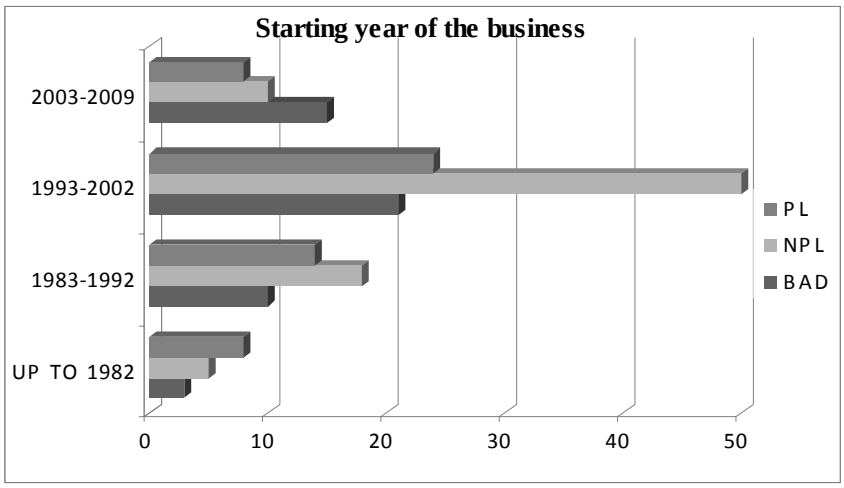

Figure 5. Starting year of the business

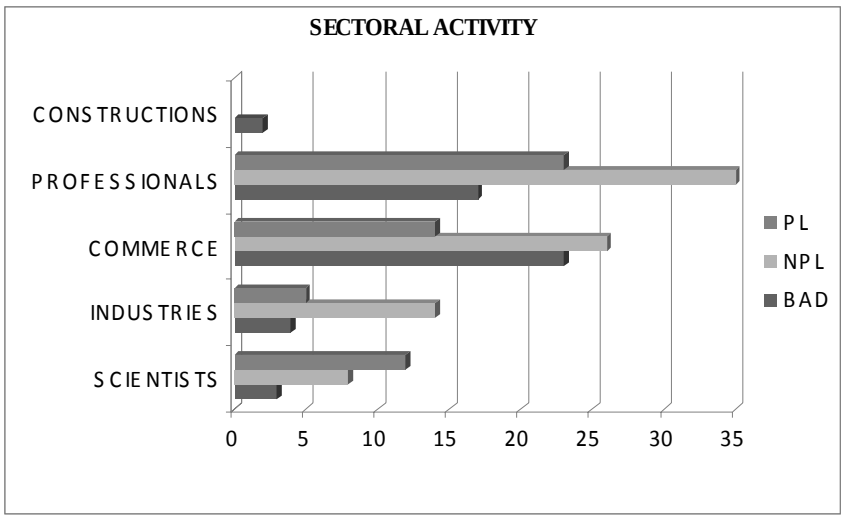

Figure 6. Sectoral activity

Analyzing the results using the variables 1 for performing loan (PL), 2 for no performing loan (NPL) and 3 for bad dept (BAD), at scientists (doctors, lowers etc) the average is 1.608, standard deviation is 4.26, coefficient of variation is 2.65 and coefficient correlation is 0.734, at professionals (plumbers, electricians etc) the average is 1.96, standard deviation is 4.71, coefficient of variation is 2.41 and coefficient correlation is 0.870, at commerce the average is 2.14, standard deviation is 11.15, coefficient of variation is 5.20 and coefficient correlation is 0.950, at industries the average is 1.92, standard deviation is 13,88, coefficient of variation is 7.23 and coefficient correlation 0.993 and at **constructions** the average is 3, standard deviation is 1.21, coefficient of variation is 0.40 and coefficient correlation – **0.68**. It is worth referring to constructions, - although there are only two in this sample - because all these enterprises are bankrupted. Taking under consideration that sub primes is the cause of crisis in USA, it is obvious that the sector of constructions has been affected from the crisis most of all. Regarding enterprises which are managing from scientists, we easily came to the conclusion that scientists repay their debts.

CONCUSSIONS

It is common sense that European Union supports SMEs with several programs. In Greece, the backbone of Greek economy is mainly made up of micro and small enterprises. Greek state supports SMEs with the application of programmes through guarantees. Although Greek Guarantee Fund for Small and Very Small Enterprises (TEMPME) set so strict conditions, that the great majority of micro and new enterprises were deterred from the access to non-interest loans or low interest loans and the use of these guarantee funds by businessmen who could not receive other kinds of loan support to the survival of those enterprises.

The great majority of the enterprises which benefit from the TEMPME programs are the larger Greek Enterprises and not the micro ones. While the dramatic recession, state and banks do not foster enough micro enterprises despite their major contribution to the survival and development to the larger ones. As the beneficiaries enterprises in villages and in small towns are smaller and less than those in Serres, we conclude that enterprises in small villages and towns should have more motives to develop. Profitable businesses can not manage to repay their dept. Therefore we conclude that financial turmoil has severely affected SMEs, especially on low-income regions as Serres.

The majority of new enterprises were excluded from TEMPME programmes. Furthermore the new entrants have severely attacked by the depression. In addition, taking under consideration the sector analysis, the consequences of the crisis are enormous at sectors as constructions.

Coming to an end it is to be deducted that for the last years TEMPME's contribution to the fostering of SMEs was significant. But still the question remains: Is the support of such programs sufficient enough for a balanced development or not?

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FACTORS OF URBAN SPRAWL IN BULGARIA

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Urban sprawl has become a topical urban issue first in North America and later in Western Europe. It turned into a major challenge to urban sustainability. However, sprawl in Western Europe has displayed many specific features different than that in North America and these features are related to the concrete circumstances in the two continents. The social, economic and urban situation in the new European democracies is also quite different and this inevitably has its impact on the forms of sprawl.

One of the main characteristics of sprawl is that it is considered to be market-led. More precisely, a major factor is the lack of balance between market trends and planning policy that allows for the market players to determine the use of their plots in suburban locations with little reference to the public interests and issues of sustainability. As the countries in Eastern and South-eastern Europe have already made certain progress on their way to market society, the problems of sprawl were faced in these countries too.

The goal of the paper is to apply widely accepted definitions of sprawl to the processes in the suburbs of Sofia and, thus, to assess whether these are processes of sprawl. It also aims to study the specific traditions and residential preferences of Sofia's population in order to identify specific characteristics and aspects of the Bulgarian model.

The findings of the paper confirm that Bulgaria's capital Sofia is experiencing processes of urban sprawl, particularly in its southern suburban areas – in the foot of Vitosha Mountain. Next, these processes display strong regional characteristics. So far sprawl in Bulgaria is less intensive than that in Western Europe but also than that in the post-socialist countries in Central Europe and in Baltic states. Eventually, the urban forms of Bulgarian sprawl tend to be denser and with mix of single-family and multi-family residential types and mix of land uses.

Key words: *urban sprawl in Bulgaria, urban market processes, EC urban policy, sustainability.*

INTRODUCTION

For more than two decades urban sprawl has been identified as a major threat to sustainable urban development in North America and Western Europe (Galster *et al*., 2001, Chin, 2002, Couch *et al*., 2007). But is it a problem in Eastern and South-eastern Europe? The urban models, established in Bulgaria and the countries in the region, are very different form the spreading models of American or English settlements (Hirt and Slaev, 2002). However, sprawl represents a serious threat even for countries where the prevailing models are seemingly completely opposite to the sprawling American urban forms. Such, for example, are the Mediterranean cities (Leontidou, 1990) – they are compact forms with very dense urban tissue, still sprawl is a serious problem in Greece, Italy and Spain. In principle, densities of settlements in Bulgaria are not different than those in the neighbouring countries and those in most European. Just like the rest of the former socialist countries in this part of Europe Bulgarian towns and cities are compact, with clear boundary between the urbanized and the rural territories.

In fact, this is an important consideration concerning sprawl. The clear city boundary is an antipode of the sprawling boundary and was one of the main specific features of the socialist city (Hirt, 2007, Bertaud, 2004). The strong control of central planning and the intensive housing forms of socialist urbanisation made the difference between the urban tissue and the rural surroundings quite obvious and easy to tell. The socialist planning system faced no problem even when it decreed for the towns and cities to shrink, like it did in Bulgaria in the early 1980s. On the contrary – in a democratic society it seems to be impossible for central planning to deal with the decentralized initiatives of owners of land in close proximity to the urban fringe. For this reason urban sprawl is considered to be a market-led process (Gong and Wheeler, 2002, Knaap, 2008) closely related to the capability of the market players to determine the use of their plots in suburban locations. The European Environmental Agency (2006), too, defined the market nature of this phenomenon. Eventually, it is not strange that many western authors expected that the former socialist countries will

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face the problems of sprawl with their advance towards the market. Indeed, as the countries in Eastern and South-eastern Europe have already made certain progress in this direction the expected problems have already been observed (Timar and Varadi, 2001, Brown and Schafft, 2002, Nedovic-Budic and Tsenkova, 2006, Hirt, 2007, Slaev, 2010, etc.). However, the social, economic and urban situation in the new European democracies is also quite different and this inevitably has its impact on the forms of sprawl.

The goal of this paper is to investigate how the specific conditions in Bulgaria shape the factors of urban sprawl and how this influences the specific forms of sprawl around Bulgaria's capital city - Sofia. Therefore, the paper, first, should provide a universal definition of sprawl. This is needed in order to identify clearly and definitely whether the processes observed in Sofia are, indeed, a form of sprawl. Secondly, the paper will study the main factors of sprawl. It will then examine with this respect the situation in Sofia. Finally, it will draw conclusions about the specific Bulgarian form of urban sprawl.

DEFINING URBAN SPRAWL IN BULGARIA

A definition that comprises all essential components of urban sprawl and, also, is relevant to the goals of this research, would be:

Urban sprawl is a market-led, unplanned process of inefficient physical expansion of urban areas into **the surrounding rural or natural lands that is characterized by:**

- **Low density of new developments, patchy, scattered forms, with a tendency for discontinuity**
- **Poor mix of different land uses and urban activities, lack of well-defined, thriving activity centres, hubs of public services and commerce**
- **Insufficiently covered by public transport services.**

This definition, on one hand, is based on most widely accepted studies of urban sprawl (Gottdiener, 1977, Hall, 1997, Brueckner, 2000, Galster *et al*., 2001, Chin, 2002, etc.). Therefore, it does reflect the essence of the "classic" form of this phenomenon. On the other hand, when applied to urban processes in Bulgarian cities Sofia, Varna, Burgas, Plovdiv, etc. it would allow for identifying the differences, between Bulgarian sprawl and its "classic" form.

Considerations that underlie the proposed definition should be outlined as follows:

The first characteristic of urban sprawl is that it is a physical expansion of urban areas into the surrounding rural or natural lands. This characteristic is essential for urban sprawl. Besides, it is closely related to another component of the definition – the low density suburban developments, patchy, scattered forms, with a tendency for discontinuity. However, there seems to be a considerable difference in the treatment by European and American researchers. Among all American authors quoted here, only Galster *et al*. (2001) mentioned the expansion as a key element of the studied phenomenon. Chin (2002) found that the term "expansion" was used to describe more compact forms of sprawl mainly in earlier definitions from the 1950s and the 1960s (Chin cited Self, 1961, Gottmann and Harper 1967, Gottdiener, 1977, Hall, 1997). On the contrary – in Europe the tradition of regulation boundaries or other types of urban borderlines such as green belts makes the expansion of urban areas visible and obvious, so it is always a basic feature of sprawl (EEA, 2006, Couch *et al*., 2007).

Another feature of sprawl of key importance is that it is an urban process producing inefficient urban forms. Many researchers point at the difference between urban growth and sprawl (Cheshire, 2009, Davis and Schaub, 2005, Brueckner, 2000). The trend towards urban growth (that is – the growth of urban population) is, in principle, a positive trend and, what is more – it is an irreversible trend of world development (UN, 2005). Therefore, it is rarely possible for cities to keep the existing boundaries of their urbanized area (UA) in the process of growth of their population. Most urban economists and planners who have worked on this issue (Bertaud, 2004, Anas and Hyok-Joo, 2006, Couch *et al*., 2007) usually consider as a criterion of efficiency whether the gradient of the population density profile is parallel to the gradient of the bid-rent curve of residential properties. The expansion should be considered efficient at least as much as the pattern of urbanization has been before the period of growth, if the slope is kept the same. But if the slope has become less steep – this is inefficient expansion of the type described by Couch *et al*. (2007) and this is a typical case of urban sprawl.

Next feature that should be included in the definition is that it is generated by market forces in combination irrelevant interventions of planning (EEA, 2006, Gong and Wheeler, 2002, Brueckner, 2000, Slaev, 2011). This feature is important because it explains the nature of urban sprawl. The market nature of sprawl can be proved, first, by the negative gradient of the slope (very low densities far from the city centre) and, second, by the very fact that planners have been trying to combat it for more than two decades, but have not managed (Knaap, 2012, Brueckner, 2000). In fact, sprawl is generated by planning too, but by poor planning. The dual role of planning with respect to urban sprawl is a specific issue, as far as planning in many cases provides essential conditions for sprawl by developing transport networks and utilities. However, in other cases planning is the major factor for development of urban forms opposite to sprawl. Bertaud (2004) regarded the positive gradient of urban densities as a proof of powerful, though usually irrelevant, planning interventions.

The low density is most widely recognized (Ewing *et al*., 2002). It is also the main technical (physical) aspect of the poor efficiency of the generated urban forms. The density issue is closely related to the considerations stated above about the population growth of cities and their expansion into their surroundings. In general, if the urban population growth causes expansions of the urbanized area that retain higher or optimal residential densities, that should be assessed positively and would not fall within the definition of sprawl. Therefore, it is necessary to define what should be regarded as efficient or optimal densities, because, apparently, there is no universal prescription. Optimal densities in the outskirts of Sofia will be probably close to those in Belgrade, but they will certainly differ from optimal densities in the peripheral territories of London or Los Angeles.

Urban forms produced by sprawl are usually described as "patchy, scattered, with a tendency for discontinuity", but in some cases they are described as "continuous" or as "endless", which has a meaning different from "discontinuous" (Ewing *et al*., 2002, Galster *et al*., 2001, Slaev, 2010). While in the USA both "endless" and "discontinuous" sprawled urban forms could be observed, in Europe territories –subject to endless sprawl are rare exceptions (see Urban Sprawl in Europe, EEA, 2006). European sprawl results in typical "patchy and scattered" developments. "It leap-frogs over areas, leaving agricultural enclaves". The traditions of compact urban forms in South-eastern Europe, however, are likely to influence the form of sprawl of Balkan cities.

The next feature of urban sprawl is the poor mix of uses and different urban activities and the lack of thriving suburban centres, which also means poor integration of the dwelling function

with sectors of industry (mainly tertiary) thus providing jobs. But again – this aspect demonstrates considerable differences between the classical problems, typical mostly for American and West European cities, while the situation in South-eastern Europe is different (Leontidou, 1990).

One more feature of sprawled urban forms should be outlined here. It is related to the system of communications, the access to suburban developments and properties and the automobile dependency (Song and Knaap 2004, Ewing *et al*., 2002), Newman and Kenworthy 1999, etc.). With this respect, too, some significant differences can be identified between the "classical" American approach, the European approach and the approach, relevant to South-eastern Europe. American authors usually consider shorter distances between urban zones, better connectivity leading to more walking and biking, fewer vehicle miles travelled or a network of interconnected streets with shorter blocks that allow greater accessibility and a broader choice of routes for drivers, pedestrians, and cyclists and better access to the light railway station (Ewing *et al*., 2002, Song and Knaap, 2004). The European approach seems to be more radical, insomuch as to adopt critical attitude to the development of road infrastructure in the peripheral territories. The EEA study (2006) even suggests that the development of the road network in the suburban areas might be a stimulus for sprawled urban forms. Therefore, the stress should be put on the system of public transport services in the peripheral zones of the cities.

FACTORS OF URBAN SPRAWL

Main factors causing urban sprawl

Chin (2002) observed that "in recent academic literature the major focus is on the effects of sprawl, with little discussion of its causes". Yet, while one may agree that there is certain misbalance in the respect commented by Chin, still considerable research has been carried out on the causes and factors of sprawl. Four main causes/ factors should be considered – the population growth of cities, the residential preferences of the population, market forces and mechanisms and the role of planning.

1. **The population growth** is a powerful factor to increase the demand for housing. The lack of sufficient supply of housing in the central cities results in high rates of housing construction in the periphery, where land is available (Chin, 2002). On the other hand, as it was already stressed when the definition was explained, urban sprawl is growth of the built-up area, which outpaces the population growth, so the latter may not be the main cause of sprawl.

2. **Residential preferences** - There is a clear consensus among researchers that residential preferences are the major factor causing sprawl. Residential choices have been fuelled by higher levels of income, increased personal mobility and improvements in transportation. As Audirac *et al*. (1990) have concluded

*"the ideal of owning a single family home, the need for an adequate environment for raising a family, a strong desire for privacy, and the appeal of a rural ambiance are among the most prominent reasons for choosing suburban and exurban locales." (*Audirac *et al*., 1990:473)

EEA (2006) has also observed that "historically, the growth of cities has been driven by increasing urban population. However, in Europe today, even where there is little or no population pressure, a variety of factors are still driving sprawl. These are rooted in the desire to realise new lifestyles in suburban environments, outside the inner city". These conclusions have been supported by many consumer preference surveys (Krisjane and Berzins, 2012, Hirt 2007, Audirac *et al*., 1990). EEA report (2006) found that "the mix of forces include both micro and macro socio- economic trends such as the means of transportation, the price of land, individual housing preferences, demographic trends, cultural traditions and constraints, the attractiveness of existing urban areas, and, not least, the application of land use planning policies at both local and regional scales".

3. **The role of the market** has become obvious as soon as housing demand had been mentioned in relation either to population growth, or to preferences. Brueckner, 2000, Self, 1961, Audirac *et al*., 1990, and others analyze the urban sprawl caused by consumer demand and other market related factors. Many of those authors support the free market approach, but the point is that the impact of the market can be shaped so that to manage and steer the process within certain limits. For this reason the market is a factor causing urban sprawl that deserves special considerations and planning has a special role with this respect. According to the EEA report (2006) "overall, evidence suggests that where unplanned, decentralised development dominates, sprawl will occur in a mechanistic way. Conversely, where growth around the periphery of the city is coordinated by strong urban policy, more compact forms of urban development can be secured".

4. **The role of planning** highly depends on the adopted planning objectives, policy and the efficiency of the instruments of their implementation (Nikiforov, 1982, Vujošević, 2007, Slaev, 2010, Slaev 2012, Zeković, 2008, Petrić, 2009). In the process of social transformation the planning system should be adjusted to the context at each stage of its development (Nedovic-Budic, 2001, Nedovic-Budic *et al*., 2012). The role of planning should be considered at several levels. First come the objectives of planning and, particularly, the priority attached to environmental sustainability. A primary goal of society is to provide more goods for all social layers. However, this often contradicts the ideology of sustainability that puts the stress on economical use of natural resources and, especially, land. Second, the planning framework affecting suburban development should be considered usually at two levels – national and local. (The intermediate regional tier rarely provides substantial contribution to the framework). Spatial regional and urban plans are the third essential component of planning. In a democratic market society citizens exercise powers, though more or less limited by the framework, to determine the development of their plots. But the development of infrastructural networks is fully determined by regional and urban plans.

Preferences and motives of urban entities (urban players) for localisation in the suburbs

The reasons for households to locate in the suburbs fall within the same reasoning that would lead their residential choice under any other circumstances. The main reason – the access to jobs in the central business district served as a basis for the development of Alonso's (1960, 1964) theory of the urban land market and, particularly, the households' bid-rent curve. But, of course, it is not only the distance from the CBD and the access to jobs that determines the residential choice. The housing market is characterized by the fact that it offers heterogeneous goods. In fact, each housing unit is unique to a certain extent. Ghatak *et al*. (1996) have come to the conclusion that the main driving forces for this choice are: real wage considerations, employment considerations, considerations related to attractive amenities (public goods, environment, etc.);

While the residential preferences are the key factor for households to locate in the suburbs, companies too have their motives for similar decisions. Gong and Wheeler (2002) in their study on the suburbanization of business and

professional services in the Atlanta Metropolitan Area were able to identify the trade-offs between the external economies in the city and the suburbs that caused suburbanization of local businesses. They found that "the city is the traditional stronghold of advanced economic activities and has the advantage of face to face communication. On the other hand the suburbs have low-cost land, convenient transportation, and pools of highly qualified professionals and flexible female workers". Thus subsectors such as credit reporting and collection services, computer and data processing services, and research and testing have grown rapidly in the suburbs, suggesting the desire to avoid high land costs and to tap suburban labour sources and their ability to operate with minimal face-to-face contacts.

In South-eastern Europe, too, intensive research in this area has investigated the specific reasons for suburbanization of different urban functions in the local context (Nikiforov, 2008, Zekovic and Hadzic, 2006). More than that - special attention had been paid to the issues of efficiency and sustainability with respect to the current social and economic conditions in the region (see Vujošević and Nedović-Budić, 2006, Vujošević, 2009, Petrić, 2004, Maričić and Petrić, 2008, Slaev, 2010, etc.)

In result of the literature survey offered above several categories of reasoning for households and companies to locate on the urban fringe or beyond should be outlined:

a) Motives for suburbanization of the dwelling function (housing) - Households may prefer to live in the suburbs for the following reasons:

- For pursue of higher standard of dwelling, higher life-style (single-family housing)
- For pursue of better environmental conditions (green spaces, open spaces, less noise)
- Because of the lower price of land and housing
- The preference for a holiday /weekend home in order to compensate for stressful urban living
- Ethnic or religious considerations, like those that caused the creation of Muslims, Africans, Chinese or Roma neighbourhoods on the urban fringe of almost all European cities (Slaev, 2007)

b) Motives for suburbanization of industries and commercial activities – Industrial and commercial companies may prefer to locate in the suburbs (Zeković, 2009) for the following reasons:

- Higher profits is, no doubt, the main reason, but it can be broken into further specific considerations, such as:
- Lower price of land and construction
- Need of large spaces for industrial and storage purposes
- Need of large spaces for shopping centres/ malls with large parking spaces for their clients
- For provision of convenient car access for customers / clients of shopping centres and malls

d) Motives for suburbanization of public (social) services - In many cases companies providing social services (health, education, etc.) or local authorities may decide to locate these activities in the suburbs for the following reasons:

- Lower price of land and construction
- Need of large spaces for a hospital, a university or a specialized high school, etc.
- Advantageous environment – open and green spaces, etc.
- Provisions of regional and master plans and local regulations

Market factors generating and accelerating urban sprawl

Markets exercise their impact on urban processes through the pressure of market demand. Issues related to the role of the market and its balance with planning in generating urban sprawl have been studied by many researchers – Lerman, S.R., 1977, McFadden, 1978, Hall, 1997, Brueckner, 2000, Gong and Wheeler, 2002, Cheshire, 2009, Knaap, 2008, are to name but a few. Brueckner (2000) identified three groups of sources of market failure in urban growth related to the processes of sprawl:

- Failure to account for the social value of open space,
- Failure to account for the social value of free way congestion,
- Failure to fully account for the infrastructure cost of new development.

While most researchers would agree that these are the sources of sprawl identified in the language of urban economics, perspectives and views on the possible economic remedies differ enormously. There is an ongoing debate on this issue between two main approaches to its solution. One of the approaches is believed to be typical for urban planners and the other approach – typical for urban economists (Anas, 1992, Brueckner, 2000, Knaap, 2008, 2012). The watershed is whether planning measures are prescribed to cope with urban sprawl or the proposed remedies are local fees and taxes or subsidies.

HOUSING TRADITIONS AND RESIDENTIAL PREFERENCES OF BULGARIANS FORMED THROUGHOUT THE XX CENTURY

Preferences and motives of Bulgarians relating to the development of suburban areas can be best understood if seen in the context of their historical development. A very peculiar case of juxtaposition between the attitudes of Sofia's citizens towards urban growth and West-European attitudes occurred during the elaboration of the first comprehensive master plan of the Bulgarian capital - the Muesmann plan (though, in fact this was the sixth plan of Sofia after 1878) (Kovachev, 2005). In this case, the different approaches of the German architect Adolf Muesmann and the City Hall and the citizens of Sofia manifested significant differences, especially on the issue of urban expansion. From 1879, when Sofia became the capital, by 1936 when the preparation of the Muesmann plan started the town grew from 20,856 to 287,095 inhabitants (NSI, 2009). Such a population growth was considered an expansion that the city could hardly afford. The new suburbs of Sofia had accommodated large numbers of industrial workers and immigrants from the Balkan war (1912-1913) and World War I (1914-1918) so they were shabby and unattractive. That was why at the start of preparation of the master plan the City Hall stated that city boundaries were already too spread out and that any further expansion should be limited (Hirt and Kovachev, 2006).

Adolf Muesmann, however, had a very different view of suburban areas. He was fully committed to an idea established in Germany (and particularly precious to the ruling Nazi party) that a family house with a garden was the best form of dwelling that reflected the traditional national values. Accordingly Muesmann envisaged expansion of the city by large territories of single-family housing. Such a view, however, was not popular with the public and city officials. Under pressure from the City Hall Muesmann revised his views on a number of specific solutions (Hirt, 2007b), but still the territorial expansion remained in size that could not be realized. And it was the major reason for the failure of the plan.

A second important period in the history of urban development in Sofia, which is directly related to the formation of preferences and motives of the people relating to the development of suburban areas, refers to the stage of socialism. During this period the process of socialist industrialization led to the highest rates of population growth and urbanization of suburban areas of the capital

city (Kovachev, 2003). Well known is the paradox of the Master Plan adopted in 1961 after a competition between the teams of Neykov and Siromahov where winner was the compact version of Neykov. But only two years later an Amendment of the plan was undertaken in line with the expansionistic plan set by Siromahov. Over the next three decades Sofia implemented the expansionary option. For 39 years (1946 to 1985), the city's population grew 2.3 times (by 670,000 inhabitants) and reached 1.2 million (NSI, 2009). Clearly, such a development could not happen in the original boundaries of the city and suburban areas were the main resource for it. Socialist urbanization, however, was based on the system of prefab panel construction. The housing estates thus developed – the "socialist suburbs" - were, of course radically different from western-type suburbs. In capitalist countries similar housing types can be found on the urban fringe of French and Italian cities. The difference is the lower quality of housing in Bulgarian cities and also the poor development of public spaces. But the point here is how this development affected the preferences of the residents. The result was that, despite the desire to settle in the capital city, residents yet at that time looked at prefab socialist estates as low grade housing. Eventually, the vast majority of city residents reinforced their perception of the central territories as the most desirable areas for habitation.

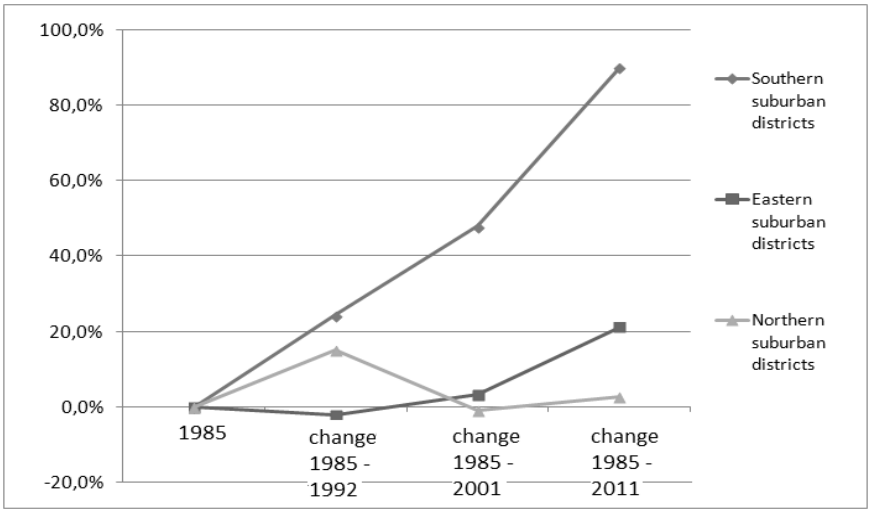

Figure 1: Change in the number of the population in the districts of Sofia by periods
Figure prepared by the first author based on data of NSI – Census 2011 (NSI, 2012)

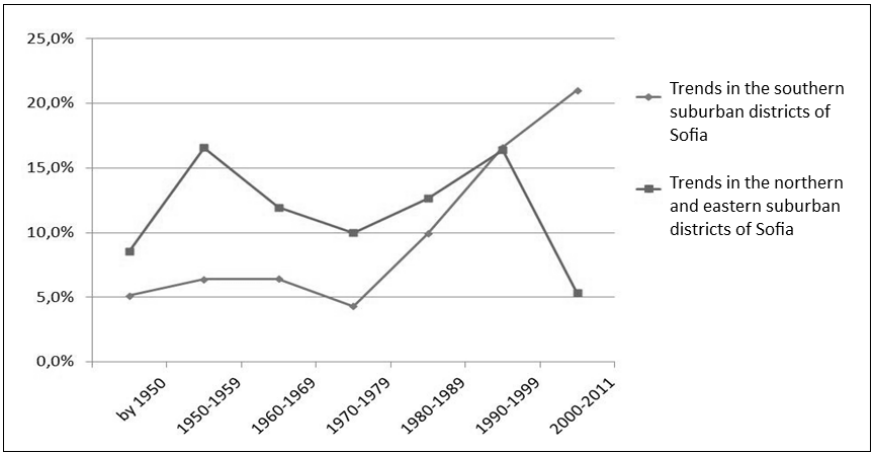

Figure 2. Changes in the percentage of housing built in Sofia's suburban districts
Figure prepared by the first author based on data of NSI – Census 2011 (NSI, 2012)

ANALYSIS OF THE CURRENT URBAN TRENDS AND THE PREFERENCES AND MOTIVES OF SOFIA'S RESIDENTS RELATING TO THE PROCESSES OF URBAN SPRAWL

The goal of analysis in this section is, first, to examine the current trends of urban expansion of the city of Sofia in order to determine whether these trends should be identified as sprawl. Second, to study the preferences and motivations of the residents of the capital, which in recent decades are causing urbanization of suburban areas in order to determine whether the processes were of Western type suburbanization.

It should be stated that both issues had been first studied by Hirt (2006, 2007a, 2007b).With regard to the issue whether Sofia's expansion is a form of urban sprawl in "Suburbanizing Sofia" Hirt (2007a) came to an explicit conclusion that the processes in the southern outskirts of the Bulgarian capital were a clear, though not quite typical form of urban sprawl (Hirt, 2007a, pp 762-764). However, she studied only the "scenic southern outskirts" in the foot of Vitosha mountain. A recent study, undertaken within a project funded by the Seventh Framework Programme of EC, has observed major differences between urban trends in the southern and the northern outskirts. The new study has found that, while the territories to the south of the capital were, indeed, subject to intensive processes of sprawl, the trends in the northern areas may not be identified as such. Some of the findings of this research are presented on Figure 1 and Figure 2.

According to data by the National Statistical Institute – Census 2011 (NSI, 2012) as a whole in the period 1985-2011 the population of the central districts of Sofia has decreased by 47,042 persons, while the population of the rest districts within the compact city has increased 68,672 and the population of the suburban districts – by 68,242 persons. This observation suggests that Sofia's population is sprawling, still the rates are not very high. However, if the changes in different suburban areas are examined the picture becomes much clearer. Figure 1 illustrates the changes in the number of the population between 1985 and 2011 in three types of suburban districts around Sofia. The differences between the trends in the three types of districts are more than obvious. In the studied period the population of the southern districts of Sofia has grown by 60,668 persons, which is by 90.1 %. The population of the eastern districts has increased by 5,001 persons or by 21.2 %, while the population of the northern districts has virtually not changed – it has increased by only 2,573 persons, which is 2.6 %.

The same trends are evident in the data sets of the National Statistical Institute concerning the rates of housing construction in the districts of Sofia (NSI, 2012). In fact, two contrary trends should be outlined in the development of Sofia's suburban areas. According to NSI data until the 1970s the southern suburban territories had attracted about 5 % of housing construction in Sofia municipality. Yet since the 1980s it grew

substantially, particularly after 2000 and during the last decade it formed 21 % of the total. On the contrary –housing construction in the northern suburban territories fell down from the "traditional" 10 to 13 % (16.4 % in the 1990s) to only 5.3% during the last decade (NSI, 2012, pp. 190-191). The difference between the trends in the southern and the northern areas is illustrated on Figure 2.

Therefore, the conclusion is that processes of sprawl are observed in the outskirts of the Bulgarian capital, but mainly in some of the suburban territories. While it should be assessed as normal that the intensity of the trends may not be the same in all areas, it should be also acknowledged that these processes seam stronger, if only the southern districts are examined, but prove to be less intensive, if all districts are considered. According to data by the Regional Agricultural Directorate in the period from 11/2004 to 09/2012 (that is 7 years and 10 months) only about 436 hectares of rural land had been converted to urban use. This equals 0.325 % of the territory of the compact city. Considering that a little more than 50 % of the land converted to housing use was located in the three southern districts, it is obvious that they were indeed, subject to sprawl. But compared to the territory of the municipality, data prove that the processes of suburbanization in Sofia are still slower than the processes in other post-socialist countries in Central Europe and in the Baltic region (see Kok and Kovács, 1999, Timár and Váradi, 2001, Sykora, 1999, Tammaru, Kulu and Kask, 2004, Krisjane and Berzins, 2009).

The main focus of the study regarding the preferences and motivations of Sofia's residents is to determine whether the type of suburbanisation should be defined as type 1 (Western-style), type 2 („from-village-to-town") or third specific type. According to Hirt for this purpose it is necessary to examine three main characteristics of the process (Hirt, 2007a, p. 757): „ (1) demographic (i.e., who settled in the urban periphery), (2) functional (i.e. what are the economic links between the centre and periphery - where do the new suburban residents work) and (3) motivational (i.e. from where the residents of peripheral areas come from and why they settle in the suburbs)". About the first characteristic Hirt observed that the average income of the new settlers were significantly higher than average for the city or for those suburban areas. In general the new settlers had high incomes - 40% of them had an income about four times the national average. They were generally highly educated with 56% of them being university graduates versus 36% with higher education for long-time residents. With regard to the functional characteristic the survey found that nearly nine-tenths of the new suburban settlers worked in other parts of Sofia - mostly well-paid and prestigious positions in the central areas. With regard to the motivational characteristic the finding was that 68% of the new settlers came from the inner-city areas and their main motives were typical for suburbanization of "western" type - an escape from the city centre in search of better housing conditions. The main conclusion drawn by Hirt (2007a) was that the dominant process in the picturesque southern outskirts of Sofia was Western-style suburbanisation (type 1).

This conclusion is, in principle, confirmed by newer surveys and studies like the NSI censuses, interviews conducted with ten Bulgarian leading real estate agencies, as well as data obtained from the Provincial Directorate of Agriculture and the Registry Agency. However, though Hirt (2007a) pointed at some significant specifics of Sofia's patterns of sprawl, recent studies testify that these specifics are more important. New data and observations now support the view that the deviations of the "Bulgarian" model from the "classical" Western model are, in fact, greater and in some aspects can even be seen as opposite to it. The new observations are based on a longer period of development and, particularly, the fact that now the trends in the northern suburban areas have been investigated in more detail. They concern mainly the demographic profile of the migrants, with those moving to the northern areas now being taken into account, and the patterns of urban forms, which had not been the focus of Hirt's research. The new findings about the specific features of Bulgarian sprawl can be summarised in four groups.

First, the demographic characteristics of the new settlers' poll data from estate agents show significantly higher levels of social mix and a lower level of social segregation than the Western model. Brokers attribute less importance to the high social status. Only about half (45.5%) of the new suburban settlers are classified as high-income. About one third (36.4%) of respondents believe that the typical buyers in suburban areas are intellectuals. It is significant to note that nearly four-fifths of the brokers placed low income people on second and third place amongst buyers. Apparently, this somewhat different demographic profile is due to the different social background of the settlers in the northern areas.

Second, concerning the functional characteristics, too, data provided by Sofia Municipality show trends different from the Western model. Unusual for traditional forms of sprawl, integration of service and industrial functions is observed, although on a limited scale. According to the data 13.7% of new building permits in the southern territories are for public-service buildings and 4.4% for industrial purposes. According to Provincial Directorate of Agriculture, however, in the southern suburban areas 69.9 % of newly urbanized lands were converted to residential use, 24.4 % - to activities of the tertiary sector and 5.7% to industrial use. In the northern suburban areas these shares were, respectively, 17.1%, 47.6% and 35.3%. The overall shares (for all suburban territories around the city) of the newly urbanized territories are – 27.4% converted to residential use, 37.7% converted to tertiary uses and 34.9% - to industrial use. Therefore, the mix of uses is characteristic of Sofia's expansion, which should be considered positive, provided that the hygienic norms are strictly implemented (the latter condition is supported by empirical data).

A third specific characteristic of the Bulgarian model is the preference for a variety of housing types, allowing higher density of development. Data from Sofia municipality show that new multi-family buildings in Vitosha district in recent years comprise 28.5 % of the total number of new residential buildings. According to data from NSI the average number of dwellings in a multi-family building in the same area is 13.3. Therefore, apartment units in multi-housing buildings comprise 83.8 % of the total number of new homes.

Finally, though the processes of suburbanization of Sofia are considerable and obvious, they are several grades lower than similar trends in/ around Prague (Sýkora and Novák, 2007) or Riga (Krisjane and Berzins, 2012), for example. Mass market consumers in Sofia are still very attracted to areas within the compact city. If the southern and northern suburban territories are considered in one group, then the rates of new construction in the intermediate areas of the compact city over the last decade have been two times higher than the overall rates in the outskirts (NSI, 2012). This is explained by the fact that the very high rates in the southern territories had been compensated by the negative rates in the northern.

CONCLUSIONS

The paper draws the following conclusions:

- Issues related to urban sprawl are faced by Bulgarian cites later than American and Western

European cities. Urban expansion had happened in the Eastern and South-eastern European countries yet during socialism, but its forms were different from sprawl.

- Nevertheless, urban sprawl in Bulgaria nowadays seems to follow the same trends as in Western European and American cities, however, shaped in patterns specific for local traditions and realities in Southeast Europe

- Just like sprawl in America and Western Europe, sprawl in Bulgaria causes problems of sustainability of urban development due to inefficient use of land resources, loss of green areas, worsening living environment and poor access to central territories.

- Yet Bulgarian cities have some advantages mainly related to traditions of higher densities and compact urban forms and relevant residential preferences. Because of these factors the processes of sprawl seem to be less intensive and the urban forms produced by sprawl around Sofia allow for some relatively better mix of different dwelling forms and mix of uses. Though different suburban areas have different prices and attract different social groups, still Sofia's suburbs are not yet zones of social segregation.

- Bulgarian urban planning should make efficient use of these advantages and look for efficient approaches and tools to cope with the negative aspects of sprawl in Bulgarian cities. However, Bulgarian planning so far has not even identified the problems that arise with sprawl and combating sprawl is not on its agenda.

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TOWARDS THE INTEGRATION OF SUSTAINABLE INFRASTRUCTURE INTO THE EXISTING BUILT ENVIRONMENT

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The construction sector in the United Kingdom is dominated by small and medium size enterprises (SMEs) which have less than 250 employees and usually do not have research capacities to develop a range of low carbon innovations applicable in the construction sector. Various European and national funding programmes have addressed this problem by providing funding for research collaboration between universities and SMEs. The paper provides a selection of the outputs of academic/industry research, undertaken by seven Scottish universities through the project CIC Start Online from September 2009 until February 2013, related to low carbon planning, building design, technologies, construction, refurbishment and performance. The studies either contributed to the further development of existing products or processes, or tested new products or processes, often developed for a specific project with a potential for application in future projects. Online dissemination of the project outcomes has assisted in attracting membership across Scotland, the United Kingdom and internationally.

Along with the low carbon building products and technologies, new low carbon infrastructure is being planned and developed in order to provide connections and services for energy generation from renewables, energy storage and decentralised distribution, water management (harvesting, saving and reuse), waste management (reduction, reuse and to-energy), transport (electric vehicles, cycling and walking) and information communication technology (ICT) for monitoring and managing infrastructure systems. The second part of the paper outlines how innovations for integration of sustainable infrastructure into the existing built environment will be supported through the follow-on joint project of nine Scottish universities, named Mainstreaming Innovation.

Key words: ***sustainable infrastructure, innovations, reduction of carbon emissions.***

INTRODUCTION

CIC Start Online project was planned to respond to several key policies and guides on sustainable building design and construction published at that time when the project was prepared and during its delivery. *The Government Economic Strategy* (Scottish Government, 2007) highlighted the importance of creating and maintaining a sustainable built environment. The *Climate Change (Scotland) Act 2009* (Scottish Government, 2009), whose aim is to reduce carbon emissions in Scotland by 80% by 2050, was another key policy to which the project responded. The report *Developing Scotland's low carbon built environment* (Kelly, 2010), highlighted that the affordability of research for SMEs, the lack of tested innovative solutions and guidelines on how to apply them in practice were perceived as barriers to the adoption of innovations. To address the above barriers, CIC Start Online organised a quarterly competition for feasibility studies and academic consultancies on sustainable building design and refurbishment undertaken for the benefit of Scottish SMEs from October 2010 until January 2012. Over 80 joint academic/industry applications were assessed by the independent assessment panel, 70 approved and over 60 completed. The outputs of several studies whose innovative products, processes and design solutions addressed low carbon planning, building design, technologies, construction, refurbishment and performance are presented in the chapter *"Innovations for sustainable building design and refurbishment supported through CIC start online"*.

From the focus on building design and refurbishment, academic/industry collaboration for developing innovations for a more sustainable built environment in Scotland has moved towards the integration of energy efficient existing and new buildings with new, more sustainable infrastructure systems for energy generation from renewables on site, energy storage and decentralised distribution, better water management (harvesting, saving, recycling), more sustainable waste management (reduction, reuse, to-energy), ICT/BMS systems for monitoring and management of

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infrastructures, including increased integration of "green infrastructure" - landscaping and biodiversity – which can mitigate the effects of changing climate. The widening of the scope for innovations is backed by some early and more recent visions of sustainable development, briefly outlined below.

Landscape and biodiversity

Sustainable infrastructure cannot be truly sustainable if it is not integrated into the natural and built environment with due care for landscaping, biodiversity and quality of design. Natural landscaping and biodiversity within the built environment have their own intrinsic value as living systems of our planet, acknowledged by the fourth principle of the Rio Declaration on Environment and Development (United Nations, 1992) in contrast to the homocentric worldview that had dominated throughout the industrial revolution which has contributed to the rise in carbon emissions. As climate change can cause extreme weather events such as prolonged and stormy rainfall or long periods without rain causing drafts that affect plants, animals and people, mitigation of the effects of extreme weather on the natural and built environment becomes increasingly important. Innovative approaches towards mitigating effects of prolonged rainfall include sustainable urban drainage which can be designed to enhance natural landscape within the built environment and can increase biodiversity (Building for the Future, 2007).

Energy and Information Communication Technology (ICT)

Energy 2020: A strategy for competitive, sustainable and secure energy (European Commission, 2010) set out initial policy decisions that will be needed to meet the 2020 energy objectives. The strategy underlines the need to rebalance energy actions in favour of a demand-driven policy, empowering consumers and decoupling economic growth from energy use. In particular, the transport and construction industries must pursue an active energy savings policy and diversify towards non-polluting energy sources. The new energy strategy focuses on five priorities: (1) achieving an energy efficient Europe, (2) building a pan-European integrated energy market, (3) empowering consumers and achieving the highest level of safety and security, (4) extending Europe's leadership in energy technology and innovation and (5) strengthening the external dimension of the EU energy market. This will be achieved through energy efficiency measures, from generation to point of use and development of infrastructure to ensure a secure supply for Europe and reduce fuel poverty.

In 2011, the economist Jeremy Rifkin, published a vision for "the third industrial revolution" that would include (1) a shift to renewable energy; (2) transformation of the building stock into micro-power plants to generate energy from renewables on site; (3) deploying hydrogen and other energy storage technologies in buildings and throughout the infrastructure to store intermittent energies; (4) using Internet technology to transform the power grid into an energy-sharing intergrid; and (5) transitioning the transport fleet to electric plug-in and fuel cell vehicles that can buy and sell electricity on an interactive power grid (Rifkin, 2011).

Rifkin's vision was earlier presented and discussed with businesses in the USA and with the EU governments, and has influenced further thinking about new infrastructure and technological concepts such as the use of information communication technologies (ICT), organic-lightemitting-diodes (OLED) and 3D printing that will change how buildings look and operate within the context of distributed information, distributed energy generation and distributed manufacturing which has been envisaged by Rifkin (Johnston, 2013). Johnston (2013) describes how Rifkin's vision is currently translated into practice and what can be expected in the near future. The way energy is generated and distributed will change - locally produced DC power from a solar panel will be used by a local DC powered device. Many aspects of Smart Grid will be based in buildings, including integration of distributed energy resources, demand response, energy-efficiency measures, electric-vehicle battery integration, thermal storage HVAC systems and provision of time of use pricing signals. ICT could lead the way as it already uses 60W Universal Power over Ethernet (UPoE), 100W Universal Serial Bus (USB) 3.0 and 380V DC power supplies for data centres, and with Cisco's estimate of 33 million devices powered by their 3rd generation UPoE system, UPoE could become a ubiquitous solution in the commercial environment. Smart DC solutions are also beginning to move into different sectors within the built environment, most predominately LED lighting in which the US is taking a lead in the development of standards for DC networks in buildings and has pulled in key players in the lighting, power distribution and ICT sectors. The next few decades could bring a further integration of the virtual and real world by giving any real thing an IP address and connecting it to an "internet of things", which could lead to the convergence of previously defined verticals in the building sector, particularly building management systems (BMS) and power distribution systems under a new name of integrated energy management. Furthermore, the convergence of Smart DC and energy management systems will open up many more opportunities for innovation such as the creation of a true Digital Energy Network in which Smart DC could evolve from intelligent fault monitoring towards the complete decentralisation of power control, where distributed "power routers" forward packets of power to IP addressable end-devices. The above description indicates changes that will happen in the existing and new buildings regarding energy generation, storage and distribution.

Transport

Along with changes in buildings, electricity powered transportation fleet will be introduced. Electric vehicles will become a part of the energy storage system, very often linked to the buildings in which their owners live or work. Symbiotic relationship between buildings and vehicles will require new solutions in the design of buildings and energy services. As the network of charging points for electric vehicles will expand beyond built up areas, the impact of this infrastructure and complementary services, similar to those developed for other types of vehicles along the roads will have spatial impacts that have to be assessed, leading towards the development of related planning and design guidelines. The consideration of location and design of charging points for vehicles is appearing as a new task for planners and designers in Scotland as Scottish Government has announced in February 2013 plans for free installation of home charging points throughout Scotland, public charging outlets within at least every 50 miles on trunk roads and an integrated network joining up electric vehicles with public transport (Scottish Government, 2013). Currently, charging of electric vehicles in Scotland is free to stimulate demand.

Water

In European Union, the Directive 2000/60/EC established a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which (a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems; (b) promotes sustainable water use based on a long-term protection of available water resources; (c) aims at enhanced protection and improvement of the aquatic environment through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges,

emissions and losses of the priority hazardous substances; (d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and (e) contributes to mitigating the effects of floods and droughts. In the United Kingdom guidance for sustainable water management through water harvesting, saving and recycling in daily activities (Environment Agency, 2007, 2010, 2011; DEFRA, 2011), in businesses and industry (Waterwise, 2010a; Zero Waste Scotland, 2012), and water industry as a whole (Waterwise 2010b) have been updated in the last few years to address the potential effects of climate change on availability of water. In Scotland, the law on the management of Scotland's water resources has been updated (Scottish Government, 2012a) to introduce new duties relating to the government vision of Scotland as a Hydro Nation and set a legislative framework that will underpin other non-legislative activity.

Waste

EU's Waste Framework Directive (Directive 2008/98/EC), dealing with prevention, preparing for reuse, recycling, other recovery (notably energy recovery) and disposal, has initiated publication of related guidance in the UK (WRAP, n.d.) as well as legislation and action plans in Scotland (Scottish Government, 2012b; Zero Waste Scotland, 2010). The new Resource Efficient Scotland advice and support service, established on 1st April 2013, replaces Scottish Government business and public sector advice services currently delivered by Zero Waste Scotland, Carbon Trust and Energy Saving Trust. Advice on energy, water, materials and waste can be accessed from a single service which will provide free support, training and access to funding to help organisations implement resource efficiency measures. Resource Efficient Scotland will also commission research and development, fund commercialisation of innovative technologies and facilitate collective industry agreements.

The above legislative and operational context, and the outlined visions of the changing built environment in forthcoming decades stimulate development of innovative solutions that will be supported by the project Mainstreaming Innovation, described in the chapter *"Supprot for innovations for integration of sustainable infrastructure into the existing built environment"*.

INNOVATIONS FOR SUSTAINABLE BUILDING DESIGN AND REFURBISHMENT SUPPORTED THROUGH CIC START ONLINE

The range of innovations supported through the project and other outputs can be classified in six subgroups presented below. Development and application of an innovative product or a process initiates the assessment of the context in which they are applied to enable optimum performance and achieve the most cost effective solution. These considerations often lead to innovative approaches in planning, building design and management, thus creating a web of related innovations.

Planning

The resilience of buildings, neighbourhoods and cities in the context of climate change as well as their adaptability to the changing users' needs were the themes of the second online conference organised by the project. Avoidance, resistance and recovery in relation to the potential increase of flooding (Roaf, 2011) and managing urban heat island (Emmanuel and Kruger, 2011) due to climate change were the topics of two videos. The theory of self-organising built environments as a response to carbon levels (Moore, 2011) provided an insight into alternative approaches to the reduction of carbon emissions. Benefits of establishing energy co-operatives were presented by Borthwick and Muneer (2011). Accessibility of urban spaces for everyone was explored in the video by White and Grant (2011). Planning issues addressed through the project studies include the influence of microclimate on building design (Kumar and Emmanuel, 2010) and the regeneration of a rural estate (Sharpe and Bridgestock, 2012). Sometimes, planning aspects were addressed to enhance the performance of an innovative building service system, e.g. in the feasibility study about the development of a hybrid solar thermal mass (HSTM) system for the application in new housing by Noguchi *et al* (2010). The study led to the alterations to an existing masterplan to enhance the HSTM system's performance as well as communal functions (Barr *et al*., 2010). Through the analyses of the site and the discussions with housing representatives, some problems in the existing plan were highlighted and key guidelines for the alternative design proposal drawn up.

Building Design

Principles and processes related to sustainable building design and applied in several Scottish architectural practices were explored and presented in a conference video (Grierson and Moultrie, 2011) and summarised in an article (Grierson, 2011), showing a diversity of approaches both in terms of practice policy and design output. The same was evident at the Scotland's Housing Expo 2010 from which several examples of sustainable housing design were presented in a conference video produced by the project (Brennan, 2011).

A range of energy simulation tools has been developed to date to assist the design of more sustainable buildings. Their capabilities, from modelling operational energy use to predicting overall carbon consumption and resource impacts, are explained in a conference video by Clarke (2010). The article by a Scottish software developer, published in the project's quarterly online magazine, explores the capability of simulation software to intervene in all stage of the design process (Wheatley, 2010), while the article by Isaacs *et al*. (2011) presented the advances in a recently developed simulation tool to analyse impacts of different design and planning options on sustainability within a 3D model.

Simulation tools were used in one feasibility study to benchmark performance between different building construction systems, but also to examine the meaning and implications of the term 'zero carbon' and the role of renewables both on and off site as a method of reaching such a goal (McEwan and Roaf, 2010). In another study the aim was to prototype a simple options appraisal tool to help make specific decisions such as payback periods for insulation and the use of blinds to avoid overheating (Counsell *et al*., 2012). As the adaptation of existing simulation tools for architectural education is critical in embedding iterative practice in sustainable design practice, this was the focus of the study by Uduku and Roderick (2012) that enquired how an existing simulation package could be adapted to become an effective undergraduate teaching tool through simplifying and clarifying key processes such as daylight analysis and building energy demand.

Other studies demonstrated the use of different software for modelling and exploring design options such as Autodesk Ecotect and CADline Cymap (Stinson and Bros-Williamson, 2012), BIM (Motawa and Corrigan, 2012), ESP-r (Jack *et al.*, 2010; Mitchell and Ritchie, 2012), EDEM tool for energy, carbon and cost assessment (Tuohy *et al*., 2010) and IES Virtual Environment (McEwan and Roaf, 2010).

Technologies

A decision making tool has been developed by Girard *et al.* (2011) to assist the optimisation of economic, environmental and energy savings in buildings. The tool enables the early assessment of on-site energy available for a building in the context of its location and provides a rapid identification of the most appropriate and cost effective way of achieving

lowest carbon emissions. Whether and how the knowledge and tools are applied in practice was the theme of a study which investigated the adoption of low-carbon technologies in Scottish housing associations (Moore *et al*., 2010).

The potential for improving the performance of new technologies by combining different innovations, e.g. achieving higher ground source heat pump coefficient of performance (COP) through the use of roof-top thermal solar collectors, was explored in a study by Muneer and McCauley (2012). This potential was also examined in the study on the energy impact of different strategies of integrating PV and thermal heat recovery systems (Noguchi, 2011; Noguchi *et al*., 2011a). Retrofit of existing housing with photovoltaic (PV) panels was explored in several studies (Bros-Williamson, 2011b; Noguchi *et al*., 2011b; Stinson and Bros-Williamson, 2012b). The potential of the use of solar powered technologies to reduce fuel poverty in one feasibility study has led to the development of 'Solar photovoltaic design guide for Scotland' by Irshad and Muneer (2012).

Construction

Novel building insulation products from recycled textile and other materials were tested by Baker and Newlands (2013). Investigating new markets for recycled plasterboard was the focus of the study by Hunter and Pahl (2013).

As off-site construction methods enable good quality control and easier integration of new technologies within building components, their development and application were addressed, e.g. in the study by Noguchi and Dhamne (2012a) that explored the potential for integration of PV/thermal roof modules for prefabricated housing. The use of cross laminated Scottish-grown timber in high density affordable housing was the theme of the feasibility study undertaken by Wilson (2013). Thermal properties of a closed timber systems were modelled by Barr and Sanders (2011, 2012).

The potential for the application of off-site systems in housing has been demonstrated in a range of projects at Scotland's Housing Expo 2010 (Barrett, 2010; Burridge, 2010; Keith, 2011) and at the Housing Innovation Showcase 2012 (Banks, 2012). Other articles in the project's online magazine presented the use of timber Brettstapel system in a school (Liddell, 2010) and in a home (Halliday, 2012), a mixed use building constructed of cross laminated timber (Miles and McQuillan, 2012) and manufacturing of off-site timber systems in Scotland (Newlands, 2012).

Refurbishment

Sustainable refurbishment was the theme of the first online conference organised by the project. The one-hour videos addressed a range of issues that have to be considered, e.g. improving energy efficiency in traditional buildings (Baker *et al.*, 2010), the use of solar PV and hot water panels for buildings (Muneer and Bowmaker, 2010), the potential for solar refurbishment of Scotland (Roaf *et al.*, 2010), upgrading Glasgow's social housing stock (Porteous *et al*., 2010), the problem of rural SME contractors and sustainable technologies (Moore, 2010), retrofit and renewables in traditional rural buildings (Brennan, 2010) and the use of simulation-based design tools for decision making (Clarke, 2010).

Several studies were subsequently developed to assist decision making for refurbishment projects, including a strategy for improving energy and carbon performance of tenements (Tuohy *et al*., 2010), a tool for assessing cost effectiveness of carbon reduction in tenement buildings (Jack *et al*., 2010) and an energy efficiency retrofit cost-benefit calculator (Jenkins *et al.*, 2012; Simpson *et al*., 2012). Improvement of building fabric to increase energy efficiency before considering the use of new technologies for energy generation from renewables was also included in a study on existing housing (Bros-Williamson, 2011a) and in older historic properties (Bros-Williamson, 2011c; Mitchell and Ritchie, 2012, 2103). As many traditional buildings in Scotland have external walls built of stone with lath and plaster in the interior, tests were undertaken to assess whether thermal insulation can be inserted between stone and lath (Bennadji and Levie, 2012).

Refurbishment of traditional pre-1919 buildings to Passivhaus (or Passive House) standard was examined in a study on an 18th century traditional Scottish house (Bros-Williamson, 2012a) and on tenement buildings (Sharpe *et al*., 2013).

Performance

Information on the performance of new technologies and design solutions is crucial to reassure building owners, clients, designers and contractors that they are choosing building materials, components, technologies and design solutions that meet the required performance, and are easy to maintain and durable. As designers wish to learn from their projects and improve on their performance, a study on embedding post-occupancy evaluation (POE) into practice was undertaken for an architectural practice to enable benchmarking of new designs against previous projects (Nugent *et al*, 2010). Regarding early examination of performance, Motawa and Corrigan (2012) explored a sustainable BIM-driven POE for buildings. The cost of embedding POE in practice was examined in a study by Shearer *et al.* (2012) and summarised in an article by Newlands (2013).

The performance of a balanced mechanical ventilation with heat recovery system as an extractor of roof-integrated PV heated air in housing was examined by Noguchi and Dhamne (2012b). The theoretical and actual performances of a ground source heat pump after its installation within a heritage building were compared by Sharpe and Shearer (2012). Thermal and condensation analysis of a typical solid wall following a refurbishment intervention was examined by Bros-Williamson (2012b). Noguchi and Raidu (2012) explored physical and metaphysical impacts of a roof mounted wind turbine in housing context.

POE assisted in identifying causes of the problems with performance in a refurbished heritage building (Sharpe and Shearer, 2012a, 2012b). Findings from POE of housing projects, presented at the online conference by Sharpe (2011), indicated the impact of occupants' behaviour on the quality of indoor air. The study by Musau and Deveci (2013) assessed the environment and energy impact of occupant behaviour in housing. The problem of indoor air quality when air-tightness of buildings is increased was discussed in an article in the quarterly online magazine (Shearer, 2011) and was the theme of the live conference 'Build Tight, Ventilate Right' (filmed and available as a DVD package from CIC Start Online).

SUPPORT FOR INNOVATIONS FOR INTEGRATION OF SUSTAINABLE INFRASTRUCTURE INTO THE EXISTING BUILT ENVIRONMENT

Following the success of the CIC Start Online project, which was completed at the end of February 2013, the consortium of the universities involved in the project prepared a proposal for the follow-up project whose scope will be wider and the consortium will consist of nine Scottish universities. The project has secured funding from Scottish Government from the start of April 2013 until the end of March 2014. The project summary is provided below.

The one-year project, named "Mainstreaming Innovation", aims to (a) reduce carbon emissions through research and application of integrated sustainable infrastructure in the existing built environment that could be

replicated on existing and new building estates (e.g. housing, education, healthcare and other building estates); (b) adapt to changing climate by strengthening the resilience of buildings and infrastructure, and by reducing fuel poverty; (c) mitigate the impacts of changing climate by influencing the development of skills and capacities for planning, designing, procuring, managing and maintaining low carbon built environment; (d) ensure security of supply of energy and resources by maximizing the use of local low carbon resources and independence of supply systems; and (e) develop methods of ensuring that innovations are presented to building owners/clients, industry and colleges.

The project will support development, testing and application of innovative low carbon technologies for improving (1) landscaping and biodiversity, (2) energy efficiency in existing buildings, (3) energy generation from renewables, storage and decentralised systems, (4) water harvesting, saving, recycling and flood prevention, (5) waste reduction, reuse and waste-to energy, (6) low and zero carbon transport and (7) ICT/BMS systems for monitoring, reporting and management of low carbon infrastructure.

New technological solutions that combine different low carbon innovations to make better use of resources, close energy loops, achieve better efficiencies, reduce the need for maintenance and minimise the costs will be encouraged. Innovations will be tested on selected existing estates for healthcare, education and housing. At least seven studies are planned per estate, 21 in total. The applications for feasibility studies will be reviewed by an independent Advisory Panel and submitted for funding to Scottish Funding Council through Interface and to Technology Strategy Board.

The project outputs will be presented at demonstration events in colleges whose curriculum includes courses related to the innovations. The outputs of all the studies will also be disseminated at seminars which will be filmed and transmitted online and saved as video recordings. The project will publish monthly E-News and a quarterly online magazine with articles on the context (legislation and policies), support (financial initiatives and other forms of support), research and best practice.

CONCLUSIONS

As an independent Assessment Panel, established to assess application submitted to CIC Start Online, approved only the applications whose outcomes would provide a direct benefit to a business that has applied jointly with academics, the innovations developed through the project were industry driven and indicated areas in which the industry needed assistance. The studies either contributed to the further development of existing products or processes, or tested new products or processes, often developed for a specific project with a potential for application in future projects. The outcomes of the studies were presented at seminars, transmitted online as interactive webinars in real time and then made available as video recordings on demand at the project website to the project members. Online dissemination of the project outcomes has assisted in attracting membership across Scotland, the United Kingdom and internationally. By the end of February 2013, the project had over 2,200 from over 1,500 organisations, of which over 910 members were from over 700 Scottish SMEs. The project has attracted over 200 international members from 53 countries. Since the CIC Start Online videos became available on YouTube, there have been over 25,508 viewings. An important legacy of the project is the searchable knowledge base of all project outputs, available on the project website which will remain accessible to everyone.

At the end of 2010, the project partners agreed to prepare a proposal for a new project and undertook research on the EU, UK and Scottish policies related to sustainable infrastructures. The research was funded by Scottish Government and will be published on the project website. The project will collaborate with Glasgow Housing Association, Health Facilities Scotland and universities' estates to test feasibility of innovations on the existing estates. Industry advice will be provided free from Skanska, an international building contractor operating in Scotland. The project will aim to identify innovations that can be put forward to Technology Strategy Board (TSB) for funding for feasibility studies for integration of sustainable infrastructure through the programme 'Buildings better connected' in 2013. TSB will follow this call with another collaborative research and development competition, planned for January 2014, which will offer £4.5m funding. TSB indicated that most of the UK government's £330bn investment over the next decade is targeted at large infrastructure projects and that there is an opportunity to capitalise on this by developing local infrastructure that is inter-connected with larger-scale infrastructure, but which responds to customers' need for flexibility and convenience. The TSB announcement also includes a potential vision of the future as offered by Rifkin (2011); which was endorsed by the EU and included in the UK energy policy.

The project Mainstreaming Innovation aims to assist Scottish SMEs on the path to that future by including not only Rifkin's vision of the new energy, ICT and transportation infrastructure, but also the infrastructure for sustainable management of water, waste, land and biodiversity. The project will be led by Glasgow Caledonian University in collaboration with Edinburgh Napier University, Robert Gordon University, the Glasgow School of Art, Heriot-Watt University, University of Edinburgh, University of Aberdeen, University of Abertay Dundee, and University of Strathclyde Glasgow.

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CLIMATE CHANGE IMPACTS ON GERMAN CITIES AND ACTIONS FOR PRESERVING QUALITY OF LIFE

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Also German cities –as many other cities worldwide- will be affected by impacts of climate change. Starting from the German Adaptation Strategy to climate change, the paper presents a short literature review on impacts of climate change and on fields of action for German municipalities and urban planners to adapt to it.

The literature review shows that main negative impacts of climate change in Germany are due to rising temperatures and cities will also need to cope with altered precipitation regimes. But also positive impacts such as reduced heating costs are reported.

Additionally, the paper highlights a second phenomenon, which also causes specific demands for urban planners regarding human health and quality of life in German cities: demographic change. Altering demographic patterns within the society will lead to altered demands for healthy living conditions.

Moreover, findings from the literature show that specific groups of the society – such as the elderly – are especially vulnerable towards impacts of climate change. A concrete sensitivity towards overheating or bad air is reported.

Both phenomena may simultaneously impact on German urban structures and will demand closer attention now and in the future. Consequently, specific fields of action to adapt to climate change will be presented highlighting their possible contribution sustaining quality of life in cities.

***Key words:** climate change adaptation, Germany, cities, demographic change, quality of life.*

INTRODUCTION

Two contemporary phenomena are appearing on the agenda of urban planners and demand adaptation measures for sustainable settlement structures in Germany: climate change and demographic change. The impacts of climate change are diverse and planners' demands for adaptation are highly complex. Research has been conducted for Asian megacities (e.g. Worldbank, 2010). But also Europe is facing climate-related impacts (e.g. EEA, 2012) and needs to adapt its settlement structures. Though, specific impacts and demands for adaptation may differ. In using Germany as an example, a literature review will highlight possible impacts due to climate change. But it also shows that planners can refer to a large field of actions to adapt German cities to these impacts.

Additionally, a second phenomenon poses additional pressure on urban planners in Germany: demographic change. Recent findings of the Federal Statistical Office (2011a) show the following effects until 2030: decreasing overall population by around 5 Million, 17% less children and youths and 33% more inhabitants of and over 65 years.

Both phenomena – altered climate conditions in cities and altered demographic structures – might simultaneously impact on German urban structures. For instance, approximated aggravations of the urban heat island effect (a.o. Endlicher and Kress, 2008) may put additional pressure on an increasing but also most vulnerable group of the society: the elderly (e.g. UBA, 2005).

The second part of the paper picks up this issue. It briefly focuses on human health and quality of life in cities as future fields where urban planners need to become active in adapting to impacts of climate change in cities.

DEMANDS FOR URBAN PLANNERS DUE TO CLIMATE CHANGE

Climate change demands more and more complex actions of urban planners in Germany. The German Adaptation Strategy for Climate change (German Federal Government, 2008:10f.) reports rising temperatures of 0,5-1,5°C (2021-2050) and of 1,5-3,5°C (2071-2100) depending on the projection model for Germany. Additionally, decreasing precipitation (appr. 40%) in the summer and increasing precipitation (appr. 0-40%) in the winter are to be expected.

Consequently, Becker *et al*. (2008) argue, that these modifications of climatic conditions significantly impact on humans, the economy and ecosystems. But still, they can be both

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negative and positive (see Table 1, see also BMVBS/ BBR, 2008: 16ff.).

Cities worldwide need special attention when it comes to impacts of climate change. For instance, in its report "Climate Risks and Adaptation in Asian Coastal Megacities" the Worldbank (World Bank, 2010) explicitly focuses on impacts exclusive to Asian megacities. Releasing the report "Urban adaptation to climate change in Europe" also the European Environmental Agency (EEA, 2012) draws special attention on this topic for European cites.

In a German context, for instance Endlicher and Kress (2008) demand to fundamentally overwork known concepts of urban planning. Beside named global impacts of climate change (see Table 1), especially German cities will face an intensification of the urban heat island effect and negative impacts for human well-being (a.o. BMVBS, 2011; Dosch *et al*. 2008; Endlicher and Kress 2008). Ongoing urban sprawl, soil sealing and densification of the urban structure can accelerate these problems (BMVBS, 2011).

According to the BMVBS (2011: 16f.) 13 out of 16 Federal States in Germany have submitted or are elaborating studies on the effects of climate change. Local climatic and topographic specifications such coast protection in the northern Federal States or alpine potential risks in Bavaria need to be addressed.

Consequently, individual concepts of adaptation are needed. Moreover, major expected consequences of climate change such as i) water management, ii) forestry, iii) agriculture, and iv) health (also German Federal Government, 2008) are the center of attention. A previous study of the Federal Environment Agency (UBA, 2005) also mentions the upper Rhine Valley as a region with specific thermal conditions. But it also highlights "congested urban areas, especially in climatically unfavourable locations (closed valleys) [which] are particularly hit by the direct impacts of climate change" (UBA, 2005: 124).

Table 1. Negative and positive effects due to climate change

Negative effects (Becker *et al*., 2008: 343)	**Positive effects** (Becker *et al*., 2008: 343)
Higher maximum temperatures lead to a higher mortality for the elderly	Reduced heating costs
Yields can be negatively affected by droughts and heat waves	Tourism areas may benefit from longer sunny periods
Extreme precipitation events results in more erosion and a higher risk of material damage and insurance costs	
Higher costs for air conditioning	
Higher costs for water provision	

Table 2. Fields of action for planners and possibilities for improved urban QoL (selection acc. to BMVBS, 2011: 20ff.)

Fields of action	**Potentials for an improved QoL as tasks of the public sector** (acc. to BMVBS, 2011: 20ff.)
Human health	• Keeping free of ventilation zones to diminish overheating of highly densified areas of the city • Enhancement of green and blue structures within cities to enhance down cooling (see also Endlicher and Kress, 2008) • Due to demographic change and an ageing society increasing demands on the public health sector
Water household	• Flood adaptive construction of new public buildings and inspection of existing public buildings • Adaptive planting of public green spaces due to drier summers • Enhancement of water retention potentials: roof greening, de-paving to enhance decentralized seeping measures and quality of open spaces • Sense of security
Traffic	• Enhancement of compact urban structures • Promotion of public transport
Open and green spaces	• Limit greenfield development • Enhancement of degree of urban green to enable cooling effects • Implement ventilation corridors • Implement ecological network structures
Air hygiene	• Protection of ventilation corridors to guarantee fresh air within the city • Protection and creation of fresh air production areas

FIELDS OF ACTION FOR ADAPTATION

Undoubtedly, urban planners have numerous possibilities to adapt to impacts of climate change (see also a.o. Sinz, 2007). As presented in the introductory part, the paper will shortly address selected fields of it. And it will put a focus on two specific aspects: quality of life and public health in cities.

We have learnt that the urban heat island effect might also increase in German cities. And this causes additional heat stress for residents. Careful attention by planners is demanded (Endlicher and Kress, 2008). Additionally to that, German cities will need to deal with ozone stress and bad air (BMVBS, 2011; UBA, 2005). "Particularly at night a cooling-down is lacking, which would be important for periodic recovery" (UBA, 2005: 126).

These impacts endanger residents' health. And they limit residents' quality of life in cities. Moreover, threats such as bad air or overheating are especially dangerous for vulnerable groups such as the elderly (e.g. UBA, 2008). Due to demographic change, their proportion of the society will increase (Federal Statistical Office, 2011). Consequently, planners will have to deal with their specific demands for healthy living conditions.

Urban quality of life

Urban quality of life (QoL) comprises factors such as employment opportunities, living costs, air pollution, public transport, urban green spaces, security, health services and many more (BMVBS 2011: 19 according to European Commission (EC), 2007; Costanza *et al*., 2007; Santos and Martins, 2007). Consequently, it is a complex task to preserve it in times of altered climatic and demographic conditions in cities. In so doing, the BMVBS (2011) has formulated ten fields of actions for cities to adapt to the impacts of climate

change. They directly or indirectly influence residents' QoL in cities. Regarding the overall focus of the paper, the following selection (Table 2) highlights the most direct links between fields of actions to adapt to climate change and preservation of QoL.

Human health: direct and indirect impacts of climate change

According to UBA (2005: 129) "Germany is especially vulnerable to the impact of climate change on health, because of the continuous enlargement of the most susceptible demographic group, the elderly". The heat wave in summer 2003 and many international studies clearly "show that mortality increases significantly on days with strong or extreme heat stress" (UBA, 2005: 125).

Beside those direct impacts, the UBA (2005: 125 following McMichael *et al*., 1997) also highlights an "indirect impact of climate change. This includes the distribution of allergens in the air, degradation of the quality and quantity of water and food, as well as the degradation of ecosystems, which humans need for their recreation."

According to the German Federal Government (2008:49) a further densification of built structures needs to be critically discussed regarding human health issues. Again, an intensification of the urban heat island effect especially during the summer season is expected. And a stronger pressure on human health could be the consequence.

CONCLUSION

The paper gave a short literature overview on impacts of climate change in German cities. We have learnt that especially thermal effects such as the aggravation of the urban heat island effect will significantly diminish residents, QoL. Moreover, Germany faces significant changes in the society due to demographic change. An ageing society puts the elderly as the largest but also most vulnerable group into the center of attention. Issue of human health and well-being may gain importance in urban planning. The paper advocates for focused research on the links of demographic and bioclimatic issues when re-structuring urban concepts in supporting sustainable urban development.

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THE EARLY WARNING APPLICATION ROLE IN FACING THE ENVIRONMENTAL CRISIS AND DISASTERS. "PRELIMINARILY RISK MANAGEMENT STRATEGY FOR THE GREATER CITY OF CAIRO"

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Natural disasters are inevitable and it is almost impossible to fully recoup the damage caused by the disasters. But it is possible to minimize the potential risk by developing disaster early warning strategies, methods using the new technology applications which play a crucial role in efficient mitigation and management of disasters.

This paper describes the importance of the remote sensing and Geographical Information System (GIS) in evolving a suitable strategy for disaster, crises and risk management using these technologies.

The main objective of this paper is to make a Preliminary risk management plan (it is a logical and systematic method of identifying, analyzing, treating and monitoring the risks involved in any activity or process. This process helps Administrations to focus on priorities and in decisions on deploying limited resources to deal with the highest risks) using the Environmental risk map of the greater city of Cairo demonstrating the most high-risk administrative areas in the city, supported by field evidence and different sources of information. to reduce the loss of life and property and protect the Nation from all hazards, including natural disasters and other man-made disasters, by leading and supporting the Nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation.

This study has shown that how can the early warning Applications can be useful in analyzing, Integrating and managing different datasets for predicting the environmental crises and disasters that may affect the urbanism inside the city and help in the preparation of the Risk management plan.

Key words: ***Early warning, Disasters, management, risk analysis, mitigation, Cairo.***

INTRODUCTION

Natural disasters cause damage to life and property all over the world in various forms. The pressure on the earth's resources caused by increased population has resulted in increased vulnerability of human and their infrastructure to the natural hazards, which have always existed. The result is a dynamic equilibrium between these forces in which scientific and technological development plays a major role. Recurring occurrences of earthquakes, floods, landslides and forest fires need to be studied using today's advanced technology to find effective preventive measures. Space technology can help the disaster mitigation process through better future scenario predictions, detection of disaster prone areas, location of protection measures and safe alternate routes, etc.

The main objective of this study is to determine the risks that threaten the Great Cairo City to conduct a preliminary risk management strategy/ plan. Moreover this paper provides a conceptual and theoretical background for the hazard and risk assessment, which provides guidance to help those in authority to address the affects of natural and environmental hazards on community's vision for future.

The following provides a brief description of the main research questions and sections that this paper intends to discuses:

Section 1

What is Disaster Management?

- Overview on Disasters/ Crisis management.
- The objectives and motivations for managing the Disasters and Crisis.

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Section 2

What is the Risk Management? And what are Risk analysis steps?

- Introduction to Risk Management.
- Risk Management Procedures.

Section 3

What is the importance of the Early Warning and its applications in disaster/Risk Management?

- Approach to Early Warning systems.
- Challenges facing E.W. Systems.
- E.W. applications and its importance in disasters, Crisis and Risk Management.

Section 4

What are the Natural and Environmental threatens in Egypt?

- Introduction About Egypt.
- Natural and environmental Hazards in Egypt.
- The Governmental Authorities and non-Governmental Organizations trends to confront the natural and environmental environmental disasters.
- Egypt disaster mitigation (ongoing and Completed) projects and activities.

Section 5

What are the main guidelines for proceeding a preliminary risk management for Greater Cairo City?

- Geographic description for Greater Cairo City (Case Study).
- The main Guidelines for proceeding the risk management.
- Risk description Table.
- Conclusion.

DISASTER DEFINITION, CHARACTERISTICS AND TYPES

Disaster can be defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (UNEP). Those hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, area affected, intensity, speed of onset, duration and frequency.

The objectives and motivations for managing Disasters and Risks

All Strategies and plans that concern with mitigating, reducing and even preventing the disasters and Crisis impacts have the same objective, which is having a disaster resilient cities, which characterized by its capacity to withstand or absorb the impact of hazard through resistance or adaptation, for enabling it to maintain certain basic functions and structures during a crisis and recover from an event. The resilient city is the city where:

- The city has steps to anticipate and mitigate the impact of disasters, incorporating monitoring and early warning technologies to protect infrastructure, community assets and individuals, including their homes and possessions, cultural heritage, environmental and economic capital, and is able to minimize physical and social losses arising from extreme weather events, earthquakes or other natural or human-induced hazards.
- It is able to respond, implement immediate recovery strategies and quickly restore basic services to resume social, institutional and economic activity after such an event.

When the hazard or threat becomes a reality, when it materializes, the risk becomes a disaster. Hence Focusing on disasters after they occur is essential, but not sufficient for reducing their tragic consequences to people, economies and the environment. However those impacts of natural disasters can be reduced through a proper disaster management, including disaster prevention (hazard and risk assessment, land use planning and legislation, building codes), disaster preparedness (forecasts, warning, prediction) and rapid and adequate disaster relief. Mitigation of natural disasters can be successful only when adequate knowledge is obtained about the expected frequency, character, and magnitude of hazardous events. Some types of disasters, like, floods or earthquakes may originate very rapidly and may affect large areas. (Pelling, 2003)

INTRODUCTION TO THE RISK MANAGEMENT

Risk Management is defined as the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental Crisis and disasters. This comprises all forms of activities, including structural and non-structural measures to avoid or to limit adverse effects of hazards.

Risk Management Procedures

At the broadest level, risk management has a proactive concept which is clearly present in Focusing on Vulnerability instead of Focus only on Hazards. It includes a range of management and policy-making activities. But to achieve the essential objectives of risk management, those activities must be subjected in sequence according to organized procedures as following (**Risk Assessment to determine** what hazards present more danger than society is willing to accept. And it consists of two main phases (**Risk Analysis** - **Risk Evaluation**) - **Risk Reporting** - **Risk Treatment** - **Monitoring and Review**).

Risk Assessment

Risk assessment is conducted to estimate how much damage or injury can be expected from exposures to a given risk agent and to assist in judging whether these consequences are great enough to require increased management or regulation. Depending on the kind of hazard, the loss of habitat, and other kinds of ecosystem damage.

Risk assessment has widely range in scope and complexity, depending on the application from simple screening analyses to major analytical efforts that require years of effort and a substantial budget. Many methods and sequence of steps are involved in conducting risk assessments vary with the kind of risk and its possible consequences.

Risk Assessment Methods

- Qualitative methods are used when the assumed level of risk does not justify the time and effort of collecting the vast amount of data needed for a quantitative risk assessment, and where the possibility of obtaining numerical data is limited.
- Quantitative approaches They mostly follow an engineering approach and focus on the evaluation of the direct physical losses resulting directly from the impact of the hazard. Risk can also be visualized spatially in the form of maps which shows the spatial variation of risk over an area.

Phases of Risk Assessment

In its most general form, Risk Assessment is defined by the ISO/ IEC Guide 73 as the overall process of risk analysis and risk evaluation (UNEP), 2010.

1. Risk Analysis

Recently, risk analysis is being used to evaluate and manage the potential of unwanted circumstances in a large array of areas. Four steps must be conducted to complete the risk analysis (FEMA):

- **Risk Identification** sets out to identify an organization's exposure to uncertainty. Risk identification should be approached in a methodical way to ensure that all significant activities within the organization have been identified and all the risks flowing from these activities defined.
- **Risk Description**: The objective of risk description is to display the identified risks in a

structured format by using a table. The risk description table overleaf can be used to facilitate the description and assessment of risks.

• **Risk Estimation**: Risk estimation can be quantitative or qualitative in terms of the probability of occurrence and the possible consequence.

• **Risk Profile**: The result of the risk analysis process can be used to produce a risk profile which gives a significance rating to each risk and provides a tool for prioritizing risk treatment efforts. This ranks each identified risk so as to give a view of the relative importance. This process allows the risk to be mapped describes the primary control procedures in place and indicates areas where the level of risk control.

2. Risk Evaluation

It is known also as **Risk characterization**; and considered the concluding step of a risk assessment, when the risk analysis process has been completed, it is necessary to compare the estimated risks against risk criteria which the organization has established. The risk criteria may include associated costs and benefits, legal requirements, socioeconomic and environmental factors, etc. Risk evaluation therefore is used to make decisions about the significance of risks to the organization and whether each specific risk should be accepted or treated.

Risk Treatment

Risk treatment is the process of selecting and implementing measures to modify the risk. It includes as its major element, risk control/mitigation, but extends more further to risk avoidance, risk transfer, risk financing. Those proposed controls need to be measured in terms of potential economic effect if no action is taken versus the cost of the proposed actions and invariably require more detailed information and assumptions than are immediately available.

Monitoring and Review

Effective risk management requires a reporting and review structure to ensure that risks are effectively identified and assessed and that appropriate controls and responses are in place. The monitoring process should provide assurance that there are appropriate controls in place for the organization's activities and that the procedures are understood and followed.

EARLY WARNING – RISK AND VULNERABILITY INDICATORS

In 1997, the UN's Guiding Principles for Effective Early Warning stated that the objective of early warning "is to empower individuals and communities, threatened by natural or similar hazards, to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life, and damage to property or nearby and fragile environments" (UNEP), 2010.

The Early Warning to be effective and complete, it needs to comprise four interacting elements:

1. **Risk knowledge**: knowledge of the relevant hazards, and of the vulnerabilities of people and society to these hazards
2. **Monitoring and warning service**: a technical capacity to monitor hazard precursors, to forecast the hazard evolution, and to issue warnings.
3. **Dissemination and communication**: the dissemination of understandable warnings, and prior preparedness information, to those at risk.
4. **Response capability**: knowledge, plans and capacities for timely and appropriate action by authorities and those at risk.

Early warning systems require a broad multidisciplinary knowledge base, building on the substantial existing discipline-based research in the geophysical, environmental and social science fields. There is a need for more systemic, crosscutting and applied research, including on the following topics:

1. Development and use of geospatial data models, risk maps and scenarios.
2. Cost-effective observations systems.
3. Data generation and assimilation.
4. Improvement of core prediction system models and prediction tools.
5. Warning decision system tools for disaster managers.
6. Management under warning uncertainty.
7. Evaluation and comparison of warning communication methods.
8. Models of human response behavior including evacuations.
9. Visualization of impacts and response options for community Preparedness.
10. Warning system performance, indicators, benchmarks, and economic assessments of warning system effectiveness.

Challenges facing Early Warning Systems

• Early warning systems have to meet several requirements, including the use of appropriate technology and know-how, clear responsibilities of parties and effective decision taking mechanisms, a functioning communication system and well-prepared evacuation and response structures.

• Different hazards require different early warning systems.

• Experiences gathered around the world show that some hazards are difficult to predict.

• At present, many systems that are able to issue warnings for a number of natural hazards are in place. A frequent problem, however, is the weak linkage between the technical capacity to issue the warning and the public's capacity to respond effectively to the warning, the capacity of the warning to trigger the appropriate response by emergency management agencies, community-based organizations and the public at large.

Early warning applications and its importance in disasters, Crisis and risk management

Most of the data required for disaster management, has special components and also changes overtime. Therefore the use of remote sensing and GIS has become essential in urban disaster management. Moreover A range of tools exist to help in providing warnings about events that could threaten the stability of a given society.

Remote Sensing Applications

In a number of countries, where warning systems and building codes are more advanced, remote sensing of the earth has been found successful to predict the occurrence of disastrous phenomena and to warn people on time.

The term "remote sensing" is broadly defined as the technique(s) for collecting images or other data about an object from measurements made at a distance from the object, and can refer, for instance, to satellite imagery, to aerial photographs or to ocean bathymetry explored from a ship using radar data (FEMA). The vantage point of space, particularly when combined with the results of field based vulnerability assessments in a GIS, has proven remote sensing to be a valuable tool for the early warning and disaster management communities, and is increasingly being applied by governments and non-governmental organizations to decrease the impacts of climate, water and weather related hazards.

Geographic Information Systems (GIS)

Since risk is a spatially varying phenomenon, GIS technology is now the standard tool for the production and presentation of risk information. Risk can be presented in the form of statistical information per administrative unit, such as a Risk Index value resulting from qualitative risk assessment, the Probable Maximum Loss or Average Annual Loss , Loss Exceedance curve for economic risk, or F-N curves for societal population risk.

GIS can be used to analyze the spatial characteristics of the data over various digital layers. If sequential data are available

quantification of spatial changes becomes possible through overlay analysis. Most importantly, the combination of both types of database can ensure sustainable management.

NATURAL AND ENVIRONMENTAL THREATENS THAT EGYPT MUST CONFRONT

Introduction about Egypt (Profile and Context)

The Arab Republic of Egypt is located in the North-Eastern and South-Western corners of Africa and Asia respectively. It is bounded to the North by the Mediterranean Sea, from the East by Palestine, from the South by Sudan, and from the West by Libya.

Geographically Egypt Consist of Four major parts (The Nile Valley and Delta – Western Desert – Eastern Desert – Sinai Peninsula). Egypt's borders run about 1,085 km from North to South and about 1,255 km from east to west encompassing an almost square-shaped total area of about 1 million square km. The average altitude is 50 ft below sea level; the highest point being Mount St. Catherine at a high of 8,668 ft and the lowest the Qattara Depression at 436 ft below sea level. (Environmental Profile of Egypt, 2001).

Natural Hazards and Environmental Crisis in Egypt

Each Hazard or Environmental Crisis known in Egypt has many causes and sever affects and impacts on community as following (Egypt state of the Environmental Report, 2009):

1. Flash floods

Flash floods are the result of short period of heavy storms that occur in the red sea area and southern Sinai. Velocity of floodwater depends mainly on the topography of basin and its soil type and characteristics. Some of these flash floods caused severe damage to people and infrastructures. Many studies have been undertaken to determine possible measures to avoid hazards that flash floods cause.

2. Dust and Sand Storms

They are common phenomena in Egypt during the spring and late winter seasons. Dust storms can result in high concentrations of particulate matters, which affect the visibility contributing to increased road accidents, and negatively affect air traffic.

3. Earthquakes

Sudden movements along geological faults in rocks specifically near the surface of the earth result in earthquakes. The main faults of Egypt and their tectonic setting and seismic records indicate there are at least three main seismic active trends:

- Northern red sea – Gulf of Suez – Cairo – Alexandria trend.
- Eastern Mediterranean – Cairo – Fayoum depression trend.
- Gulf of Aqaba trend.

4. Landslides

Due to the special nature of the earth crust in Egypt and its geology together with the uprise of subsurface water have caused several types of landslide.

5. Rock fall

In 2002 and 2008 a Rock slides on the edges of the brittle Muqattam hills - Cairo, crushed a shantytown in the eastern Duwayqa area. And Up to 200 people have been buried under their homes after rockslides.

6. Uprise of Subsurface water

This problem poses a great threat to old Cairo and its all Islamic monuments and almost all other pharaonic and Christian heritage. The area affected in Greater Cairo reaches almost 2000sq.km whereas the affected population ranges between 12-15 million people.

7. Coastal erosion

This phenomenon is observed along the shores of the delta. Buildings of the high dam deprives the northern shores from the silt they used to receive annually (approx. 35 million tons of sand and 45 mill. tons of mud and silt). The shore line retreated to a great extent in different areas like Rashid, Borollos and Ras El-Bar.

8. Environmental pollution

Oil pollution in sea water, wastes reaching the Nile water and soil polluted with excessive use of agricultural chemicals such as fertilizers and pesticides. Air polluted with various Chemicals and suspended matter.

The Governmental Authorities and Non-Governmental organizations trends to Confront the Natural and Environmental Disasters

In Egypt there are several protocols between relevant agencies and institutions pertaining to Disaster Management and Risk Reduction including but not limited to the Ministry of Interior, the Egyptian Atomic Energy Authority, the Academy of Scientific Research and Technology, the Ministry of Housing, Utilities and Urban Communities, the Egyptian Environmental Affairs Agency and the Armed Forces (Riad, 2002). These protocols intend to organize and coordinate the participation of these agencies in disaster management and reduction and elaborating codes and plans for protecting humans and facilities in case of disastrous accidents. Public agencies, both central and local, and civil society organizations allocate necessary resources for preparedness. Disaster risk reduction is on the agenda of various institutions including, executing agencies, research centers and NGOs, however Egypt has a national strategy and necessary legislations that address disaster risk reduction. (The National Environmental Action Plan 2002-2017, 2001)

Examples for some sectors participations

- **The government established an information database and hazard mapping** for each governorate, which includes data about residents of each village and their characteristics, administrative information, data on social, physical infrastructures and on economic establishments as well. The database also includes complete survey on vital target places, such as power stations, water plants, hospitals.
- **The ministry of planning has established** an integrated hazard mapping system and complete projection on the possible hazards that were divided according to their nature.
- **Central Agency for public mobilization and statistics** uses its Geographic information System (GIS) to find stabile alternatives in the management of disasters. According to the location of the event and means to utilize the resources at neighboring sites, a plan for evacuation and reallocation of inflicted population is possible.

Egypt disasters mitigation Projects and activities (ongoing and Completed)

- **Identification of hazard zones (Hazard assessment)**
  - Earthquake hazards and assessment in Egypt.
  - Detailed seismological field studies of the October 1992 earthquake and its after-shocks.
  - Mitigation of flash flood hazard in Egypt.
  - Hazards due to ground-water condition in Egypt.
  - Desertification of arable lands in Egypt.
- **Monitoring, prediction and warning**
  - Earthquakes monitoring network.
  - Monitoring, prediction and warning of flash floods. Monitoring, prediction and warning of radiation hazards.
- **Land-use and risk management**
  - National land-use map.
- **Public education and information**
  - Holding training courses and workshops, international conferences covering all aspects of disaster mitigation.

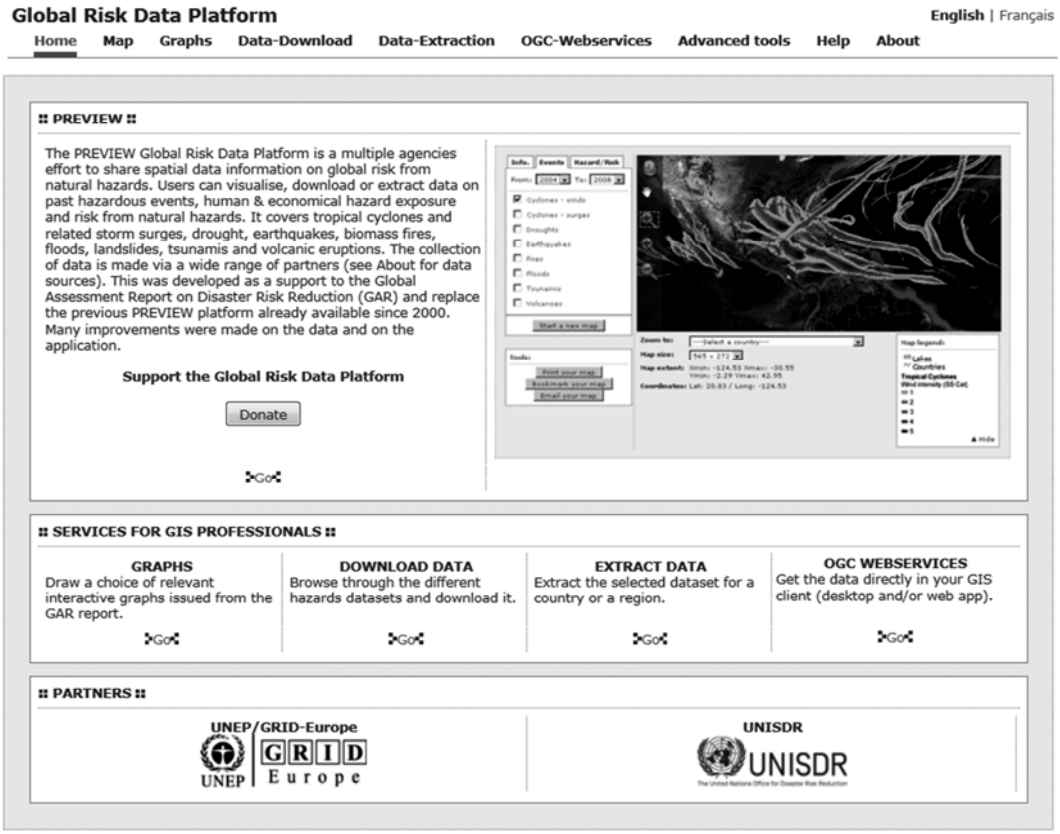


Figure 1. The PREVIEW Global Risk Data Platform is a multiple agencies effort to share spatial data information on global risk from natural hazards (EM-DAT)

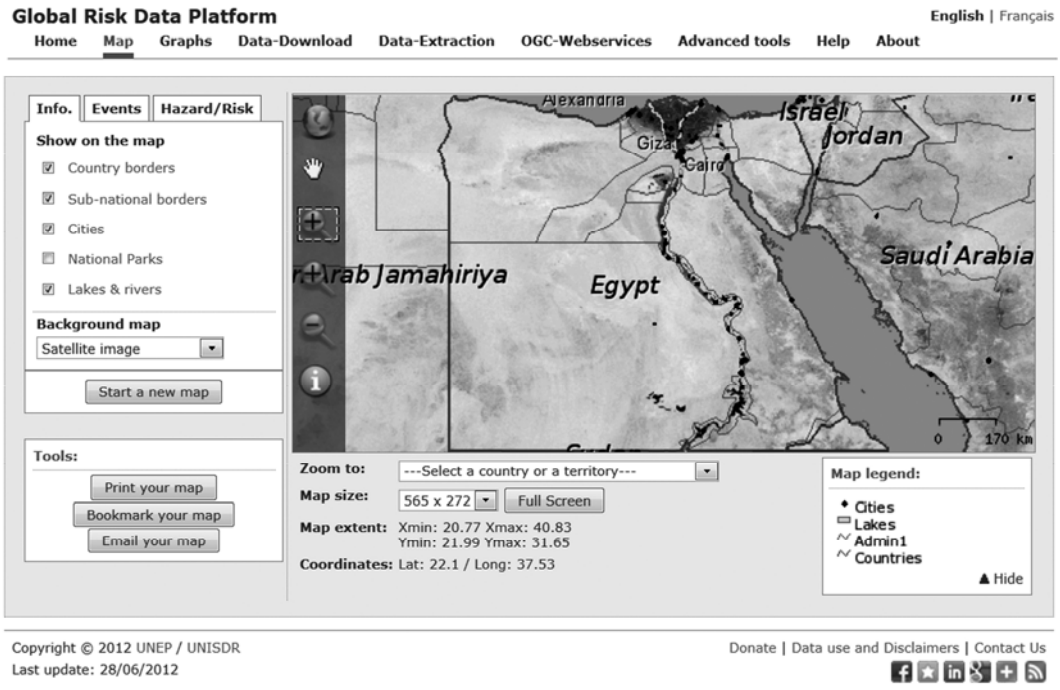
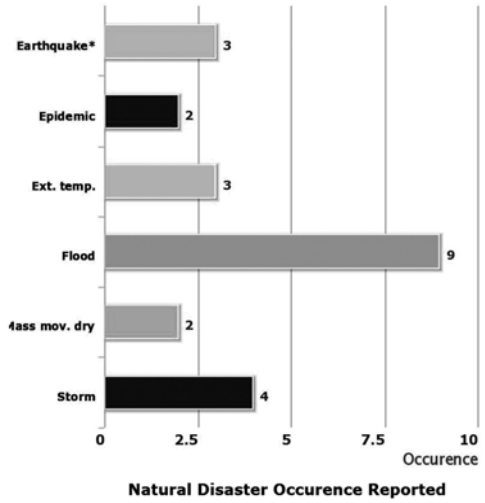


Figure 2. Egypt Risk Map (EM-DAT)

Natural Disasters from 1980 - 2010

Overview

No of events:	23
No of people killed:	1,527
Average killed per year:	49
No of people affected:	262,864
Average affected per year:	8,479
Economic Damage (US$ X 1,000):	1,342,000
Economic Damage per year (US$ X 1,000):	43,290



Natural Disaster Occurence Reported

Top 10 Natural Disasters Reported

Affected People

Disaster	Date	Affected	(no. of people)
Flood	1994	160,660	
Earthquake*	1992	92,649	
Flood	2010	3,500	
Flood	1995	3,000	
Flood	2002	800	
Mass Movement Dry	2008	697	
Mass mov. dry	1993	300	
Flood	1996	260	
Earthquake*	2002	250	
Flood	1991	208	

Killed People

Disaster	Date	Killed	(no. of people)
Flood	1994	600	
Earthquake*	1992	552	
Mass Movement Dry	2008	98	
Mass mov. dry	1993	34	
Extreme temp.	1995	32	
Storm	2010	31	
Storm	1987	30	
Extreme temp.	1996	22	
Storm	1997	18	
Epidemic	2006	15	

Economic Damages

Disaster	Date	Cost	(US$ X 1,000)
Earthquake*	1992	1,200,000	
Flood	1994	140,000	
Flood	1997	1,000	
Storm	1997	1,000	
Storm	1987	0	
Extreme temp.	2000	0	
Flood	2002	0	
Earthquake*	2002	0	
Flood	2002	0	
Storm	2004	0	

Statistics Per Event

Killed People

Drought:	...
Earthquake*:	187.33
Epidemic:	7.50
Extreme temp:	19.00
Flood:	74.33
Insect infestation:	...
Mass mov. dry:	66.00
Mass mov. wet:	...
Volcano:	...
Storm:	23.00
Wildfire:	...

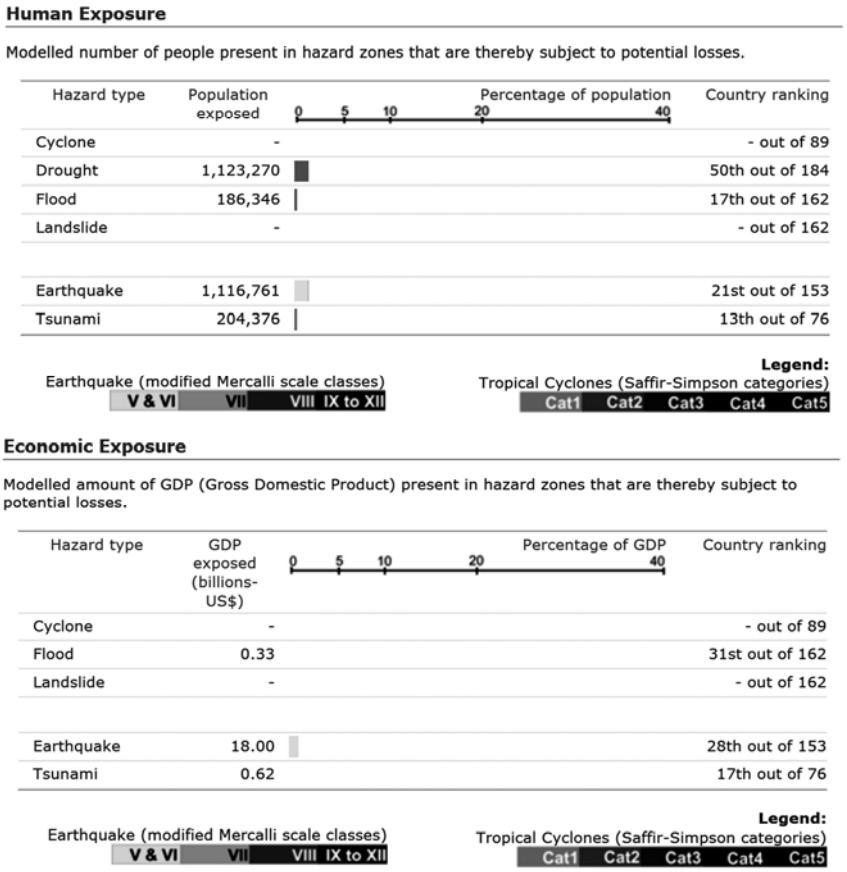
Affected People

Drought:	...
Earthquake*:	30,989.33
Epidemic:	71.50
Extreme temp:	35.00
Flood:	18,722.00
Insect infestation:	...
Mass mov. dry:	498.50
Mass mov. wet:	...
Volcano:	...
Storm:	38.25
Wildfire:	...

Economic Damages

Drought:	...
Earthquake*:	400,000.00
Epidemic:	...
Extreme temp:	...
Flood:	15,666.67
Insect infestation:	...
Mass mov. dry:	...
Mass mov. wet:	...
Volcano:	...
Storm:	250.00
Wildfire:	...

Figure 3. Egypt Disaster Statistics - Data related to human and economic losses from disasters that have occurred between 1980 and 2010 (EM-DAT)



Human Exposure

Modelled number of people present in hazard zones that are thereby subject to potential losses.

Hazard type	Population exposed	Percentage of population (0 5 10 20 40)	Country ranking
Cyclone	-		- out of 89
Drought	1,123,270		50th out of 184
Flood	186,346		17th out of 162
Landslide	-		- out of 162
Earthquake	1,116,761		21st out of 153
Tsunami	204,376		13th out of 76

Earthquake (modified Mercalli scale classes): V & VI | VII | VIII IX to XII

Legend:
Tropical Cyclones (Saffir-Simpson categories): Cat1 | Cat2 | Cat3 | Cat4 | Cat5

Economic Exposure

Modelled amount of GDP (Gross Domestic Product) present in hazard zones that are thereby subject to potential losses.

Hazard type	GDP exposed (billions-US$)	Percentage of GDP (0 5 10 20 40)	Country ranking
Cyclone	-		- out of 89
Flood	0.33		31st out of 162
Landslide	-		- out of 162
Earthquake	18.00		28th out of 153
Tsunami	0.62		17th out of 76

Earthquake (modified Mercalli scale classes): V & VI | VII | VIII IX to XII

Legend:
Tropical Cyclones (Saffir-Simpson categories): Cat1 | Cat2 | Cat3 | Cat4 | Cat5

Vulnerability and Risk

The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

	Vulnerability Index	Risk Absolute	Risk Relative	Mortality Risk Index
Multiple				
Cyclone				
Flood				
Landslide				
Earthquake				

Legend:
Very low 0 1 2 3 4 5 6 7 8 9 10 Very high

Vulnerability Index: Estimated number of people killed per year (per mio. exposed)

Risk Absolute: Average killed per year

Risk Relative: Killed per million per year

Mortality Risk Index: Average of both indicators (RA+RR/2)

Class	Absolute risk	Relative risk	Mortality Risk Index	Vulnerability Index
0	0	0	Unknow exposure	0
1	> 0 - 0.3	> 0 - 0.03	Negligible	0.3
2	0.3 - 1	0.03 - 0.1	Very low	1
3	1 -3	0.1 - 0.3	Low	3
4	3 - 10	0.3 - 1	Medium low	10
5	10 - 30	1 - 3	Medium	30
6	30 - 100	3 - 10	Medium high	100
7	100 -300	10 - 30	High	300
8	300 - 1000	30 - 100	Very High	1000
9	1000 - 3000	100 - 300	Major	3000
10	> 3000	> 300	Extreme	10000

Figure 4. Egypt Risk Profile Statistics -
This risk profile is an analysis of the mortality and economic loss risk for three weather-related hazards: tropical cyclones, floods and landslides.
In addition new insights have been gained into other hazards such as earthquakes, tsunami and drought. (EM-DAT)

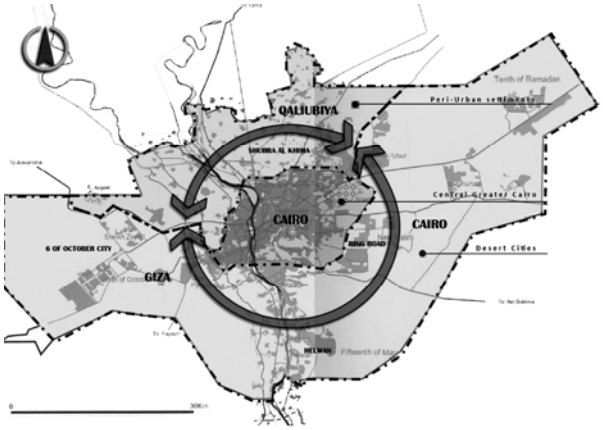


Figure 5. Administrative Boundaries of Greater Cairo

Table 1. Risks and Vulnerability Description (Egypt state of the Environmental Report, 2009)

Analysis		Evaluation	Treatment	Monitoring and review
Nature of Risk	Priority of Risk (Low – High)	Consequences (damages & Losses)	Risk Treatment (Recommendation Solution)	Means, strategies and Policies
Flash Flood – Flood – Earthquake – Landslide - Rock fall - Coastal erosion - Environmental degradation due to agricultural practices - Air/ Soil/ Water Pollution - Dust & Sand Storms.				

THE MAIN GUIDELINES FOR PROCEEDING A PRELIMINARY RISK MANAGEMENT PLAN FOR GREATER CAIRO CITY

Defining the Greater Cairo Region

Before defining the study area, it should be noted that the term "Greater Cairo" is invariably applied in Egypt to describe different overlapping areas developed over years. Nowadays the Greater Cairo Metropolitan Area divided between five governorates; Cairo, Giza, Qalyobiya, the newly established Helwan and 6th October Before establishing the new Helwan and 6th of October governorates.

Greater Cairo Geographic location

The Greater Cairo (G.C.) area is situated between the 29°43 and 30°26 N latitudes and the 30°43 and 31°53 E longitudes with an area of 1.09 million Feddan. The Nile runs through this area in a flood plain 9 to 35 km wide, the topography of the region is almost flat, bounded by hills to the east and west.

Weather conditions

The region is located in the subtropical climatic region with a dry climate. In winter the general climate of the region is cold, moist and rainy with minimum mean temperature of 13°C, while during summer, it is hot, dry and rainless with maximum mean temperature of 28°C. In spring and autumn dust and sandstorms frequently blow.

The main Guidelines to conduct a preliminary risk management Strategy/plan

Table 1. for Risks and vulnerability description, drew the main guidelines to conduct the preliminary risk management strategy. All risk assessment process for the Greater Cairo city can utilize the Main Egyptian risk assessment. (See figures: 1,2,3,4).

CONCLUSIONS AND RESULTS DISCUSSION

Conclusions

According to what mentioned previously we can determine the main conclusions as following:

First: Monitoring of disasters using remote sensing, GIS and GPS has two aspects; one is to record the real status of damages due to those disasters (Data Collection) and the other is to analyze the cause of a disaster and to predict the occurrence of the disaster (Processing Data). Moreover remote sensing should be integrated with GIS technique in terms of risk management, hazard mapping and public awareness.

Second: Many Natural Hazards and Environmental Crisis occurred repeatedly in Egypt such as: flash floods, dust and sandy storms, Earthquakes, Landslides, Rock Fall, uprise of subsurface water, Costal erosion and Environmental pollution, each of them has causes and sever affects and impacts. This forced the Egyptian government to develop its National Policy Framework on Crisis Management and Disaster Risk Reduction.

Third: Egypt has advanced facilities for satellite reception of image and analysis of data collected by satellites. Egypt is also a participant in several international networks for regional monitoring to exchange information.

Fourth: Egypt's capability of environmental management is continuously improving, However, There are still main challenges that face the country, such as; air pollution, soil salinity and desertification, marine pollution, untreated sewage water, rapid increase of population which affects the natural resources and discord between development policies and environmental guiding principles.

Fifth: The Egyptian environmental affairs agency provided most of the cities specially the Greater Cairo region with indicators to monitor the Air and fresh quality and noise level, to ensure they are within the allowable rate, as a proactive early warning procedure.

Sixth: The presented indicators generally show trends in specific parameters that describe aspects of the state of Air and fresh water quality in Egypt. These indicators can be used by decision-makers to assess environmental policies in air and water sector. Unfortunately time constraints, as well as limitations or lack of data have been major obstacles toward the formulation of such indicators.

Seventh: Although a legal framework that consist several actions relevant to the Crisis Management and Disaster Risk Reduction exists in Egypt (more than 10 laws and decrees), there is a need for revised legislation and their enforcement and to institutionalize the legal structures.

Result Discussion and Recommendation

The Main Issue here is not how to make a disaster or risk reduction strategy; because there are plenty of those inefficient theoretical strategies, the main issue is the limitation of visions in proceeding those strategies, for example what if one of those strategies didn't achieve its goals? The disaster will be occurred. That what make the Egyptian Disaster risk reduction not completely efficient, because there isn't plan B which is necessary to deal with any variables may suddenly occur, not only that but also the conflict in responsibility between relevant agencies and institutions pertaining to Disaster Management and Risk Reduction.

An Efficient Action plan for Risk reduction must be set with many alternatives to each exposed threatens or Risk. Risks must be organized according to risk priority (High-Mid-Low) and this action plan must specify the protocols between relevant agencies and institutions pertaining to Disaster Management and Risk Reduction. Moreover the results and consequences must be subjected to monitoring and reviewing process to estimate the effectiveness of the plan.

Many proactive scenarios for disasters and Risks that threaten the Greater Cairo city must be conducted with utilization for the simulation programs to determine the different expectations and specify a proper Treatment methodology to each case individually according to the risk analysis matrix.

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WATER MANAGEMENT, ENVIRONMENTAL PROTECTION AND SPATIAL PLANNING RECONCILIATION - "ACCOMMODATING" THE DANUBE AND THE TISA RIVER IN SERBIA

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Water management in Serbia has been mostly operating in a framework of public companies and institutions focused on strictly sectorial and technical expertise on hydraulic engineering, environmental protection and navigable traffic engineering within the highly autonomous legislative framework. On the cross-point of spatial planning and water management there is a growing debate on the important discourses of the policy domains. Seeing rivers as an "accommodated" generator of opportunities is a statement which is opposing the traditional consideration of strict separation of water from the land. Spatial planning as a framework for regulating the land use has an important function in integrating the water management and landscape more closely. In Serbian spatial planning practice there is growing practice of area-specific development planning (reflected through the Spatial plans for the special-purpose areas) which are considered to accommodate new ideas on spatiality better than the traditional, sectorial planning documents. The question is placed as to how these practices could direct new spatial arrangements of integrative collaborative spatial planning and not just merely reflect the framework of the existing planning order. This paper seeks the potential and actual role of spatial planning in addressing challenges related to particular river environments on the Tisa and the Danube rivers. The research is based on the analysis of two Spatial plans for the special-purpose areas which are still in conceptual phase – The Cultural landscape of Bač and Multifunctional ecological corridor of the Tisa river.

Key words: *integrated spatial planning, water management, strategic actions.*

INTRODUCTION

The land management and design of human settlements has been a harmonious ecological statement between man and the elements of nature, with a special focus on water resources. Management of water systems in Vojvodina was the basis of rationality that dominated the planning of early settlement network. The canals and waterways were part of agriculture, transportation, norms and also had distinct cultural connotations. The water management as an engineering skill brought immeasurable value to the region. It prevented floods, regulates groundwater levels and formed the irrigation systems which refined the agricultural activities. Over the decades, there has been a tremendous pressure on water resources and its management due to unbridled activities - agriculture, urbanisation and industry, which still remains an important driver of environmental degradation. At the same time there has been rational need of local communities to maximize the use of the granted waterfront potential. Therefore, the common property of waterfronts and canals became systematically difficult to maintain. The need for comprehensive and multi-practice coordinated development, oriented towards mitigation of degradation and preservation of historical use, activities and forms of the waterfronts in Vojvodina became the urgency. (Maksin-Mićić *at al*. 2009)

The Tisa and the Danube river catchment areas in Serbia have been the subject to numerous projects, strategies, development programs and transnational regional cooperation initiatives. Many projects provided wide cooperation framework between local, regional and national governments, planning and research institutions on national and international level. The common characteristic of all these actions has been the integration of relevant sectors. The integrated strategis are meant to help to attain a sustainable economic system on national and regional level, optimal

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use of natural and cultural resources, balanced distribution of competitive development areas and enhancement of the internal and external functional relations in the settlement system. They have also been formulated to serve the implementation of the EU directives, agendas and territorial development objectives (TICAD).

STRATEGIC APPROACH

Based on the awareness of processes in spatial planning practice in Serbia and the land use dynamics, one of the main challenges for reaching the satisfying level of territorial integration remains the improvement of physical and functional communication channels between areas managed by different sectors. The potential role of the Spatial plans for the special-purpose areas[2] in addressing challenges related to particular water environments on the Tisa and the Danube rivers can actually be seen through enhancement of the strategic communication links. In this case-study, the strategic communication should be established by networking interests, capacities, data[3] and general resources of water management, spatial/urban planning and nature/cultural heritage protection sector.

between key actors and not just merely reflect the framework of the existing planning order that equally involves all the stakeholders. It has also been suggested the new formulation of Spatial plans for the special-purpose areas as area-specific spatial plans.

COMMON ACTIONS

The articulation of the common actions for conceptualization of The Cultural landscape of Bac and The Multifunctional ecological corridor of the Tisa river, are reflected through the statement which is opposing the traditional consideration of strict demarcation of water from the land, protected from unprotected areas, cultivated from natural lands and so on. These common actions are supposed to create sustainable conditions that would be generators of future opportunities.

The process of preparation of the common spatial actions initially involved the communication on how the rivers catchment and their surrounding areas have been seen by each sector. The main groups of spatial development frameworks have been derived from the sectorial agendas with focused on common development perspectives and active environmental protection.

The purpose of the spatial development frameworks was to:

- manage the long term spatial development
- generate the central spatial ideas and align them with relevant national and provincial spatial principles, strategies and policies;
- guide local development spatial initiatives contained in the more detailed municipal spatial plans that cover a shorter planning time frame (a few years), and the preparation of local regulation plans;
- identify areas that are suitable for construction development, areas where the impacts of development need to be managed, and areas that are not suited for any development;
- identify strategies to prevent degradation of critical landscapes, and to ensure the necessary level of protection for the remaining ones;
- provide policy guidance for local communities to direct decision making on the nature, form, scale levels and location of urban development, land use change, infrastructure development, disaster mitigation and environmental resource protection.

Table 1. Plan to improve nature protection and economic opportunities

Spatial concepts	**Central spatial ideas**
Ecological grid: Creation of the network of ecological routes that enable convenient coexistence of natural habitats with other land uses.	- **Establishing the main Ecological corridor**: Creating a system of continuous north-south international corridor along the Tisa river - Development of east-west links: Creating a system of continuous east-west links to improve consistency and movements on the regional and local level.
Areas for intensification: Areas identified for intensified economic activity and where urban growth should be promoted.	- **Main economic intensification areas**: The corridor provides significant opportunity for further commercial and residential developments with the special focus on tourism diversification which supports the regional strategies for decentralized spatial development. - **A system of urban nodes**: A system of regional, district and local nodes is identified where intensification of services is supported and which are proposed at highly accessible locations on the accessibility grid. - **Urban nodes in 'village context'**: Promotion of more multi-functional, vibrant and characterful, contained rural area nodes.

Table2. Enhanced urban growth and created balance between urban development and environmental protection - Central spatial ideas

Spatial concepts	**Central spatial ideas**
Natural assets: Significant cultural and natural resources and biodiversity areas	- **Water system and green linkages**: protect the Tisa river corridor, forests, pastures, grass lands, wetlands, estuaries and swamps as the major green anchor in the region which provide habitat protection and recreational opportunities and link various conservation areas. - **Productive landscapes**: Protect Vojvodina's cultural heritage and productive agriculture, aquiculture, viticulture and promote them as tourism attraction. - **River banks**: Ensure public access to the riverbanks and associated activates (beaches, fishing, hiking) and ensure appropriate development on the coast is located in identified coastal nodes.
Development edges: Lines used to manage urban growth and steer environmental protection	- **Urban edge lines**: A long-term edge lines has been demarcated to protect natural resources and scenic landscapes, and limit urban sprawl. - **The river edge line**: An edge line demarcated along the river banks to mitigate natural disasters, protect ecological processes and maintain the riverside as a public amenity.
Future urban growth areas: New development areas	- **Main regional road corridor M-24**: This is considered as future growth corridor of the province providing significant opportunity for new residential and commercial development - **The cross-river twin-towns ('enclaves')**: Bečej-Novi Bečej, Ada-Padej, Senta-Čoka, Kanjiža-Novi Kneževac and the far south Titel-Knićanin are considered future urban growth areas.

[2]A type of comprehensive spatial plans that stand between national (provincial) and local level which concern is the most often the areas of protected nature, water accumulations, coal basins or infrastructure corridors. According to the current law, these plans include the determination of the planning starting point, the spatial development objectives and land use, organizations and protection measures within the planning area.

[3] Especially GIS data.

The spatial development frameworks generated spatial concepts that were elaborated trough number of *central spatial ideas*. Following matrix, presented in Tables 1, 2, 3, illustrate three spatial development frameworks established for the Multifunctional ecological corridor of the Tisa River.

In general, presented discussion and the case study on strategic communication approach to territory management underlines the need to consider water as an important structuring principle for spatial planning. The reconciliation of spatial planning, water management and protection sector in the context of environmental concerns and development pressures in Serbia can be achieved by spatial development choices considered in the light of strategic alliances that reflects the characteristics of specific area. There are some points underlined that are showing how spatial planning can contribute to water management, the protection and enhancement of environmental resources (Healey, 2004).

These include:

- Long term nature of spatial planning - environmental problems and their fixing are often considered over long period of time and broad spatial scale;
- Comprehensiveness of spatial planning polices can integrate environmental protection goals;
- Biding nature of spatial plans brings a powerful influence over the distribution of pollutants;
- Spatial planning statements can offer protection to sensitive environmental areas such as wetlands, habitats and historical landscapes;
- The process of preparation of spatial plans involves a number of stakeholders that provides possibilities of expressing conflicting demands;
- Hierarchy of spatial plans enables environmental problems to be addressed and resolved at an appropriate spatial scale;
- Spatial planning is related to the natural environment and human societies. This is significant as many environmental problems are caused by the way that humans relate to the natural environment, a relationship that spatial planning can influence.

Table3: Creation of an inclusive, integrated and vibrant settlement network

Spatial concepts	**Central spatial ideas**
Public services: A local area where public facilities are concentrated.	- Reinforcing the **Twin-towns** as the civic centres: Where there are already high schools, sport centres, courts, libraries, hospital etc. - Local civic services **to support pockets of need**: To meet increasing local area needs in rural areas and lower density areas.
Destination places: Significant landmarks that have scenic, natural, cultural or historical value.	- **The river jewels**: Access points to the river that can accommodate large numbers of people and associated recreational and economic activities. - **Nature attraction areas**: Nature areas that support recreation and tourism.
Structuring open spaces and critical public links: An interlinking network of nature parks, sports fields and green links for cycling and walking	- **Structuring open space**: Green links, sports facilities, golf course (Zabalj), cemeteries and linear open spaces contribute to the open space system of the area. - **Critical public links**: The north-south chain link (scenic bicycle route link), and nature protection areas links (walking and boat routes).
Integrated settlement patterns: Settlement structures that support a mix of different residential options, income groups and related social and economic opportunities	- **Ilnfill pockets**: Undeveloped land within the urban edges should contribute to increasing overall average residential densities addressing the imbalances in access to civic services and other opportunities.

CONCLUSION

More recent attention has been placed on managing the multiple uses of the rivers catchment areas, especially in areas where conflicts among users and the environment are already clear. Even more concern has been focused on the need to conserve nature, especially ecologically sensitive areas, in the context of multi-purpose planning of the Tisa and the Danube river space. Despite institutional efforts and the fact that number of policies has been implemented, the scope of integrated planning of river basins has not been clearly defined.

The future of comprehensive planning in Serbia depends on how the collaborative approach could be integrated in the evolution of current planning system. In the framework of institutionalized planning practice, in this research the effort has been directed in trying to apply innovative communication methods to bridge the gap between sectorial interests, attitudes related, not just to the distribution of powers between sectors, but also the way the space has been evaluated, interpreted and finally directed in sustainable manner.

By opening the rhetorical discussion on policy domains, in this paper, the aim has been to point out the effort put to establish changing arrangements between water management, spatial planning and environmental protection within institutional framework. According to Giddens (1984) institutional change is mostly a process of gradually altering interactions that is resulting in new policy practices with the aim to promote and institutionalize new policy concepts that will lead to the re-articulation of policy arrangements". The challenge for the further analysis would be to overlap presented analysis in a comparative manner, examining practices and policy arrangements in other countries with similar or different sectors involved.

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CONTESTED LANDSCAPES. CONFLICTS OF INTERESTS AND CONTROVERSIES IN PLANNING AND USING SPACE

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This paper sets out to explore the relationship between planning and conflict in the use of space, and to reflect on the ideas underpinning transformations of the territory, beginning with the relations existing between projects and policies, since planning decisions are a statement of something more than just organizational projects for space. In an urban realm where the market increasingly swallows up space, contributing to shaping form and functions according to a profit-based logic, battles are sometimes waged to defend public goods. The paper deals with the case of two areas at the center of controversies and disputes related to divergent interests, which spring from totally different points of view on space and the role of the assets shaping the landscape. The contrast is illustrated between the logics of a market based on the pursuit of economic gain to the detriment of social construction, and the right to a collective heritage, with the aim of asserting the need and possibility to go beyond the logics of individualism in planning.

***Key words:** conflict, revenue, collective interest, Tuvixeddu, coastal territory of Sardinia.*

CONFLICTS ON SPACE MANAGEMENT

As Lefebvre (1968) pointed out, space is a social, even before physical, product of human action, since it contains very different objects, which are not just things but rather relations. In other words, much more is contained in it than a series of tangible elements, so it is more an instrument through which to understand social dynamics, rather than an end in itself to such knowledge.

In this sense, space cannot be considered a (physical-geographic) fact that can be evaluated independently from the use made of it, since it consists of the set of relations inherent in this use, and the (social, economic and socially defined) rules that guide and give meaning to these relations, incorporated in the space as it appears to empirical observation. Interests and different expectations focus on it that make it a battle-field where different forms of power and various forms of resistance confront each other. Space management is a highly complex factor that involves customized interests and visions, and many, diversified stakeholders, with a high political, social, economic and environmental impact.

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So it is decidedly more than a simple bureaucratic exercise and cannot be solved simply by a trial of strength. Although space has always been at the center of conflicts and struggles, episodes of intolerance and friction mainly related to form, use and fruition of space are multiplying. These underpin a more general problem of rights as regards choices for space in relation to the various interests that come into play (Le Galès, 2002).

The widespread belief that ownership of a property allows one to do whatever one wants with it involves the need to find the direction that not only respects individual freedom, without compromising that of others, but also creates points of encounter through the protection of collective goods.

The literature has increasingly faced this question from different viewpoints promoting one or other aspect (Morrissey and Gaffikin, 2006). Recent decades have seen a wealth of literature on cultural geography regarding identity, codified culture, the public sphere and the formation of space (Harvey, 2000; Zukin, 1995). Other contributions have explored the blurring of boundaries between public and private in the built environment (Madanipour, 1999), the connections between real, metaphorical and cyber- space (Graham and Marvin, 1996), recognizing that there are social processes involved (Featherstone and Lash, 1999; Gregory and Urry, 1985) and non-material factors such as religion and ethnicity that play an important role in conflict situations (Sandercock, 1998). Growing attention has thus developed for the complex connections between space, values, identity and politics (Tajbakhsh, 2001).

Nevertheless, these situations constitute a theme not yet sufficiently explored, though highly stimulating for the discipline and more than any other issue, therefore, a challenge and unknown area for mediation between parties, to grasp their reasons and evaluate their coexistence.

In this paper the term 'contested space' refers to a space where interests and ideals collide, revealing totally different ways of looking at territorial planning: one that makes the territory a resource to exploit, and the other an asset to share. To this end, it reports on two cases that are the expression at different scales of the same form of contested space where the conflict focuses on the clash between two powers, economic and social, and which, through the manipulation of management instruments, pose questions on fairness and access, the right of decision and the right of action, the benefit of a few, compared to that of many.

DOMINANT INTERESTS

In urban transformation one of the most important, decisive conflicts is actually that between land use value and exchange value, in other words, between a vision that considers the city a good and one that interprets it as a commodity. The features of this conflict can be summarized in the antithesis expressed by the dichotomy economic value/social value, between the city producing revenue and the city of the community (Neuman, 2005; Salzano, 2011), where the latter includes not only the city in the strict sense but also the "country" in the traditional sense, i.e. both the urban and rural territory. Urbanization processes driven by the logics of real estate development have crossed the boundaries of the historic city, mostly producing scenarios characterized by poor urban quality, fragmented and untidy, ignoring the environmental sensitivity of the territory, and unfinished from the viewpoint of creating urbanization works, for they implement inconsistent and questionable construction principles and features. They are devoid of space for public use, with little attention to forms and ways of including the pre-existing elements, both physical but also symbolic - all typical elements of uncontrolled development, which consumes resources, assets, energy and land following a mechanism that has ended up becoming one of the main causes of most of the current urban problems. From this standpoint, the territory is considered and used as a tool by which to increase the wealth of owners, just as the city becomes, on a smaller scale, a machine, constructed and maintained over time by the community to increase private income.

In Italy the transition from a critical view of urban income to full adhesion to it took place in the early Seventies, when private appropriation of income (financial and property) became the predominant component of the gains made by those managing capital closely intertwined with profit, thanks also to land speculation prompted by national policies (Tocci, 2009). But overall, it was a global trend that led to a drastic change in the role of the city as regards the economy in other contexts, too. So nowadays modern cities are the spatial image of real estate speculation.

Spaces, services, equipment and common functions around which the city of the past and during the period of the welfare state was created and organized, were at the center of attention and organizational efforts; they became a problem, being an obstacle to speculation, as were the instruments to regulate territorial government (Sorensen, 2003).

The land use plan has the power to influence the land market and real estate prices through the allocation of development rights, identification of use, zoning, construction of public works, infrastructure and primary and secondary urbanization, and to change the rules according to which the market acts (Lai *et al.*, 2011). However, at the same time, market and land use appear to be the conditions within which the plan is drawn up and has to work. If the plan affects land use and real estate (land and building), the contrary is also obviously true.

It is more and more difficult to find urban plans that oppose urban transformations leveled out on economic exploitation of the territory, for the benefit of a few. However, this does not mean total adhesion. This paper proposes two correlated Italian case studies to discuss these issues. The first concerns the conflict over the urban area of Tuvixeddu (Cagliari, Sardinia), the second over the coastal territory of Sardinia.

TUVIXEDDU. SPECIAL EMPTY URBAN SPACES

The long-term affair of Tuvixeddu is a complex matter that still cannot be considered finally resolved and has involved the Sardinian Region and the Tuvixeddu Municipality for years in a controversy consisting of a sequence of legal disputes and political clashes. The case is significant for at least two kinds of reasons: it has involved both public and private interests, apparently divergent, and has seen two public bodies lined up in diametrically opposed positions, which have collided, one to defend the right of private building and the other the public right to enjoy space. The former sees great economic potential in an abandoned space in the inner city resulting from a redevelopment project based on building, and landscape heritage as a resource to be exploited, while the latter promotes the opposite idea of an empty public space which will become a garden for the entire city, recovering the strategic role that naturally belongs to it.

The area of Tuvixeddu, situated on one of the hills characterizing the geomorphology of the city of Cagliari, and defining its environmental structure and historical roots, hosts one of the largest Punic necropolises in the Mediterranean, but has nevertheless always been a "waste" area. Swallowed up by urban development over time, which saturated the center and expanded over the nearby hills, it was used for most of the Twentieth century as a quarry, the premises of a cement plant of which some signs still exist today, slowly leveling out the hill by the extraction of limestone for use as a raw material for building in other parts of the city. It then became a no-man's-land at the disposal of the homeless in more recent times, to return to the center of attention on the city scene due to the huge economic interests and speculation that sprang up over a large construction project of approximately 272,000 m^3 in the area close by, and the strong reaction that followed. The dispute that ensued to determine the future of the area and establish whether it was possible to build there has lasted for more than ten years, dividing the opinion of the citizens, and is a striking example of a conflict over the concept of public good and private law.

The very delicate issue, considering the interests at stake and high visibility the case took on over the years, made the latent potential of a forgotten area be rediscovered right in the city center. An area which is among other things in between two opposite realities: on the one hand, an elite residential zone characterized by very high real estate values and, on the other, a popular area running over the hill on the opposite side till it reaches the edge of the first.

This rather complex story can be summarized in some key passages that trace the main stages of the conflict (Figure 1). In 2000 the Municipality of Cagliari, together with the Sardinian Region, signed an agreement with private individuals that allowed the latter to proceed with building on the area near Tuvixeddu according to a project approved in 1997 after a long period of controversy, also to try to end a dispute arising from expropriation in order to construct some social housing and settle the respective debt incurred. The area covered by the planning agreement was some 48 hectares, entirely private, a part of which (34 acres) was yielded to comply with urban planning standards and to create a park. Within that area lay the necropolis itself, bound under a series of regulations and finally by the "Codice Urbani" ('Urbani' Code). The project envisaged 350 apartments and villas, a student hostel with 450 places, a restaurant with a conference room, an archaeological museum, an archaeological-environmental park and general/university amenities. Overall, it configured the construction of a luxury residential area near the necropolis.

Work began in 2003 but in 2006 the Region suspended the agreement on the grounds of the *Piano Paesaggistico Regionale (PPR)* [Regional Landscape Plan] having been approved, which among other things envisaged an extension of the area up till then under restriction. From that moment a long conflict

began to decide the fate of the area. The Region passed some decrees to stop the work. The Municipality opposed them and lodged an appeal with the *Tribunale Amministrativo Regionale (TAR*) [Regional Administrative Court] claiming the Region's illegal intervention. The Region responded, appealing directly to the Ministry of Cultural Heritage for a restriction to be established that would protect the whole area and prevent any form of building. Shortly after the Region imposed a halt on all building permits for the area both pre-and post-PPR, and proceeded to suspend the work that had in the meantime resumed. The constructor then appealed to the TAR, too, in an attempt to invalidate the block. In February the Region withdrew the suspension but at the same time established the *'Commissione di Tutela del Paesaggio'* [Commission for the protection of the landscape], which endorsed the statement of public interest in the area. The works were thus stopped once again.

Also in 2007, the Region instructed Gilles Clément to submit an alternative project for the area. His proposal was radically different from that advocated by the Municipality and promoted by the company Coimpresa; the landscape designer envisioned a "planetary garden" with autonomous management (energy), no building, but enhancement of the three components - historic, industrial and ecological - that had influenced the life of Tuvixeddu.

The company lodged an appeal against both measures. Public opinion and the public authorities were divided in two, on one side the Regional and Provincial Authorities, together with some environmental associations and the support of a group of intellectuals and, on the other, the Municipality and private companies.

In 2008 the Sardinian TAR ruling was issued, which canceled the restriction and resolutions of the Regional Executive, deeming them subject to procedural defects and indeed nullifying the protective provisions stemming from the Regional Landscape Plan.

The Region appealed in turn against the TAR sentence, challenged the judgment of the Sardinian Administrative Judge, where he had accepted the grounds for recourse by the Municipality of Cagliari due to the Tuvixeddu-Tuvumannu complex being one of the "areas with pre-existing historic-cultural value" protected pursuant to the PPR.

In July 2009 the Architectural and Landscape Heritage Superintendence placed a new restriction: a large area of the hill was an "industrial mining complex to be protected".

In 2011 the Council of State accepted the appeal submitted by the Region, declaring legitimate the constraints imposed by them and confirming (as the TAR Sardinia already had) that the Region could, through the landscape plan, justifiably provide specific discipline to protect areas of environmental and historic-cultural value.

This ratified the final withdrawal of the original project though it opened up new issues: the revision of the urban plan and the planning agreement, and the fate of the necropolis in the event of cancellation of the planning agreement.

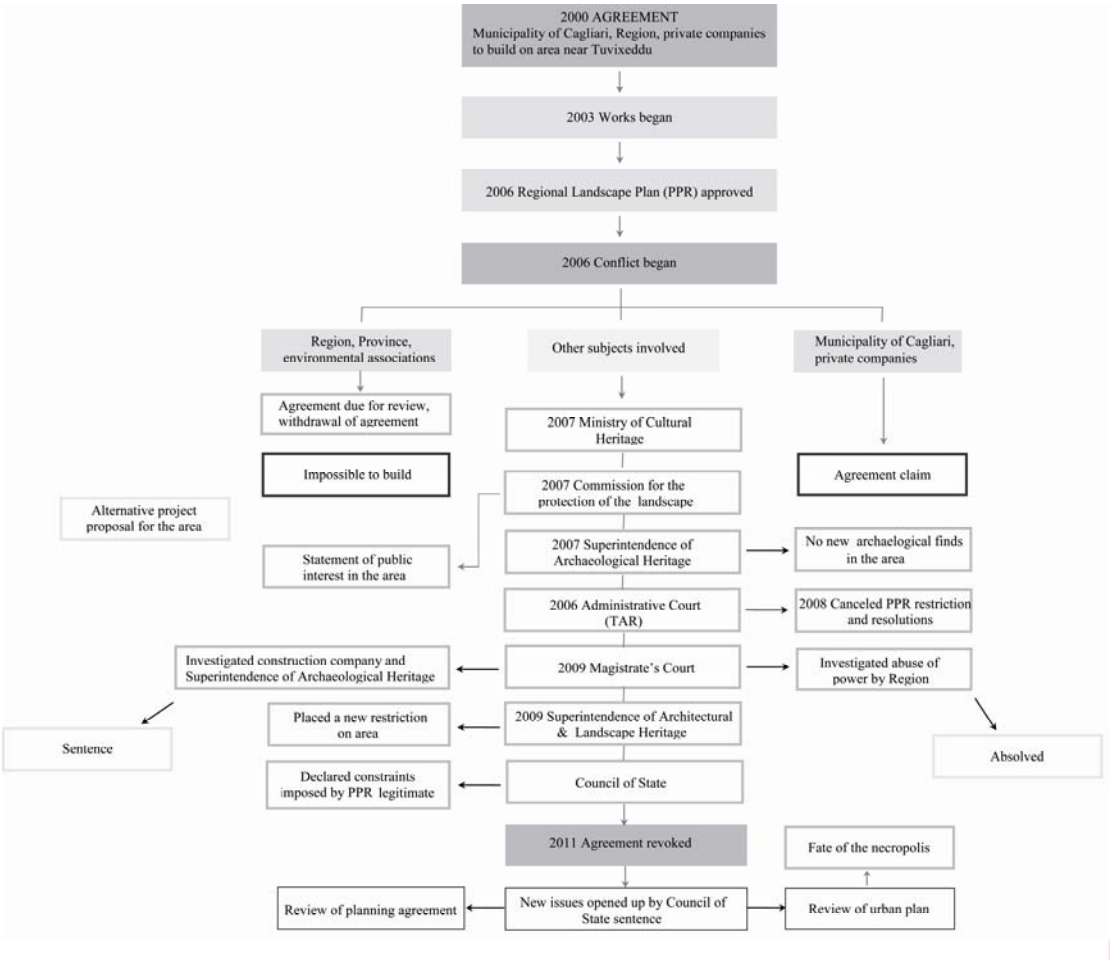

Figure 1. Key elements of the story of Tuvixeddu. Source: M. Balestrieri

THE COAST. SPECIAL TERRITORIAL GAPS

The conflict over the coastal areas of Sardinia is also inextricably linked with the above-mentioned PPR. The Plan proposed a new model of tourism that was also a model of economic development, based on the protection of the uncontaminated coastal landscape and enhancement, also in terms of building, of the inland areas. At the same time, it represented a clear stance from the point of view of stating the roles and relationship between local autonomous governments and regional/national governments. It posed, in fact, a key question, among others: who should take the lead in protecting the landscape? In this sense the plan is the experience of a Regional Authority that has asserted its role and invested in a development policy putting the issue of the common good at the center of the debate. It is certainly one of the most interesting recent planning experiences in Italy for its "experimental" nature, both because it was the first landscape plan approved in accordance with the provisions of the *'Codice dei Beni Culturali e del Paesaggio'* [Cultural and Landscape Heritage Code] (Legislative Decree 42/2004), and for having followed a path consistent with an innovative model of development and economic growth. But the clear position of coastal strip protection in a region that has grown from an agro-pastoral economy to one based on services, especially tourism, has led to a battle over the coasts and their exploitation.

The conflict that has ensued can be described by summarizing the events that led to the approval of the plan and involved opposing factions of the Region, coastal Municipalities (though not all) and the government. In order to remedy the chaos of the construction sphere along the coast caused in October 2003 by the decision of the TAR to reject, at the request of environmental groups, landscape plans approved by the previous Executive, in August 2004 a Regional Executive Decree called the "save the coast" decree was passed. It placed a limit to safeguard the shores by banning any building within a range of 2 km from the coastline, even where concessions had already been given, pending definition of a Regional Landscape Plan.

The decree preceding the subsequent plan raised a series of disputes between opposing political factions but also within the majority that had launched it, and immediately met opposition from mayors of coastal Municipalities, seeking to oppose the decree by submitting an appeal to the TAR to proceed with canceling it. But the TAR confirmed validity of the decree, which became law (Regional Law n. 8 of 25 November 2004) and was then renewed for one year, until the PPR had been drawn up. All building activity along the coasts thus stopped, both the small, widespread operations and the large property development underway on the island. In December the Italian Cabinet intervened in the dispute and decided to challenge Regional law by appealing to the Constitutional Court alleging that the Region had overstepped its competency on the subject, conflicting with national competency. Meanwhile, the Region reiterated its position by establishing the *Conservatoria delle Coste* [Coast Conservation], with the task of progressively acquiring the most sensitive parts of coastline by voluntary donations, or direct purchase, to ensure their protection.

In December 2005 the Regional Landscape Plan proposal was adopted. It divided the coast into landscape units, and specific modes of intervention were planned for each of them. It reduced the possibility of building constructions in agricultural areas but allowed awards for cubic volumes and incentives to build accommodation in urban centers and to reuse existing structures following the logic of the widespread hotel system. Furthermore, a limit was placed on the applicability of the old concessions: only those procedures authorized before the "save the coast" decree and for which infrastructure works had already started, could be implemented.

In January 2006 the Constitutional Court rejected the appeal filed by the Government against the Regional law. In September 2006 the Region gave final approval to the PPR. The Municipalities and Provinces had to comply within six months.

The approval did not put an end to the tensions that had accompanied all the previous phases. The adjustment of the Municipalities' Master plans to the PPR involved significant losses in residential volume and holiday homes in the coastal zone.

The center-right party proposed an abrogative referendum, but the Regional office for referendums rejected the request. Then the proponents appealed to the Sardinian TAR, which accepted it in November 2007, but a few months later first the Council of State and then the TAR, once again brought into the matter by the opponents of the plan, rejected this possibility once and for all, while the authorities responsible for adjusting local Master plans disagreed with the rules established by the PPR.

DISCUSSION. QUESTIONS AND ANSWERS

In addition to the desired consensus, city and territory transformation processes provoke new conflicts, too, related to different, sometimes divergent, interests that should be analyzed in the light of the broader socio-economic and political system they belong to, and which can tell us a lot about how to understand planning and space management.

Some places maintain a structuring and identitary role for the contexts they are part of due to their environmental and historical value, even if they have remained in second place for a long time with respect to the evolution of the urban area. However, they also appear as attractive areas for building speculation and forms of gentrification which, on the one hand, intervene in bringing true value to decayed and thus apparently marginal areas but, on the other, indicate final privatization of spaces that have a community character inherent in them due to the meaning and environmental, social and symbolic value of the landscape and history they encapsulate (Leeds *et al*., 2008; Nedučin *et al*., 2009; Dokić *et al*., 2008).

Thus apparent "urban gaps" become spaces whose use is contested between public and private, giving rise to conflicts in which the stakes are the sense of the project for the city. Should economic growth and real estate income be pursued or equity and sharing preferred? In the face of the lack of public resources and the mirage of guaranteed income with minimal expenses, urban ground often becomes a commodity to be exchanged, and any space still empty in the increasingly saturated cities is like a fund to be drawn upon in case of need. This is particularly true for areas that, though central, have taken on a marginal role through neglect and abandonment, which suggests strong revenues in the event of conversion. Thus, monetization of the territory begins, following a mechanism that enables services for citizens to be funded by urbanization and construction costs but which, at the same time, produces new residents, new businesses and therefore a new demand for services, triggering a process that often has devastating effects on the natural heritage.

Hence the conflicts related to power imbalance and the theme of urban revenue constitute, in an urban reality increasingly subservient to the market and crushed by budget problems, a particularly significant issue.

The two case studies summarized exemplify the conflict between income and public good at different scales. Furthermore, they broach a

number of issues that lead us to reflect on content, objectives and methods in the market logic that increasingly dominates planning choices.

The first question relates to the "empty" spaces, spaces that have not been built on and, as such, are considered and treated as useless in the planning scenarios. In the market logic empty spaces become spaces to fill. But does the value of a space only exist in terms of what fills it? In the city every square centimeter is used as a part of something else (almost exclusively in economic terms), and free space is restricted, not only in physical terms but also in terms of self-determination and spontaneous socialization. The space outside the city is treated the same way, with rural space no longer considered and assessed for its own qualities, but for its ability to enter the cycle of urban uses (and economic value). Becoming just "ground awaiting urbanization". This brings up the issue of empty spaces as strategic elements (and the dignity of space that is not urban, that does not "produce"), since gaps host relations.

The second issue is the environmental question: what role should the environment have in the urban dimension? Environmental quality is a factor that increases the market value of an area but cannot be considered just a "street furniture" element. The need seems increasingly stronger to design considering the environment as the main core of space organization. Greater sensitivity to the dynamics underlying the formation and maintenance of natural resources requires invasive transformation policies to be necessarily overcome - especially all those that consider the environment a merely decorative element - and utilitarian logics of the private sort, which subtract a wealth of resources from public use, to be surpassed.

Environmental quality should not be an elite right proportional to personal wealth (Walker and Bulkeley, 2006). The appropriation by the dominant groups of sites of special environmental value and specific identitary significance not only undermines their integrity but is a form of exclusion and social injustice. In an urban realm dominated by the market, spaces lose any claim to equity, and "contact" spaces, spaces for creating relations, are transformed into spaces to be sold. As the privatization of collective public space proceeds, public space is actually reduced to space of mass consumption.

A second set of issues concerns the objectives underlying the planning choices and methods and these bring up some questions. What is the relationship between power and planning? What kind of impact does it have on planning processes and governance of space? Only recently has the theoretical reflection on planning explicitly and directly addressed the question of the power that is necessarily inherent in it, and tried to grasp the difference between physiological situations and the pathological distorted condition of the relationship between planning and power, be it decisional or not, in the practice of technical action. Space and its events at any scale are not neutral with respect to power practices. The city, through the ideologies underlying it and all the conventions governing it, is an organization structured to make the dominant social mechanism work and maintain existing power relations, though not without resistance, contradictions and disputes.

Although this does not lead to a city completely consistent with the system regulating it, since the city's production process is the result of continuous political and ideological struggles, it will inevitably bear the signs and dominant traits of it. "Planning is the guiding-principle for future action. In a world dominated by strongly conflicting interests and great inequalities […] planning that confronts power constitutes simultaneously a daily necessity and constant ethical challenge" (Forester, 1989, p. 3). Hence the inevitable need to discuss and negotiate choices that will unavoidably have an impact on territories and communities. An issue that brings up the concept of power as responsibility, but also transparency, retraceability and participation in decision-making.

Is it possible to protect the collective interest without sacrificing economic interest? Public policies have taken on behavior patterns entirely borrowed from the market logics that have accelerated the processes of social devastation, also to enhance real estate assets and increase revenues. This is the case of many Italian historic town centers. Affected by indiscriminate reclamation projects, they have lost their identity, become false and destructive of pre-existing mankind, and now identifiable only through the application of leisure criteria and formulas. So while speculative action has caused the "tourism-oriented" metropolitan experience, many public authorities have entrusted the definition of the urban landscape to experiential consumption (Pine and Gilmore, 1999).

The space project has, however, the purpose of revealing meanings and perspectives in the places of the city to lead to the discovery of, or allow to seep through, a joint sense of aim and belonging (Maciocco, 2008).

But where do private rights end and collective rights begin? Peterson and Liu (2008) have argued that: "even when people hold negative attitudes toward unplanned development, natural property rights values (favourable evaluations of property as an inviolable and pre-political right) prevent them from acting on their concerns".

At the same time, cases of authorities that have been able to steer transformation processes without succumbing to pressure from special interest groups are rare (Friedman, 1987). When a councillor grants an urban planning variant, he/she creates an income that should be shared between the public and private sectors according to transparent criteria. To the maximum values at stake in the negotiation corresponds the minimum of rules that should justify it. The approval of an urban variant is mostly left to the authorities' subjective choices, put at risk by the high economic values at stake. The more astute legal culture has highlighted the bareness of rules in these decisions, which greatly contrasts with the extent of the interests involved. In the absence of rules, justification remains entrusted to the rhetoric of political discourse and to the power of competent persuasion.

The authorities have rarely felt the need to establish any reference *a priori* to the distribution of benefits between the public and private sectors. No wonder, then, that in such opaqueness of public and private interests politics loses the responsibility of governing. Not surprisingly, the majority of the corruption cases that have been discussed recently in Italy concern urban planning operations. The link between development of income and mutation of the political class is largely underestimated on the theoretical plane, despite the abundance of empirical data that indicate its importance (Tocci, 2009).

The authorities pretend not to see the effects of urban planning decisions on collective life, thus obscuring the imbalance between private income and public costs of transformation. In the case of Tuvixeddu for years the Municipal authorities had public interest coincide with private, believing building by the private sector to be the only way to give back urban decorum to a part of the city. The strong opposition of some of the citizens, committees and action groups, Regional Executive action and the introduction of new norms for the protection of landscape heritage have changed the balance of power, to the point of blocking the speculative process. The concept has spread, reiterated also in the case of coastal areas, that the protection of the environment, landscape and past heritage could constitute a new model of development opposing speculation.

CONCLUSION

In modern times the territory appears more and more to be the 'stakes' in political, social and economic tensions, which, although diversified and sometimes contradictory, have in common the need to rewrite and redefine our life space both individually and collectively.

Special attention should be paid to the clash between private and public interests, which is manifest in disputes over some spaces that, due to their environmental quality, lend themselves to various purposes, which involve highly diversified planning methods and criteria. Central to the current urban policy seems to be the subordination of social issues to economic priorities.

The two cases presented point out how different motivation converges on landscape and on public and private interests; they constitute at the same time one of the few examples of territorial protection policy deployed on a large scale in favour of the collective benefit despite strong economic pressures. In fact, although landscape transformation engenders increasingly new informal lines of opposition, instruments of government and urban policy have the task of defending the heritage.

The growing collusion and submission of the authorities towards market forces are creating urban and extra-urban landscapes increasingly alienated from local identities and values, with consequences closely related to a lower quality of life, sociality, equity, and the degree of survival of natural resources exploited well beyond their capacity. With respect to this problem the lack of a shared vision emerges regarding urban renewal strategies and territorial policies at all levels of expertise, and a strong conflict of interests that leads to the sale of local resource assets to generate income. The logic of real estate exploitation needs to be broken, placing the re-discovery and defense of public goods at the center of the project, using instruments based on confrontation and negotiation, and accepting and dealing with the conflict.

We need to think of conflict not as something that we must necessarily get rid of, but as a physiological dimension of the coexistence of individuals and resources, including opportunities. In a condition where planning decisions are no longer the expression of harmonious consensus, to define policies becomes more complex. We must question what connects different phenomena and different causes.

Due to reconsideration of the development of the Tuvixeddu site, the whole vision of the city was again brought into question. At the same time, the conflict over its fate has started up a public debate which has led to the rediscovery of the site also by those citizens who were not aware of its importance. Similarly, the story of the PPR has put the landscape as a collective good at the center of the debate, assuming national importance and opening a new chapter in the relations between landscape and planning.

Thus, conflicts are a key element in stimulating academic discussion and public debate on public goods for we need policies that do not exclude revenue but do not place it above the collective interest.

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DIGITAL SPATIAL DATA AS SUPPORT FOR RIVER BASIN MANAGEMENT: THE CASE OF SOTLA RIVER BASIN

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Many real-world spatially related problems, including river-basin planning and management, give rise to geographical information system based decision making, since the performance of spatial policy alternatives were traditionally and are still often represented by thematic maps. Advanced technologies and approaches, such as geographical information systems (GIS), offer a unique opportunity to tackle spatial problems traditionally associated with more efficient and effective data collection, analysis, and alternative evaluation. This paper discusses the advantages and challenges of the use of digital spatial data and geographical information systems in river basis management. Spatial data on social, environmental and other spatial conditions for the study area of 451.77 km^2, the Slovenian part of the Sotla river basin, are used to study the GIS capabilities of supporting spatial decisions in the framework of river basin management.

***Key words:** river basin management, spatial data, GIS, spatial evaluation, Sotla river basin.*

INTRODUCTION

In the last decades, the extent and intensity of different forms of degradation of the environment have proven the need to follow the guidelines of the long-term sustainability in all fields of human activities. In order to provide a platform for suitable decisions in accordance with the paradigm of sustainable development, a qualitative, unified and holistic approach to inventory of real world and institutional entities in the environment concerned should be applied. In the environmental protection framework, a special attention is given to water, since it has always remained at the foundation of human existence as a precious natural resource. Nowadays the quantity of potable water on earth is limited and its availability per person is reducing day by day due to increase in global population and damage to environment (Gowda and Doddaswamy, 2011).

It is widely known that watershed hydrology and water quality is dependent on many factors, including land use and soil conditions. In the article, we focus on the river basin management as an important step towards the protection of water resources. A river basin covers the entire river system, including its groundwater. In this paper, the river basin is defined as a catchment, the topographic area from which all runoff finally reach one single given point; watersheds refer to the topographic barriers that divide catchments from each other. Here, the ground water system might be neglected.

Decision making related to river basin management poses very difficult and challenging problems. Data and information which are the basis for river basin management decisions are directly or indirectly linked with the geographical location, with the spatial entity. For this reason, geographical information systems (GIS) can play an important role in this process, since GIS is providing a convenient environment in spatial decision problem domain.

Volk *et al.* (2008) have already introduced the idea, that the implementation of the European Water Framework Directive (Council Directive 2000/60/EC) posed new challenges, including the increased demand for new GIS solutions that incorporate simulation models and tools to analyze, interpret, and display spatial information for river basin planning. It is becoming clear, that new approaches are needed which take on board important research findings emanating also from geographical information science (McDonnell, 2008). The Integrated Water Resources Management (IWRM) that has been widely accepted as the proper strategy to handle river basins is based on comprehensive, spatially distributed information (GWP-TAC). Flügel (2007) stresses the need for corresponding data model to transfer the concept of IWRM approach into a corresponding information system. McDonnell (2008) claims that the data alone cannot supply all the information required to support IWRM, but there is a need for analysis which enables bringing together the disparate datasets to consider the impacts, interactions and broader context of phenomena. The importance of GIS and digital geospatial data in water resources management has been emphasized also by McKinney and Cai (2002) in the debate about linking GIS and water resources management models. The authors argued that unique aspects of water resource management problems required a special approach to development of GIS data structures, which would bring spatial dimensions into the traditional water resource data base (Ibid.).

This paper explores the use of spatial data in GIS

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as the basis for transparent decision making and management of the river basin. The research has been done in the study area of the Sotla river basin in the Eastern part of Slovenia, at the Slovenian-Croatian state border. The advanced approach to the river basin management requires the holistic approach and study of the whole river basin area. For the purpose of our study only the Slovenian part of the river basin has been considered. The main reason was the availability of spatial data.

GIS IN RIVER BASIN MANAGEMENT – REVIEW

Nowadays, GIS techniques and procedures have assumed an important position in decision making, where decisions are directly or indirectly related to the spatial entities, in the sense that they offer unique capabilities for automating, managing, and analysing a variety of spatial data for decision making (Drobne and Lisec, 2009). Here, decision problems that involve geographical data are referred to as spatial or geographical decision problems.

Focusing on the geographical data support for the river basin planning and management, numerous variables linked to different spatial units are involved. The use of digital geospatial data for the management of water resources and river basin means a series of certain activities, as can be seen in Figure 1. Research, analysis and evaluation of water resources and river basins are only one step towards advanced river basin management; development of appropriate models, simulation tools and environmental decision support systems is the crucial step in the management of water resources and river basin. From the geographical point of view the latter means applicative geography. Krevs (2002) recognized close connection between GIS and applicative geography; at the same time he exposed relatively poor utilization of possibilities that GIS offers to geography. McDonnell (2008) recognized provision of information as one of basic challenges for integrated water resources management. Matejiček, Engst and Zbynek (2006) found out that many environmental data analyses had been coupled with GIS in the previous decades to simulate environmental processes. Those authors were more precise with defining that various strategies for data integration and functionality in GIS could be divided into a few classes (Ibid.; see also Matejiček 1996, 1998, 1999).

In the nineties of the past century, GIS was widely used in hydrology and well suited to developing input to distributed-runoff simulation models (Brilly *et al.*, 1999). At the turn of the millennium, GIS was dominantly used for data processing and visualization of available data sources as well as handling of data to apply environmental assessment models (Renschler *et al.*, 2000). Sivertun and Prange (2003) used GIS to carry out non-point source critical area analysis, where they found out that such a model allowed the analysis of a large area with a high resolution. Johnston *et al*. (2005) estimated GIS as valuable watershed assessment tool, while several authors studied GIS support for watershed modelling (Lian and Maackay, 2000; Sun *et al.*, 2003; Sathyamoorthy, 2008) and watershed management (Moss, 2004; Jessel and Jacobs, 2005; Lisec *et al.*, 2010). Matejiček *et al.* (2006) focused on spatio-temporal analysis of environmental pollution in urban areas. Twumasi and Merem (2007) used remote sensing and GIS in the analysis of ecosystem decline along the river. They characterize such approach as a conduit for environmental health within shared waters of the River Niger Basin. Assaf and Saadeh (2008) worked on assessing water quality management options in river basin and developed an integrated GIS-based decision support system. Consequently, the policy makers and other stakeholders in the Upper Litani Basin, Lebanon gained a clearer understanding of the key factors and processes involved in the sewage induced degradation of surface water quality. Flügel (2007) stressed the importance of the adaptive integrated data information system for global water research.

In our research, we consider models, simulation tools and environmental decision support systems as advanced and complex tools in water resources and river basin management. The principle of modelling is often based on elaboration of equation, which will relatively easily help to process equal or similar phenomena as in the reality (Dobravec, 2003). Because of the complexity of the real world, the problem of considering all factors in the input modules appears; furthermore, it is impossible to define all operands in the central part and it is impossible to define the course of the operation itself (Ibid.). Similarly Trajković (2004) concludes how no particular indicator set can satisfy the needs of all potential users. Models for the purpose of water resources and river basins management are complex as well; some of them are shortly presented in the continuation.

Cai (2008) stated that it was possible to implement a holistic water resources-economic optimization for river basin management with a model. McKinney and Cai (2002) saw important connection between GIS and models for water resource management. They offered an object-oriented method, which treated the landscape as a set of spatial objects, for example river reaches, and thematic objects, for example flow balance in a reservoir. A basin-wide GIS-based hydrologic watershed planning and management model was developed in the case of Cape Fear river basin in North Carolina; the aim of the model was to diminish strained water supply caused by explosive population growth (Holdstoc *et al.*, 2000). To analyse water productivity, which is an indicator of water use efficiency, the crop growth simulation models coupled with GIS were applied in Laoag river basin in Philippines; substantial strategies in irrigated agriculture were provided with those models (Ines *at al.*, 2002). Volk *et al*. (2008) developed GIS supported methods and tools for the planning process and measurement control for river basin management in the Upper Ems River Basin. Schlüter *et al*. (2005) recommended a water management model for the ecological impact assessment; with optimization of the long-term water allocation they tested model in the Amudarya River delta. Furthermore, a GIS-based simulation tool was used to illustrate implications of uncertainties for water management in the Amudarya river delta; the authors argued that the simulation tools could support a process of reasoning about the implications of uncertainties for the outcome of management policies in a specific river basin management context (Schlüter and Rüger, 2007).

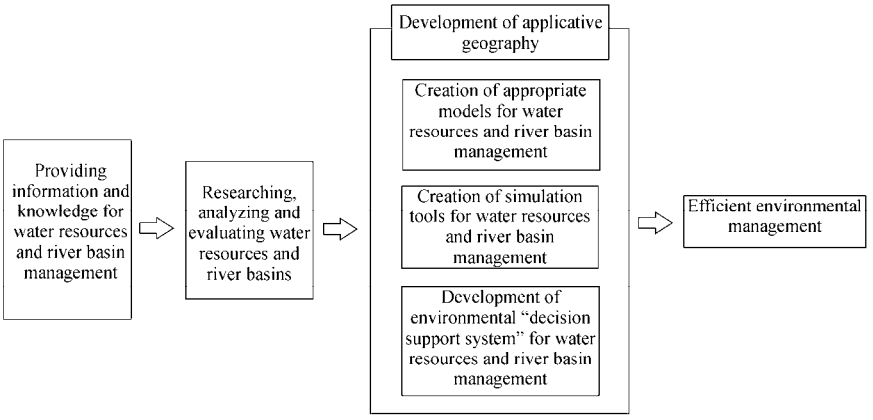

Figure 1. Use of digital geospatial data for efficient environmental management – from the base step to the efficient management

Leung *et al*. (2005) developed an environmental decision-support system for the management of water pollution in a tidal river network. The common problem that most authors have coupled with is the availability, quality and connectivity of digital geospatial data and interoperability of different geographical information systems. For this reason a special attention is given to this problem in the continuation.

The use of digital geospatial data for the purpose of river basin management is tightly connected with the quality and connectivity of data. The quality of spatial data is considered in accordance with international standards that involve positional and attribute accuracy, logical consistency, completeness etc., but also in the wider context such as semantic accuracy and usage, and connectivity with other datasets. The connectivity means a functional connectivity of specific geospatial data. Seamless integration of geospatial data from different sources and establishment of common patterns of objects in space mean perfect infrastructure of geospatial data, which is a condition for advanced analytical work. An important step towards integration of spatial data and establishment of common spatial data infrastructure in Europe has been done by the INSPIRE Directive - Infrastructure for Spatial Information in the European Community (*Council Directive 2007/2/EC*).

MATERIALS AND METHODS

For the purpose of our study, we tried to define indicators which are of crucial importance for the sustainable river basin management. The main idea derived from the study of Guimarães and Magrini (2008), authors of the indicators for sustainable development in the management of river basin, who find out that the systemic formulation of river basin indicators creates an information system that helps in river basin planning, allows efficient management of environmental resources and standardizes the comparison among basins. They evaluated 32 indicators as sufficient to determine the degree of sustainability of the watershed management. The proposed structure of the indicators is (Ibid.):

- social dimension: 8 indicators (Population growth rate, Gini index of income inequality, Per capita family earnings, Life expectancy at birth, Infant mortality rate, Literacy rate, Years of schooling, Unemployment rate);
- environmental dimension: 20 indicators (Air quality in urban areas, Participation of renewable sources in the supply of energy, Use of fertilizers, Use of agricultural pesticides, Land being used in agriculture, cattle raising and forest management, Remaining area and deforestation of woods

Table 1. A set of available digital geospatial databases and indicators for river basin management planning and the relevance with Guimarães' and Magrini's indicators for sustainable development of river basins

Dimension	Geospatial database name	Owner	Indicator	Relevance with Guimarães' and Magrini's indicators
Social	Population density	Statistical office of the Republic of Slovenia	- population density 200 inhabitants/km^2 and more	
Environmental	SOIL			
	Soil	Ministry of Agriculture, Forestry and Food of the Republic of Slovenia	- soil type	
	Land Cover	Ministry of Agriculture, Forestry and Food of the Republic of Slovenia	- proportion of intensive agricultural land - proportion of forest land - proportion of urban land - presence of extensive wetlands	✓ ✓
	Building Cadastre	Surveying and Mapping Authority of the Republic of Slovenia	- number and distribution of industrial buildings - number and distribution of catering buildings	
	Protected areas	Environmental Agency of the Republic of Slovenia	- presence of protected nature areas	✓
	Natura 2000 areas	Environmental Agency of the Republic of Slovenia	- presence of protected sites Natura 2000	✓
	WATER			
	Hydrography - Topographic Database	Surveying and Mapping Authority of the Republic of Slovenia	- number of stagnant water	
	Floodplains	Environmental Agency of the Republic of Slovenia	- areas of fewer and more frequent floods	
	Categorization of degraded watercourses	Institute for Water of the Republic of Slovenia	- length of significantly and strongly to very strongly modified river channels in the hydrographic area	
	Industrial effluent and fish-farms	Institute for Water of the Republic of Slovenia	- number of fish-farms - emissions higher than 80% of the limit value	
	Municipal infrastructure	Environmental Agency of the Republic of Slovenia	- presence of municipal waste landfills - presence of industrial waste landfills - presence of sewage treatment plants	✓ ✓ ✓
	Vulnerability of groundwater aquifers	Geological Survey of Slovenia	- groundwater vulnerability	
	Natural heritage	Environmental Agency of the Republic of Slovenia	- share of hydrological values	✓
	Protected areas of water resources	Geological Survey of Slovenia	- number of captured springs and drainage captures of drinking water	✓

and coastal vegetation species, Desertification and transformation of soil to sand, Protected areas, Access to garbage / waste collection, Quantity of garbage / waste produced, Quantity of garbage / waste collected, Quantity of garbage / waste recycled, Quantity of garbage / waste for sanitation discharge, Access to water distribution system, Access to sewage sanitation system, Sewage treatment, Water supply, Water demand, Quality of water, Intensity of water use);

- economic dimension: 2 indicators (Public expenditures with environmental protection, Existence of a river basin master plan);
- institutional dimension: 2 indicators (Per capita energy consumption, Energy intensity).

Unlike the above mentioned indicators we proposed a set of those indicators that could be determined through digital geospatial data, available for the study area. Our set of indicators is more modest and shows that availability of digital geospatial data is not sufficient for the holistic and sustainable river basin management. Based on the available digital geospatial data we created 21 indicators. One of them falls within the social dimension and twenty of them within the environmental dimension. Furthermore, the relevance between a set of Guimarães' and Magrini's (2008) indicators and our set of indicators is poor, what can be figured out in Table 1 – there are only nine selected indicators for our research that correspond to the above mentioned authors' indicators. In some cases more of our indicators refer to one Guimarães' and Magrini's indicator. Ultimately, we have found that with our indicators we met only four Guimarães' and Magrini's indicators. While only some of the proposed indicators for sustainable river basin management can be created on the basis of existing and available digital geospatial data, the others can be created on existing and available statistical and other set of data. Such indicators are for example share of unemployment, the amount of recycled waste, energy consumption per capita etc. For both types of indicators we have found out that some were still not easily obtained for application to river basins, which implies the need for field work at the local level, noted also by Guimarães and Magrini (2008).

In some cases we considered reasonable to simplify or adapt the categorisation of an indicator. In this way we can obtain new functionality and improve the transparency of the indicator. Simplifications or adaptations of the categorisations can refer for example on indicators such as proportion of intensive agricultural land, length of significantly and strongly to very strongly modified river channels etc.

Figure 2. Sotla river basin and its hydrographic areas

CASE STUDY

The Sotla river basin is located on the margins of Pannonian plain and it spreads from the north to the south along the Slovenian-Croatian border. Sotla River is a left tributary of the Sava River. The total area of river basin is 583.8 km^2 and 81.7% of it belongs to Slovenia. As already mentioned, we have focused on the Slovenian part of the river basin (below Sotla river basin), which extends on 451.8 km^2. The Sotla river basin is exceptionally asymmetric since most of the tributaries are at the Slovenian side in the upper and middle flow. The basin is characteristic for its fan branching and is therefore more exposed to floods. It consists of 5 hydrographic areas: the Sotla-Rogatec (upper stream of the Sotla till the Mestinjščica tributary), Mestinjščcica river basin, Sotla-Podčetrtek (central part of the Sotla river basin till the Bistrica tributary) the Bistrica river basin, and Sotla-Bizeljsko (lower part of the Sotla river basin) (Figure 2).

Based on the environmental status of the Sotla river basin and fundamental objectives of the river basin management we defined certain measures for Sotla river basin management. Environmental status means the current situation of various geographical parameters in the river basin (for example soil type, riparian land use, etc.). The river basin management objectives are defined on the legal bases and predict the optimal condition of the environment. Conceptually we leaned on ecoremediation approach, which means the protection and expansion of natural ecosystems while allowing human activities (Vrhovšek and Vovk Korže, 2009).

Environmental status of the Sotla river basin indicates the rich diversity of surface waters (rivers, streams, still waters) and ground waters (spring, mineral and thermal water). There are obvious certain impact factors on water resources such as agriculture, urban areas (settlement of Rogaška Slatina had 5105 inhabitants and Šmarje pri Jelšah had 1765 inhabitants according to the statistical data for 2012), industry and tourism infrastructure of health resorts in Rogaška Slatina and Podčetrtek, an also dispersed numerous settlements in the countryside. Hydrological characteristics point at considerably high

vulnerability of the Sotla river and its tributaries according to its specific outflow, which comes to 16 l/s/km^2, average annual flow which comes to 9 m^3/s, and average low flow, which comes to 0.9 m^3/s (all results are for the lower part of the Sotla river). In the Sotla river basin there is a trend of gradual decrease in average annual precipitation and increase in average annual air temperature, which leads to reduction of water resources amounts. Slovenia has enough water on average according to water balance (Slovenian Environment Agency, 2008); however, some annual periods are critical, in the Sotla river basin as well. These periods are usually at the end of summer as the consequence of a precipitation lack accompanied by high summer temperatures. The streams in the river basin are naturally preserved since they are naturally slightly to moderately modified. In addition, there are many hydro-technical regulations of the river bed from the 1970s and 1980s, which are usually outdated and not maintained. The biggest environmental problem in the Sotla river basin is significant pollution in the upper part of the river stream. Chemical status of the Sotla in Rogaška Slatina is unfavourable but it is getting improved gradually along the river stream. Point pollution sources (sewage, industrial, agricultural and other facilities and activities) also burden mostly the upper part of the Sotla river basin (hydrographic area of the Sotla-Rogatec) while disperse pollution sources, headed by intensive agriculture, burden mostly lower part of the river basin (hydrographic area of the Sotla-Bizeljsko).

RESULTS AND DISUSSIONS

Definition of fundamental objectives of the river basin management means definition of global objectives which regulate the coexistence between human and water. The fundamental objectives have been studied and defined on the legal basis, which includes the European Community regulations and international conventions, national legislation, bilateral agreements and municipal ordinances. It has been ascertained that not only the state but also the local municipalities have many obligations in relation to the environment and water resources. In Slovenia, there is a huge issue to achieve the fundamental objective of the Water Framework Directive, namely to reach a good status for all waters, including surface water. The main reason for the concern about the implementation of the Directive until 2015 is sector approach in water resources management.

In our study, the Sotla river basin management measures have been defined based on main spatial entities and digital geospatial data sources. Measures mean actual solutions to achieve fundamental objectives and to preserve or improve the environmental status. The spatial placements of the measures have been organized in different GIS layers geo-referenced in the Slovenian national spatial reference system D48/GK. The measures were geo-referenced directly (through transformation parameters between the original and national spatial reference systems if needed) and indirectly (geo-referencing of data through geo-referenced spatial units). Some of measures are shown in Table 2 and Figure 3.

For better transparency and illustration we present cartographically the selected measures only for the hydrographic area Sotla-Podčetrtek, and the measure of improving the hydro-morphological status with eco-remediation techniques also for the hydrographic area Mestinjščica. For the measure of creation of ponds, pools and wetlands for natural water retention we considered land use and soil type; here, the areas of meadows, pastures or marshy grasslands coincided with riparian or gley soils are considered as appropriate. There is 21.1 km^2 of such area in the Sotla river basin, which represents 4.7% of the entire river basin. There is 1.5 km^2 of such area in the hydrographic area Sotla-Podčetrtek, which represents 2.5% of the entire hydrographic area. Simple GIS analysis of spatial determination of this measure is shown in Figure 4. Intersection of both spatial elements

Table 2. Definition of some measures for Sotla river basin management with main spatial elements, digital geospatial data sources, the geospatial data attributes and geometrical forms of the measures

Measure	Main spatial elements	Digital geospatial data sources	Attributes	Geometrical form of the display of the measure
Creation of ponds, pools and wetlands for natural water retention	land use soil type	- Agricultural land use - Soil	- meadows, pastures, marshy grasslands - riparian soils, gley soils	polygon
Preserving and creating protective vegetation belts	rivers and streams land use	- Hydrography - Agricultural land use	- main water streams (Sotla, Mestinjscica and Bistrica) - borders of fields and meadows in a belt 30 metres from the river bank	polygon
Revitalisation of degraded riverbeds	degraded rivers and streams water dams	- Categorization of degraded watercourses - Water level in the reservoir lake Sotelsko jezero	- water streams of 2nd, 3rd and 4th hydromorphological category -water dams Vonarje and Prislin	line
Rehabilitation of critical erosion places	rivers and streams land use	- Hydrography - Actual agricultural land use	- built areas in a 10 m belt on each side of the meander of the rivers Sotla, Mestinjscica and Bistrica	point
Reduction of plantation farming, encouraging the ploughing transversally to the land slope, supplementing farming by growing industrial hemp, growing reed	rivers and streams soil type land use	- Hydrography - Soil - Agricultural land use	- rivers Sotla, Mestinjscica and Bistrica and their tributaries - riparian soils, gley soils - fields and meadows	polygon
Planting willows along the rivers and streams	soil type rivers and streams land use	- Soil - Hydrography - Agricultural land use	- riparian and gley soils, infertile areas (water areas) - 30m belt on each side of the rivers Sotla, Mestinjscica and Bistrica - fields, meadows, pastures, marshy grasslands, overgrown areas, areas of trees and bushes, wetlands	line

(land use and soil type) results appropriate areas for the implementation of the above mentioned measure.

The measure of preserving and creating protective vegetation belts is appropriate for the areas where surface water streams contact areas of intensive agriculture. We recommend implementation of this measure inside of the belt up to 30 m on each side of the rivers Sotla, Mestinjščica and Bistrica, where those rivers contact agricultural fields and meadows. According to the results of the analysis, there is 1.07 km^2 of such area in the Sotla river basin, which represents 0.24% of entire basin area. In the hydrographic area Sotla-Podčetrtek there is 0.03 km^2 of such area, which represents 0.05% of the entire hydrographic area. The measure of rehabilitation of critical erosion places is proposed where meanders along the Sotla, Mestinjščica and Bistrica threaten built up areas due to lateral erosion. There are 45 such places in the Sotla river basin; 3 of them in the hydrographic area Sotla-Podčetrtek. Geometrical form of the measure in spatial data model is the point. Plains along the Sotla river and its tributaries are often areas of intensive agricultural production, which is the source of dispersed pollution for water resources. This are areas of riparian or gley soils. As mitigation measures we suggest reduction of plantation farming, encouraging ploughing transversally to the land slope, supplementing farming by growing industrial hemp and growing reeds (Phragmites australis). By ploughing transversally to the slope we prevent rinsing of plant protection products directly to the river and we reduce soil erosion.

Industrial hemp is suitable for crop rotation on the wet ground and riparian areas along the river Sotla and its tributaries are such. Reeds are a source of biomass, appropriate for heating, as a building material in the restoration of cultural landscapes, as well as a shelter for endangered animals. There is 40.5 km^2 of dispersed pollution area in the Sotla river basin, which represents 8.96% of the entire basin area. In the hydrographic area Sotla-Podčetrtek there is 10.6 km^2 of such area, which represents 17.2% of the entire hydrographic area. The measure of planting willows along the rivers Sotla, Mestinjščica and Bistrica means an opportunity to revive basketry as a landscape property as well as an opportunity for additional income for farmers. We suggest the implementation of this measure in the areas where riparian and clay soils coincide with one of the following land use: fields, meadows, marshy grasslands, areas in overgrowing, individual trees and bushes, wetlands. There is riparian belt along

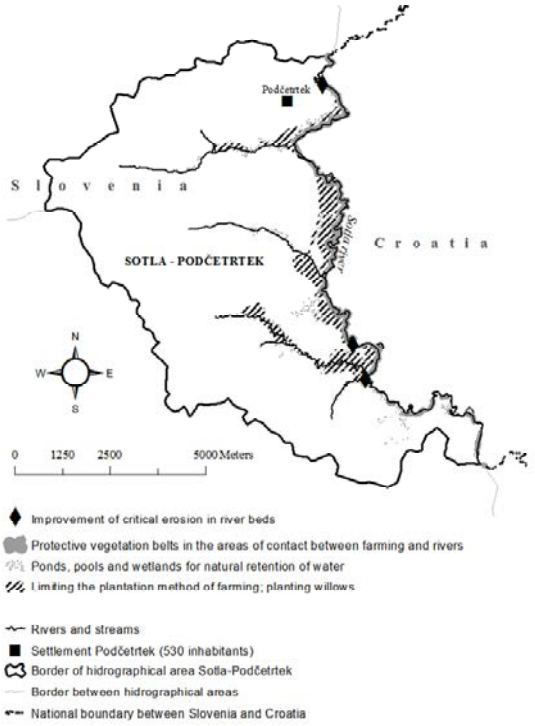

Figure 3. Spatial determination of some measures of river basin management for hydrographic area Sotla-Podčetrtek

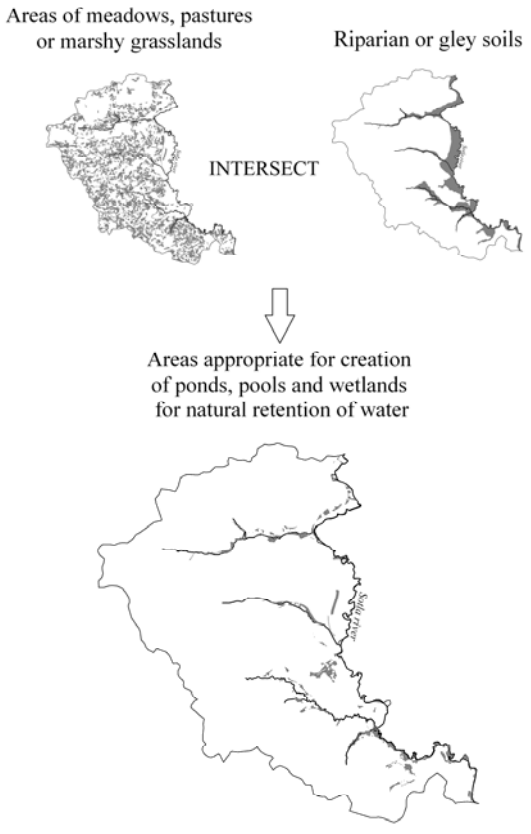

Figure 4. Data overlay in GIS for spatial determination of the appropriate areas for creation of ponds, pools and wetlands for natural water retention in the hydrographic area Sotla-Podčetrtek

119.5 km length of mentioned water streams appropriate for planting willows representing 84% of total length of those streams. In the hydrographic area Sotla-Podčetrtek there is 22.5 km length of the river Sotla appropriate for implementing this measure, which represents 98.3% of total length of this river in mentioned hydrographic area.

The last measure that we are presenting is revitalisation of degraded riverbeds and means prevention or restoration of aquatic and riparian ecosystems and their parts with pools, rapids, sediment banks, river beds overgrown with reeds, side river channels etc. For definition of the areas suitable for this measure we considered two spatial elements: degraded rivers and streams, and water dams. The latter because there is more than 165 hectares of the reservoir lake in the lower part of the hydrographic area Sotla-Rogatec, dammed by two concrete barriers. The water had to be released from the reservoir in 1988 because of high pollution. Digital geospatial data sources for the definition of the measure are Categorization of degraded watercourses and Water level in the reservoir lake Sotelsko jezero. Revitalisation of degraded river bed is necessary in all streams of 2nd (slightly to moderately modified streams), 3rd (significantly modified streams) or 4th (strongly to very strongly modified streams) hydromorphological category, while both dams require improvement. The length of the streams in Sotla river basin that need revitalisation is 96.3 km, representing 68.5% of the total length of those streams. The length of the streams that need revitalisation is 22.2 km in the hydrographic area Sotla-Podčetrtek, representing 88% of the total length of those streams.

As another example of the measure of revitalisation of degraded riverbeds we focus on the hydrographic area Mestinjščica (Figure 5). With numbers from 1 to 5 segments of the streams are marked that are classified as significantly and strongly to very strongly modified streams and were modified in 50-ies and later of past century in purposes of urbanization, industry, traffic, and melioration of agricultural land. Stream segment number 2, for example, represents the brook Lemberžica, which was channeled in 80-ies of past century with classical hydro-technical interventions in purpose of building the wood factory on the 85,000 square meters big industrial area. Eco-remediation techniques such as artificial indentations, rapids, gravel banks, and shading sunny (right) bank would be appropriate for revitalization of the brook.

Figure 5. The hydrographic area Mestinjščica with the locations of significantly and strongly to very strongly modified streams, which represent also locations of proposed measure of improving the hydro-morphological status with eco-remediation techniques

CONCLUSIONS

Qualitative semantic integrated spatial data together with the GIS technology provides the basis to develop information that can support decisions on different governmental levels – from the local to the national and international level. This is true also in the field of river basin management when supported by advanced GIS technology. In the last decades, a bright future has been recognized by using GIS technology to support spatial decision making. However, there is still numerous of problems relating to the use of spatial data for river basin management – from the data quality and data accessibility points of view.

Based on foreign experiences we have tried to use digital geospatial data for determination of different indicators of the river basin planning. It has been shown that despite the variety of existing spatial data, there are only some appropriate to define the basin management indicators (for example protected areas), while for the others indicators we were constrained to use the statistical data (for example number of years of schooling) or descriptive data (for example the existence of basin management plan). However, these data are also related to the spatial entities therefore it is possible to georeference them indirectly. In this way we reach unification of the format of the information as well as georeferencing and visualization of data.

In the continuation, some of the possible measures for the river basin management which can be determined based on digital geospatial data, have been presented. The paper does not present the whole river basin management approach and does not include all measures which should be encompassed in the holistic river basin management. The extent of digital geospatial data use for defining measures has been dependent on availability, quality and connectivity of geospatial data. The main purpose of the research was to prove and illustrate the advantage of GIS use in the river basin management, obstacles in the sense of data availability and data quality, and in particular to show the complexity of the decision space in the field of the river basin management. Further work in this field calls for the inclusion of the other natural-geographic and also social-economic elements in the river basin management, in particular ecologically acceptable flow (EAF), buffer capacity of ecosystems, institutional alliances within municipalities in the management of water resources, etc. Here again the problem of digital geospatial data quality has to be mentioned, but also the availability of digital spatial data. The advanced spatial data infrastructure may positive affect also the praxis in the field of the environmental and natural resources management; this might further impact on service delivery and local policy implementation. Our study has in particular shown also the lack of cross-border integration of spatial data, when for example the river basin management require data from different countries/ administrations. A common spatial data infrastructure would be an aid to working in partnership across different agencies and across administrative boundaries.

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ARCHITECTURAL COMMUNICATION: INTRA AND EXTRA ACTIVITY OF ARCHITECTURE

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Apart from a brief overview of architectural communication viewed from the standpoint of theory of information and semiotics, this paper contains two forms of dualistically viewed architectural communication. The duality denotation/connotation ("primary" and "secondary" architectural communication) is one of semiotic postulates taken from Umberto Eco who viewed architectural communication as a semiotic phenomenon. In addition, architectural communication can be viewed as an intra and an extra activity of architecture where the overall activity of the edifice performed through its spatial manifestation may be understood as an act of communication. In that respect, the activity may be perceived as the "behavior of architecture", which corresponds to Lefebvre's production of space.

***Key words:** Architectural communication, denotation, connotation, intra activity, extra activity.*

INTRODUCTION

The cultural anthropology interprets culture as the man's each and every intervention against a natural phenomenon, which has been modified to such an extent that it can be included into a social relation (Eco, 1973:23). The overall history of culture can be seen, in fact, as an evolution of the communication media (McLuhan, 1971). As a cultural phenomenon architecture is a communication phenomenon in its own right (Hollein, 2009:162). Vitruvius noted that architecture lends itself to different interpretations: "In all matters, but particularly in architecture, there are these two points – the thing signified, and that which gives it its significance" (Vitruvius, 2007:34). The term „speaking architecture" („architecture parlante") appears for the first time in 1852 in a text by an unknown author dealing with the Ledoux's approach (Radović, 1998: 327).

ARCHITECTURAL COMMUNICATION – THEORY OF INFORMATION AND SEMIOTICS

In order to understand architectural communication, linear and circular models of mathematical theories of information may be used (e.g. Shannon-Weaver's linear and Wiener's circular models), which indicate that architecture may be interpreted as a means (medium) for conveying messages, although patterns of art tend to give shapes rather than data (Arnheim, 1977:81) (Figure 1).

The information technology term "recipient" becomes a "reader" in semiotics, as reading includes a higher level of activity and is directly influenced by cultural context. This makes it possible to view the phenomenon of architecture as a readable text of culture. In semiotic theories architecture is understood as a sign, or sign

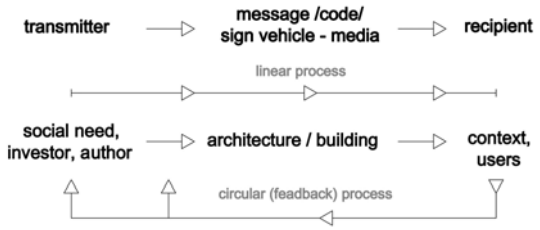

Figure 1. Linear and circular model from the theories of information - architecture has been recognized as a means (medium) for conveying information. (S.S.Vučković)

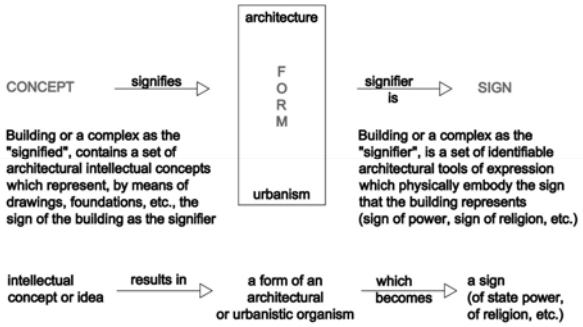

Figure 2. Form within the signifier and signified. Form is a communication medium between the concept and the sign (Neidhardt, 1997: 66)

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system which creates and transmits meaning: architectural edifice is at the same time the signified, as a result of concepts or ideas, and the signifier of a sign, namely the form is the communication medium between the concept and the sign (Neidhardt, 1997:66)[1] (Figure 2).

Barthes (1971) applies semiotics as a system analysis to each aspect of communication as a kind of "collective idea-myth" encouraging creative involvement of a critical reader (Barthes, 1971:263-314). Umberto Eco defines semiotics as a research program dealing with all cultural processes as communication processes in the role of a reader. Starting with philosophical texts and afterwards in literary and juridical ones, Jacque Derrida overturned the binary oppositions of semiotic – his theory of Deconstruction created new notions and concepts, marking differences and eternal interplay between polarities (Culler, 2007).

THE LANGUAGE OF ARCHITECTURE

In a study of architectural communication it is necessary to consider the relationship between language and architecture. The use of linguistic instruments in understanding architecture as a text poses a question, can images become texts and is there a language of architecture (Vasilski, 2011). Lotman sees art as a second level modeling system (the first level is the natural language) and interprets the work of art (and thus the architecture) as a communication relation (Lotman, 1976:39).

Jencks's use of the term *architectural language, architectural grammar, words, phrases, syntax, semantics, metaphor, code* (Jencks, 2007:24) has been criticized as a verbatim and one-way application of linguistic analogy (Gandelsonas, 1998). Architecture may be interpreted as a "knowledge production area" while the description of architecture by means of linguistic instruments is possible only at the level of a metaphor (Agrest, 1998). Looking at architecture as a readable surface and form, Venturi differentiates, on the one hand, a "graphical sign" (billboard, application of a conventional element) which uses architecture as a carrier of such information ("decorative shed") and on the other hand, architectural edifices where the form and function concur, where the construction, structure and volume have become a "duck" with symbolic meaning (Venturi, Scott Brown, Izenour, 1990). In a structural and conceptual way, architectural language is unique and universal in its "geometric truth" regardless of the changes to the form of the edifice. It is unacceptable to compare one architectural element (for example, "windows") with "words" (Milenković, 2003:16).

Non-linguistic context defines language as a system consisting of signs coded in a particular way. In a wider sense, the design of edifices for every day use has, as a public service, become a language which gives form to edifices and models messages. The design "speaks", it communicates through messages (Sudjic, 2008:16). In the language of non-verbal communication Hall defines the term "proxemics" which implies a person's subconscious structuring of space, from organizing space at home to organizing cities (Janićijević, 2000:295–300; Hall, 1976)[2]. The term "artifact code" is related to fixed traits of edifices around us such as space, size, volume, or those which are semi-fixed such as light, colors, furniture, etc., which help impose a certain kind of communication, i.e. "…elements of our environment convey messages about us, they determine the nature of communication which is yet to happen" (Janićijević, 2000: 302; Ekman, Friesen, 1969).

DENOTATION AND CONNOTATION – "PRIMARY" AND "SECONDARY" ARCHITECTURAL COMMUNICATION

Architecture, like any other usable object, gives certain information to its user; it conveys the manner in which this information should be used - *denotation*, "primary" architectural communication. Through its spatial and visual presence it offers a set of information, depending on the particular context, social and cultural, technological, geographical, economic and other conditions - *connotation*, secondary architectural communication. Here the terms "primary" and "secondary" are not axiologically discriminative, like in whether one is more important than the other, but are mentioned in the context of semiological mechanics meaning that secondary functions rely on the denotation of primary functions (Eco, 2003:187–188). The term denotation is used to define the first, main or the only meaning, as opposed to connotation which implies multiple meanings. According to Barthes, denotation is an obvious, literal meaning of a sign, primary or unique meaning, "what" that has come into being while connotation is the "how" it came into being (Janićijević, 2000:176–180). Dorfles noticed "double articulation", functional meaning he calls "normal" (pillars, doors, etc.) and "figurative meaning", aware of the fact that the systems of signs in architecture are constantly being renewed and thus continually repeated (Radović, 1998:327–328). Lawson, for example, in the context of spatial meaning, related to the process of interpretation, speaks about internal and external meaning (Lawson, 2001: 13) (Figure 3).

"Primary" communication - denotation is primarily related to the communication of a function or as Barthes claims "…as soon as there is a society, every usage is converted into a sign of itself" (Barthes, 1971:343), hence the functions can be interpreted as an aspect of communication. This enables their better understanding and reveals other, equally important, types of functionality which have remained hidden due to their unilateral functionalistic perception (Eco, 2003:182). The difference between architecture and other cultural phenomena consists in its spatial functioning, people enter into it; architecture is utilized primarily on the inside. The factors which enable the application of architecture (passing through, entering, stopping, climbing, lying down, leaning against, gazing through the window, holding to something, etc.) are not merely potential functions, but mainly, connected meanings which direct us to the application of those functions. In fact, primary communication implies interpretation of "directions and courses" (Norberg-Schulz, 2006:36) which are characteristic of every place, decoding architecture through a certain system of signs which cause different

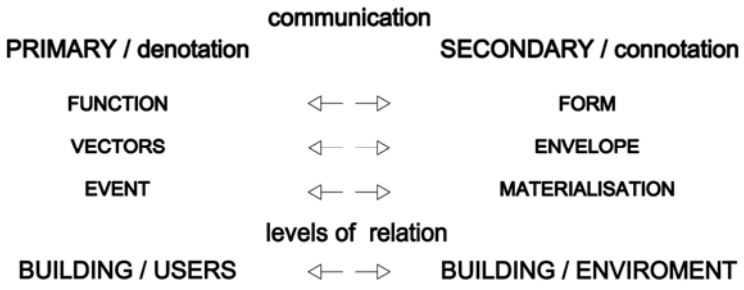

Figure 3. Primary and secondary architectural communication and levels of relations of users/environment (S.S.Vučković)

behaviors. "Primary" communication consists of a system of primary architectural codes which become "iconic codes" (for example, the principle of stairs becomes the subject of communication exchange) which we have unconsciously adopted through the repetition of space utilization (Eco, 2003:183). Denotative meanings have been defined by means of a code and they are prescribed in a certain way. The edifices conveys how it should be utilized by means of information that we receive through space organization, lines of movement, alteration of movement and stopping, dynamics and static quality of space, etc. Therefore, the architecture communicates the function which needs to be performed and gives us information as to how to perform that function, even when such function is not performed. By articulating the space, architecture communicates the ways in which the space has been articulated (Figure 4).

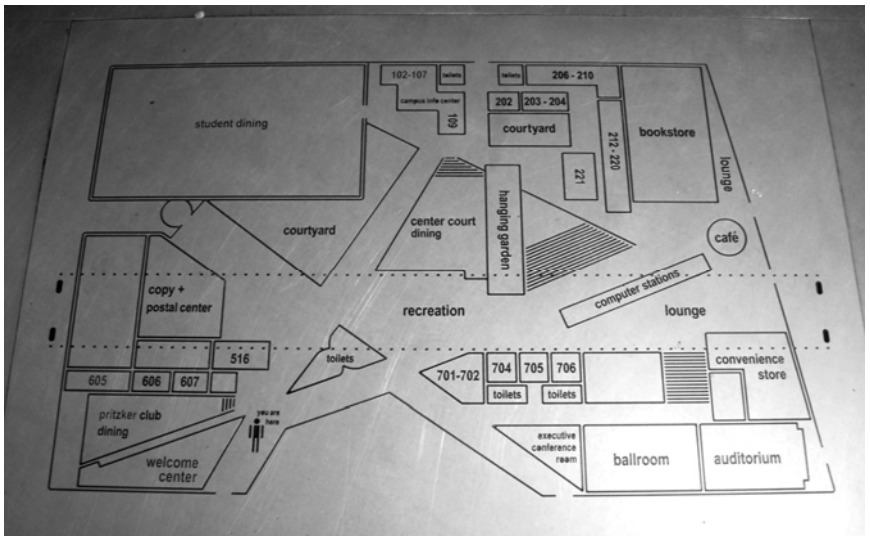

Figure 4. Doormat at the entrance of McCormick Tribune Campus Center (Rem Koolhaas, IIT, Chicago): the base of the edifice – applied function - "primary" communication (S.S.Vučković)

"Secondary" communication–connotation pertains to the reading of complex types of messages which the architecture communicates as a product of complex cultural relations. In that respect, architecture is, without a doubt, a mass communication medium, and as such, it communicates in a multilayered and polysemic manner, leaving possibility for different interpretations and meanings (Stevanovic, 2011). Secondary communication is manifested through different aspects of connotation which show that there is an ideology behind each and every architectural edifice, which preceded architect's activity itself (Argan, 1989:12). The shape of windows on the facade, type, number, mutual relations do not denote only the function ("primary" communication) but also point to a certain concept of living and edifice utilization, they connote a particular ideological idea of living which the architect communicates (Eco, 2003:185). This shows that connotation is also a message about different concepts of function. At the same time, it claims that comparing different architectural edifice in a "formal" way is almost unnecessary. It is possible to compare them only with respect to relations they establish in a social context they are in (Agrest, 1998:201).

In that sense, the interesting thing is the overlapping of codes from different cultural systems through a metaphoric transposition. This is the case with the Le Corbusier's Savoye Villa, where "the code of the nave" and "the code of the house" are in an analogous relation, while the new linear form of the windows yields new meaning, or a new architectural ideology (Agrest, 1998:203). According to Barthes connotation is the "other significance", secondary or multiple meaning. He even considers denotation of a sign as one of its connotations (Barthes, 1971:383–385). When Zumthor speaks about the atmosphere which the architect creates(Zumthor, 2006), he too is in the field of "secondary" communication as well as the form which "follows fear, beauty, funding" (Elin, 2002).

Viewed from the perspective of a modern myth, connotation has all the characteristics of an ideology as the culture is not found in denotations but rather in connotations (Janićijević, 2000:179). It has already been said that the "primary" communication is more linked to function while the "secondary" communication is linked to everything else which is not only a function, a sum of cultural units which create meaning. Translated into the basic architectural duality "function – form", it would be safe to say that connotation is more connected to the form of the edifice. If architecture is perceived as a materialization of ideas (concepts) then this materialization (envelope, material, manner of material application, detail, etc.) is the part of a social, cultural, political, economic and geographic context and as such it conveys certain information - it communicates.

Tschumi, in the light of deconstruction, goes beyond the dichotomy of function - form and recognizes that complementarity in architecture and space as a relation between vector and envelope i.e. edifices consist of vectors and envelopes. Entering and moving through a building creates lines of movement – vectors, while the envelope is the protection against external influences - vectors activate and envelopes define the space (Tschumi, 2003:64). Easy way of following lines of movement trough space and messages as to how certain activities are performed (reading vectors) are all indicators of "primary" communication. The manner in which we receive messages of architecture as a generated space is certainly directly linked to the function, but is also inseparable from the materialization (form) of the edifice. It is clear that vectors which define movement within and around the edifice, thus activating the space, are in certain relation to the envelope. This relation may be indifferent, reciprocal and conflicting (Tschumi, 2003) and it is possible to view the relation between architectural denotation and connotation through these three levels.

Architecture, as the art of space articulation, is the art of setting limits in space. The "envelope–border", especially in architectural deconstructivist concepts, is the most reflexive plane of architectural connotation. The envelope as a border establishes different types of relations: from the aspect of approach to space – open versus closed; from the aspect of ownership – state owned versus privately owned; from the social aspect - commercial versus domestic; from the legal aspect, etc. Architectural connotation is related to architecture as an image, as mass media (Colomina, 2008), to the envelope as the mediator (Hays, 2003:66), as a spectacle, as a transposed demonstration of complex economic and technological relations. Hal Foster, adding to the definition of Guy Debord of spectacle as a "capital accumulated to the point where it becomes an image", says that the spectacle has become "an image accumulated to the point where it becomes capital" (Vidler, 2008:vii). Colomina points out the significance of the discovery of X-rays and CAT scans for making a "see-through edifice" a mass phenomenon and giving access to the

public to what is considered private (Colomina, 2003). Koolhaas researches this special relation between the private and the public through the meaning of the envelope as a social interface (Koolhaas, 2003). Rakatansky understands the role of edifice envelope as a map, graph, diagram, table in social dynamics of architecture where the relation between the social sphere and the envelope reveals how architecture can express these relations in much more complex and articulated ways (Rakatansky, 2003:76). The envelope is a map which creates a dialogue between the outside and the inside; it defines the inclusion and exclusion of programs and contexts. Hence, for example, double envelope of the Concert Hall and Exhibition Complex in Ruen in France (designed by Tschumi), is not merely a sound buffer between the inside and the outside (which permits noise of up to 105 dB inside and 35 dB on the outside), but is also an "in–between" (Tschumi and Walker, 2006:114), social space, place for meeting and interacting. This space is activated by movement of users when entering and exiting, a place where "primary" and "secondary" communication overlap.

The manner in which the user decodes space, namely how the user reads the conveyed "messages" in order to master the space is directly linked to "primary" communication. Interpretation of the edifice on a wider, basically ever contextual level (neighbors, street, block, city, society, etc.), implies a set of connected connotations – "secondary" communication.

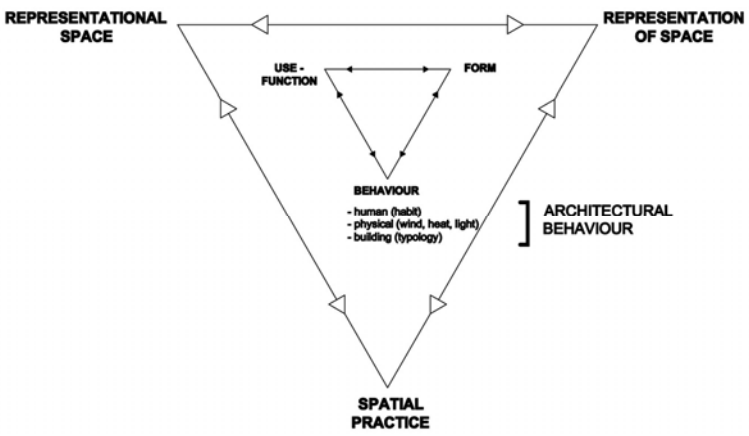

Figure 5. Comparison between the representation of Lefebvre's „production of space" and architectural definition: „form-function-behavior". Architectural communication is in the domain of behavior of architecture/space utilization. (Atelier Bow-Wow, 2008: 12)

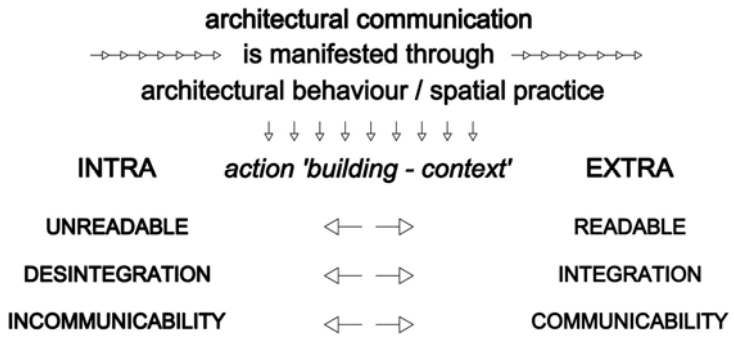

Figure 6. Forms of architectural communication – intra and extra activity of architecture (S.S.Vučković)

BEHAVIOR OF ARCHITECTURE - *INTRA* AND *EXTRA* ACTIVITY

Deconstructivist criticism of semiotcs offers opportunity to understand the architectural communication outside of semiotic duality denotation/connotation, as spatial interaction or "interpenetration" (Norberg-Schulz, 2009: 155–156), and accordingly as a response to the context. If the architecture is understood beyond function and form, beyond lines of movement (vectors) and envelopes, then it would be possible to speak about *activity - action* that an architectural edifice causes in space. Architectural edifice has certain impact on spatial context which results in re-semiotization of the context. In that sense, it is possible to speak about *architectural behavior* which could be placed midway between the function and the form, which corresponds to Lefebvre's production of space. It is possible to draw a parallel between Lefebvre's "a conceptual triad" (Lefebvre, 1991: 33): *space of representation – representation of space – utilization of space* and representation of architecture through the relation: *function – form – behavior* (Atelier Bow-Wow, 2008:11–13). This comparison shows that between the *function/space of representation* and *form/representation of space* there is a field of particular importance for accepting architectural communication: *space utilization/behavior of architecture*, which is an equal participant in the final product of architecture (Figure 5).

Each *activity - action* causes reaction (users, environment, city, society, etc.). The relation between action and reaction indicates that certain kind of communication exists. *Activity* is a wider term than function of the edifice and implies at the same time everything that is happening in the space through the relation between the form and environment, materialization, atmosphere that the edifice creates, etc. Depending on the manner in which this activity evolves, as well as the manner in which it is interpreted, architectural communication can be viewed through *INTRA* and *EXTRA activity* of edifices (Figure 6).

INTRA Activity

Intra (lat. intra, interus) in, inside, from inside, within, within limits (Vujaklija, 1996/97:350) implies a concept of edifices which are "closed on the inside", introvert, disintegrated in relation to the environment, uncommunicative, non-interpretable, inert, illegible, difficult to use, having "hard" boundaries completely separating the outside from the inside, blocking the flow and continuity of space in the process of movement and access to the edifice. The connection which such an edifice establishes with its surrounding is hard, almost violent, it tries to impose itself on the surrounding and the context in an attempt to dominate which often implies a dominant, emphasized form. This is, in one aspect, a type of project which Monaco called "progetto forte" (Monaco, 2004:57–63), a stable, strong project, which is characterized as being rational, strictly defined, closed, un-transformable, inflexible, implying totalitarianism, predictability, logic, rationality, stable and structural spatial organization which creates resistant architecture.

In its interior such edifices may have a highly transformable concept but they maintain poor communication with its context.

Throughout history of architecture all the way to Renaissance and Baroque, the "closed" concept dominated. Renaissance adhered to the idea of producing "clean" edifices, immune to any contact with the environment and focused on its self - sufficiency and perfection. Unlike Renaissance, Baroque worked on developing a concept which goes from a closed towards an open form, from static towards dynamic, thus establishing spatial integration and dialogue with the context (Monaco, 2004:32). "Classical" language of architecture (Samerson, 2002) which is closed and repetition-based transitioned into a "modern" language prone to openness and novelties. With the loss of the traditional wall following the advent of modern architecture, the envelope of the edifice has, through the introduction of large glass surfaces, become transparent and the link between the external and the internal has become more direct. But, the form, with its desire for a totalitarian transformation of space, has the propensity to impose itself rather than establish a dialogue with its environment on an equal footing. A strong project ("progetto forte") in its concept is not transformable, but in much the same way as any other spatial intervention, it too is subject to changes through time, in particular in cases where its structure remained incomplete.

EXTRA Activity

Extra (lat. extra) outside, out, particular, characteristic, extraordinary, outstanding; something that is done more or better" than required and asked for (Vujaklija, 1996/97: 262) implies the concept of edifice which is "outwardly open", extrovert, which establishes an interactive relation with its environment, which is communicative, readable, integrated into the environment. Its border (envelope) is not a barrier from the outside towards the inside and vice versa, but rather its logical continuation, where the continuity of space is achieved in the process of movement and approach to the edifice. This is the type of edifice which Michel Serres and Bruno Latour call "quasi edifice" (Hirsch, 2006:18) which is neither "hard" nor "soft", an edifice which develops a new holistic model of comprehension in which the edifice is viewed as a fact or value, as a physical form and social function. "Quasi edifice" comprehends facts and values as a whole. The problem of architecture does not consist in how it is viewed from the outside, nor how it is lived on the inside, but rather a dialectical relation between the inside and the outside, both on urbanistic and architectural scale. This is precisely that special value which characterizes edifices designed with such concept in mind. Deconstructivist theories contributed to the fact that contemporary envelope is increasingly becoming a mediator – it establishes a relationship with the social and cultural milieu of their environment, it is becoming softer. The new envelope is not only made up of semiotic material taken from popular culture, it does not detach the outside from the inside, private from public as is the case with modern architecture, it becomes soft, a "gelatinous fluid" with digital messages (Hays, 2003:67). The line between the private and the public does not correspond to the edifice's envelope. The envelope could rather be understood as a "separatrix", a term taken from Derrida, which is defined as "a curve, even if straight", which brings together and pulls apart two different systems (Lynn, 2003:72). Envelope is a special type of space - it is a borderland not a borderline. The envelope activates public space, it is not merely a border between the outside and the inside, between an edifice and the terrain, but the edifice is an integral part of the terrain. The border is a link between the duality of space: inside/outside, private/public, interaction with space surrounding the edifice, however not as a form of dilution but allowing each of them to maintain their own specificity (Sassen, 2006). "Progetto debole" (Monaco, 2004:57–63), a weak, instable project, is characterized by the easiness of transformation, narration, flexibility, by chance not predictability, openness to changes, transformability, lack of definition, polyvalence, interactivity with the environment. That is new experience of being based on "weakness" ("pensiero debole"), on Vattimo's not so much "being" as "coming into being" (Monaco, 2004: 53). That is a "live" project, and it is precisely the "weakness" which makes it alive and keeps it changing. Tschumi defines this as SEM – space, event, movement (Tschumi and Walker, 2006:42) - an event in space which cannot be strictly controlled and predicted, there must be an opportunity for a change and acceptance of such changes. The aim of such approach is not "predicting" but rather "expecting", which results in a dynamic architecture dependent on different external conditions.

Each and every type of open architecture which Monaco distinguishes (*continuous architecture*, having the ability to continue, extend and expand, horizontally or vertically; *flexible architecture*, which almost pulsates and adapts to the conditions of the context and users and *moving architecture*, which is partially or completely mobile and alters the quality of space through its mobility) (Monaco, 2004:136-190), are all types of extra activities.

INTRA VERSUS EXTRA – MIES VERSUS KOOLHAAS

The established concept of *intra* and *extra activity* as a types of architectural communication can be seen in comparative analysis of two architectural edifices from the XX century: *Mies versus Koolhaas*, a dialogue which Koolhaas establishes with "classical" ideas of modern architecture. Mies's Crown Hall from 1956 and Koolhaas's The McCormick Tribune Campus Center (competition in 1997) are both located on the Campus of Illinois Institute of Technology (IIT) in Chicago, only several hundred yards apart.

A strong, stable orthogonal form and prismatic geometry of the Crown Hall detached from the terrain, holds the edifice with a strong steel construction visible from the outside, leaving it open and flexible in its interior which remains adaptable for different uses. In this way a space which functions as a school (a laboratory for students of architecture) is formed. McCormick Center presents "hybridization of functions" an idea Koolhaas adheres to, an edifice which is

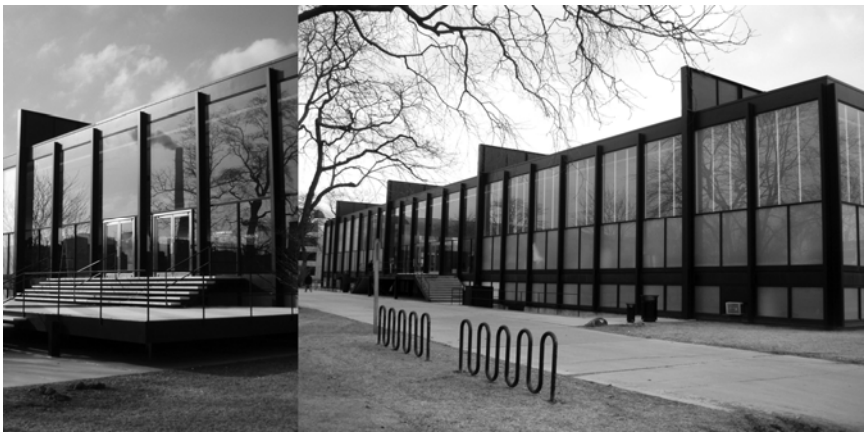

Figure 7. Intra versus extra activity of architecture (closed versus open, modern versus contemporary): Crown Hall (Mies van der Rohe, 1950-56), intra activity – rigid, "strong" form and flexibility of internal space (S.S.Vučković)

absolutely free on the inside, crisscrossed with lines of movement and different contents which have made a transition from a previously undeveloped, vacant space into an edifice. An open, "external space with lines of movement" is transposed in adequate form and content.

Thus integration with the context, as well as the weak, porous relation from the outside to the inside and vice versa, represents a basic concept on which the edifice is activated. This edifice determines "the forms of instability of a functional program", where the spatial heterogeneity at the same time causes the disarticulation of the form and the concept of "flexible accumulation" (Monaco, 2004:169) which is the next closest thing to the idea of "open work" in the architecture (Eco, 1965; Monaco, 2004:129). Although this too is one of Koolhaas's projects which is a kind of critique of the basic principles of modern architecture, nevertheless he relies on it and deems it as the starting point, enabling it to transform itself into a "weak" structure which allows for a spontaneous evolution. (Figures 7, 8). Adapting to the ever-changing conditions of the context and needs of users, this example primarily shows the evolution of architectural expression.

CONCLUSION

Architectural communication, as it is viewed here through intra and extra activity, has gradually evolved throughout the history of architecture, from closeness, disintegration and lack of communicability to openness, fluidity and communicability of space and form. Modernist architecture partially made a better contact with environment, whereas Postmodernism once again brought up the "closed" concept into architecture. However, both architectural movements can be seen as intra activity of architecture. Through deconstructivist concepts which imply, among other things, creating form without meaning, fragmentation and understanding of space as event, architecture achieved a stronger interaction with context, extra activity of architecture.

The communication ability of each edifice, or space it creates, is an important trait of its qualitative characteristic. The fact that design process and architecture may be seen and analyzed from communicational point of view can contribute to creating of high-quality space in complete interaction with context. The quality of "primary" and "secondary" communication, in particular of intra and extra activity, shows in fact the quality of architectural behavior, or architecture as a means of communication between people and nature.

Figure 8. Intra versus extra activity of architecture (closed versus open, modern versus contemporary): McCormick Tribune Campus Center (Rem Koolhaas, 1997-2003), extra activity - openess, integration of external and internal space, lines of movement generate form and space (S.S.Vučković)

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[1] Neidhardt applies Peirce's triad of *icon – index - symbol* as an indicator of the unity of methods. He groups it with the Broadbent's classification of approaches to shaping the form (pragmatic, analogous, canonical (syntactic), typological approach), thus demonstrating the manner of interpretation of an architectural edifice or the viewer's reaction (Neidhardt, 1997: 65). Unlike De Saussure dichotomy of meaning *signified-signifier*, Charles Sanders Peirce creates a semiotic triangle – trichotomy: *sign – object – interpreter*, where the object, as the carrier of a sign, is divided into a trichotomy*: index – icon - symbol.* For more information see: Janićijević (2000); Eco (1973); Guiraud (2001).

[2] *Proxemics* differentiates between three types of space: *fixed space* whose boundaries are not measurable; *semi-fixed* space whose boundaries can be shifted and *informal space* which is the personal space around a person's body, whose size tends to define physical and social distance between people. (Janićijević, 2000: 295 – 300; Hall, 1976).

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CHANGING ARCHITECTURAL EDUCATION FOR REACHING SUSTAINABLE FUTURE: A CONTRIBUTION TO THE DISCUSSION

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This paper discusses potential changes for the architectural education in response to rapid environmental, economic and socio-political situations, globally and locally. Unpredictability and complexity of those changes on one side and increasing exclusion of architects in urban developments on the other side, are forcing us to rethink the role and purpose of architects and architecture in society in general. We started to question methodology and the substance of architectural education which would create professional architects that would be able to deliver and implement creative sustainable solutions. It is evident that the need for the sustainable architectural design, sensitive to environment and energy issues, has reached a critical level in both public and professional circles. However, the issue of social sensibility is still not adequately taken into consideration by professionals. We argue that it is a consequence of archaic academic curricula which must be changed in order to support a paradigm shift. This change would be from the "architect provider" to the "architect enabler". As a result of this issue, we introduce a new educational methodology to support: (1) building student's capacity for being engaged in collaborative design process, and (2) building bridges between the different disciplines in order to reach integral education.

Key words: : architectural education, sustainable future, collaborative design process, integral design studio.

INTRODUCTION

New millennium came with new challenges for architecture as a profession: it has to transform and adapt itself in order to ensure a role with a greater relevance in a global search for sustainable solutions. How can teaching architecture prepare students and make them able to response to these challenges? According to the UNESCO and International Union of Architects' (UIA) Charter for Architectural Education the "architecture involves everything that influences the way in which the built environment is planned, designed, made, used, furnished, landscaped and maintained" and that "architectural education constitutes some of the most significant environmental and professional challenges of the contemporary world" (UIA, 2011:1). If so, how should the curricula be re-designed to accommodate a better understanding of consequences of climate change, rapidly urbanizing agglomerations, economic uncertainty, raising importance of technology, rural exodus, environmental degradation, inequalities and informal/illegal development? These issues cannot be addressed through a single profession so how can we best teach and prepare students to work in close cooperation with other professions? As said, on one side, we have to deal with the increasing complexity of the architect's role (knowledge, skills, competence, etc.) and on the other with increasing exclusion of architects from built environment projects. How can architecture achieve better outcomes and avoid undesirable consequences for local communities under 'globalized' conditions of uncertainty? Architectural education should encourage creativity, dialogue, inclusivity and critical thinking, but also a willingness and determination toward effective communication and collaboration. This article should be understood as a call for discussion and tries to contribute with ideas of some possible courses of changes in architectural education in order to reach that ideal.

NEW ISSUES OF IMPORTANCE

Changing perspective on architect's role and position

There are different perspectives on architect's role in the process of creating of space. Types and origin of ideas, values, knowledge, facts and attitudes embeded in spatial solutions depend on that perspective - understanding personal position and role in that process. Defining personal position and role in the process of creating/tranforming of space/world is influenced by personal understanding of the world. In our opinion, today there are two parallelly existing philosophical positions serving as sources/starting points of contemporary architecture practices: (1) postmodernism:

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there are numerous perspectives of the world and there are no criteria for choosing one, true and real; and (2) reflexive modernism: a picture of the world is formed through interactions of different perspectives.

Because of the fear of error and unforeseeable consequences of acting, striving to achieve "one perspective and to conquer certain knowledge that is true and unchangeable" is natural (Stojnov, 2003:11). According to postmodern understanding of reality, this will never happen. Postmodern perspective contributed to relativisation of the existence of one set of measures of what is correct and offered "to people to learn that they can and that they should get decentred from their perspectives and understand that they are only one of many ways of designing the world (or a number of worlds) and that other perspectives are not necesserally heresies, misconceptions, sophistries or betrayals but huge treasure and products of human spirit's creativity" (Stojnov, 2003:12). A knowledge consists of individual, plural and heterogeneous knowledges. According to Jean-Francois Lyotard (in Đurić, 2011) there are no "comprehensive views" that can be used to evaluate universal truth about anything.

Reflexive or interpretative modernism assumes that a picture of the world is created through interaction of several subjects, where each individual picture gets changed, confirmed or rejected in interaction with other subjective pictures. Interpretative approach assumes that "an individual is not isolated from others and that he lives in a complex network of social relations with others. It is through this network that culturological resources, such as ways of thinking, organization and ways of living, are developed, transformed, maintained and reproduced" (Geertz, 1983 and Latour, 1987 in Healey, 1997:44). Since architecture is a profession that influences and changes in various ways people, processes and spaces, we believe that it has to have rational reasons for the proffesional choices. Reflexive modernism stesses that the rational is confirmed in interaction with a given social context. Thus, the process of creating solutions has to be inclusive, i.e. capable of accepting the differences, and also to enable inclusion of non-scientific variables. This assumes joining of technical and scientific knowledge with moral principles and moral responses, which together create what we call a practical awareness and common sense.

Energy and environmentally but socially sensible design also

"Al Gore talked about the climate crisis .... You see, he's right. I mean, there is a major climate crisis.... But I believe there's a second climate crisis, which is as severe, which has the same origins, and that we have to deal with the same urgency. But this is a crisis of, not natural resources – though I believe that's true – but a crisis of human resources. " (Robinson, 2010). The topics of global warming, climate changes, energy efficiency and methods of protection and improvement of living and working environment are very present in professional and wider public. These topics are embedded in development documents of various levels of competence (Živković and Lalović, 2011), necessary laws have been passed, sub-laws and recommendations are being developed, and standards introduced on all levels of architectural activities: from production of construction materials or software solutions (Lalović and Živković, 2011) to planning of spatial development. Education of architects in regard to these topics has obtained its initial inputs and the process of transformation has started. It is essential that a critical mass of those alarmed has been reached so that in the years to come we can expect a considerable professional progress in creation and implementation of environmentally sensible and energy efficient designs (Bajić Brković and Milaković, 2011). According to Al Gore (2010) we have at our fingertips all the tools necessary to overcome the climate crisis and that the only ingredient missing is collective will. Although there is a considerable space to improve the curriculum with the knowledge from these fields, the focus of this article is hereby transfered to the field that, as we believe, has been neglected in the process of education of architects: socially sensible design and socially active architects.

Current global economic crisis has made the gap between the poor and the rich even bigger, has increased the number of urban suburbs' poor, unemployed and socially excluded inhabitants (Jokić and Petovar, 2009), has emptied some more villages, contributed to the degradation of the surrounding and has made social inequalities even more spatially visible. The gap between between what millions of people need and what the current system of housing and building provides continues to grow (Fisher, 2008). This represents an urgent invitation to mobilize all those involved in development, including the architects. In the activities of architects, i.e. their education, some new approaches can be recognized as well as some new forms of macro and micro methods of interventions that can mitigate above mentioned social problems and trends. "Who are our clients, who do we work for? Is this a right time to move architects from the position of service providers towards more active roles in creation of better surroundings and better society? Can architecture have any impact on the society at all? If yes, what are the creative approaches to the community?"[1)]

A growing movement among architects and their architectural practice(s) can be recognised. It has many different names, such as "architecture for humanity", "public (interest) architecture", "emergency architecture", "architecture as activism", "architecture for the other 90%" etc., but similar ideology - architects can help the poor, marginalized, powerless, vulnerable people (Smith, 2007). The common meaning is the search for architectural solutions that address the most basic needs of the population not traditionally served by architects. A large number of international funds[2)] and associations[3)] monitor and support[4)] the work of these architects, and a growing number of publications[5)] and university programs[6)] deal with this issue. The ideology of this architectural movement is a part of a broader ideological framework of socially and environmentally responsible architecture that is based on the following premises (Bell, Wakeford, 2008): some social and environmental problems can be solved by architecture; the main purpose of the architecture is improving the quality of life in community(ies); therefore, the subject of architecture are not only objects and spatial complexes, but the quality of life of individuals and communities in which they are placed; the meaning, purpose and quality of architecture cannot be considered without assessing the impact on the community.

The idea of socially active and responsible architecture is not new. The early modern movement possessed a clear sense of political engagement, and it envisioned broad societal change as a crucial and fundamental part of architectural practices. In 1950s, 1960s and 1970s several waves of socially and environmentally sensitive movements among architects occurred as part of broader awakening processes: social activism and civil rights movement in 1960s, environmental movements in the 1970s (concerns about pollution, waste disposal, energy resources, etc.) and 1980s anti-nuclear movement. They initiated a wide search for harmony between the inhabitants and their physical and socio-cultural environment and resulted in numerous human settlement concepts/proposals/solutions, different in size, needed technology, design methodology, etc. The main specific of new generation of socially active architects is focusing "on providing the benefits of architecture to

specific categories of people, those traditionally un-served by the profession": vulnerable, poor and marginalized people (Bell, 2003). In this case focus is on the architectural solutions to humanitarian crises. According to Bell and Wakeford (2008) this movement is moving from the margins into the mainstream: it is the architecture for the new era with new approaches to prefabrication, manufactured housing, and modular design, merging the roles of designer and developer with a enabler deeply committed to pro bono work.

"The approach to architecture which assumes architects waiting for a strong investor willing to invest in (often unnecessary luxurious) projects is a model that makes us wonder whether the profession is aware of the moment we are at right now. While on one side we are standing in line waiting to be chosen by a rich investor to bring into life some of their (or our own) dream designs, on the other side we are surrounded with the misery of millions living under extremely inadequate conditions, without proper apartments, schools, public and common areas" (Rajić, 2011). Is this a issue that concerns the practical work and education of architects or not? According to UIA (2011) it is: "There is still room for the development of new tasks for the profession when architects become aware of the increasing needs identified and possibilities offered in areas which have not, up to now, been of major concern to the profession...This is particularly true for those who are working in a developing context, where the architects could accept the role of an "enabler", rather than that of a "provider", and where the profession can meet new challenges....There is no doubt that an architect's capacity to solve problems, can greatly contribute to tasks such as community development, self-help programs, educational facilities, etc., and thus make a significant contribution to the improvement of the quality of life of those who are not accepted as citizens in their full right and who cannot be counted among the architect's usual clients." (UIA, 2011).

RETHINKING AND REDISIGNING THE DESIGN PROCESS / STUDIO

Design studio or studio based pedagogy is considered to be main methodological tool of architectural education. Studio is a pedagogical construct by which newly acquired knowledge and skills are brought together and applied in the problem resolving design process. It is a process which presumes applying of theoretical knowledge and concepts in to certain context and finding practical problem solutions. However, rapid changes in socially generated knowledge and/or changes in skills and methods and instruments for their mastering should have a direct impact on the way we conduct studio activities. Accordingly the foregoing, it is necessary to reconsider common studio design learning process, which in order to be practically effective should take form of collaborative and integrated learning and working.

Collaborative process: group learning and designing

The journals *Design Intelligence* and *Almanac of Architecture and Design*[7] in the last 13 years have been researching the quality of schools for architects in the USA and adequacy of education of young professionals for practical needs. For the research done in 2001, 800 leading architectural companies in the USA were interviewed. The question referred to what kind of knowledge and values they wanted from young architects. Most of them answered that "We want students who think in a creative way… We don't care much about their skills...we can help them develop their skills in the office" (Al-Qawasmi and Vasquez de Velasco, 2006: viii). Further on during the interview they were asked to identify the schools that in the previous five years had released the best educated people in their opinion[8]. After getting an insight into the curricula of nominated best schools, the conclusion was that the only common denominator was "knowledge based design" curricula, i.e. the curricula based on the attitude that "field of architecture holds a knowledge base of its own", therefore, "the solutions were generated exclusively from that base" (Al-Qawasmi and Vasquez de Velasco, 2006: ix). These results showed that in spite of their claim that they need employees "who think in a creative way", these companies actually look for "those who can deliver sound product in time", i.e. those who are efficient and effective ratherin preparation of technical documentation than in making sustainable design solutions. In a similar research, today, 10 years later, leading schools of architecture tells us that their key commitments are: collaborative working methods, interdisciplinary approach, mastering communication and sharing skills: "These programs are graduating students who are able to tackle complex and difficult work, create and share knowledge, and invent new design solutions in their fields. The best students have the human skills and personal temperaments to collaborate at professional levels ... Students learn not just technologies and craft but also leadership, judgment, and insight into changing contexts and upcoming challenges" (Cramer, 2011).

This shift from "knowledge based design" to "interdisciplinary and collaborative design" implies that it is recognised that complex global problems requirenew ways of learning, thinking and working. Sustainable solutions cannot be generatedonly within one (architectural) profession but through active inter-professional cooperation[9]. Additionaly, every successful collaborative process creates a new resource for cooperation in other fields/problems/contexts of a given territory: "Participants develop new skills, build new networks, expand their activities and ambitions, learn that standards and structures can be adapted and changed with their mutual efforts" (Innes, 2004: x). In such processes the participants learn through single or multiple shifts in thinking – reevaluation and reformulation of initial interests they had when they started the dialogue (Innes and Booher, 2010:6). This is how creative solutions are reached, while the participants develop common meanings and new heuristics necessary for facing the problems and become more capable for realization of sustainable community development without instructions and directions of some authority in hierarchy: they become able to realize new ideas in practice, i.e. to introduce innovation. So, a collaborative process is not a process of bargaining and exchange that should lead to a compromise, but a process of searching for new solutions that represent mutually useful options.

Building architects' collaboration skills

Commonly, schools of architecture curricula focus on the development of the students' awareness, knowledge and abilities. These terms come from Bloom's[10] (Bloom, 1956:7) definition of educational objectives, according to which any given learning task favors one of three psychological domains: (1) Cognitive domain, revolves around knowledge, comprehension and critical thinking about a particular topic and deals with a person's ability to process and utilize information in a meaningful way[11], (2) Psychomotor domain, involves manipulative or physical skills and (3) Affective domain, describes the way people react emotionally and their ability to feel another being pain or joy, it relates to the development of values, appreciation, empathy, opinions and attitudes that result from the learning process. The five major categories are listed from the simplest behavior to the most complex (Krathwohl, *et al.*, 1973):

1. Receiving Phenomena: Awareness, willingness to hear, selected attention. Listen to others with respect.

2. Responding to Phenomena: Active participation on the part of the learners. Attends

and reacts to a particular phenomenon. Learning outcomes may emphasize compliance in responding, willingness to respond, or satisfaction in responding (motivation).

3. Valuing: The worth or value a person attaches to a particular object, phenomenon, or behavior. This ranges from simple acceptance to the more complex state of commitment. Student demonstrates belief in the democratic process, sensitive towards individual and cultural differences, shows the ability to solve problems, proposes a plan to social improvement and follows through with commitment, informs other on matters that one feels strongly about.

4. Organization: Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating an unique value system. The emphasis is on comparing, relating, and synthesizing values. Student recognizes the need for balance between freedom and responsible behavior, accepts responsibility for one's behavior, explains the role of systematic planning in solving problems, accepts professional ethical standards, creates a life plan in harmony with abilities, interests, and beliefs.

5. Internalizing values: The behavior is pervasive, consistent, and most importantly, characteristic of the learner and it is driven by his value system. Instructional objectives are concerned with the general patterns of student's adjustment (personal, social, emotional). Student shows self-reliance when working independently, cooperates in group activities (displays teamwork), uses a collaborative approach in problem solving, displays a professional commitment to ethical practice on a daily basis, revises judgments and changes behavior in light of new evidence.

In every educational process some affective domain objectives are realized, but these objectives, since not being specified in the curricula, can be found in so called "hidden" curricula (Roberts *et al.*, 2006) that remain undocumented and thus unvalued in regard to those from the cognitive domain. According to the UIA the objective of the architectural education is to "develop the capacity in students to be able to conceptualize, design, understand and realize the act of building within a context of the practice of architecture which balances the tensions between emotion, reason and intuition, and which gives physical form to the needs of the society and the individual" (Charter, 2005).

Integral design/studio: Crossing over and out of the discipline and sectoral borders

"A number of symptoms conceal the general cause of the disorientation of education in today's world: the loss of meaning and the universal hunger for meaning. A viable education can only be an integral education of the human being" (Nicolescu, 1999:1). Such integral education assumes the one that establishes "bridges between different disciplines", i.e. where solutions are looked for and created through cooperation and team work of students and teachers of different disciplines. "The architecture is a discipline which draws knowledge from the humanities, the social and the physical sciences, technology, environmental sciences, the creative arts and the liberal arts" (UIA Charter, 2011), and in creation of architectural solutions it is necessary to achieve integration of all knowledge sources. According to Nicolescu (1999) the cooperative design studios help students distinguish the following:

1. Multidisciplinary work - assumes researching certain topics through several disciplines at the same time. Disciplines are being crossed, but such work improves each discipline individually, and objectives/results remain limited by the frame of each individual discipline.

2. Interdisciplinary work - assumes the transfer of methods from one discipline into the other. Different levels of interdisciplinary work can be distinguished – from the level of application, i.e. direct transfer of certain method from one discipline into the other to a so-called disciplinary big-bang, when due to the knowledge gained through such transfer of methods between disciplines certain new disciplines are formed.

3. Trans-disciplinary work - assumes that an object of research exists between, over and beyond all disciplines. The objective of trans-disciplinary work is to understand the world but with the assumption of the unity of knowledge: "... it is based on questioning, as well as on the rejection of all a priori answers and certitude contradictory to the facts. At the same time, it revalues the role of deeply rooted intuition, of imagination, of sensitivity, and of the body in the transmission of knowledge" (Nicolaus, 1999:2).

Through integration of different disciplines in creating solutions we can reconcile effectiveness and affectivity, because sharing of knowledge is accompanied with a new tolerance grounded in trans-disciplinary work. It enables a comprehensive evaluation of the effects on surrounding, perception of life cycles of all components of the solution and provides a good basis for implementation of sustainable solutions. Three main work models can be distinguished, according the type and level of cooperative work in integral studio design, each one offering special learning opportunities for students of architecture:

1. Consultation model. Architecture students invite students from other disciplines to come to the studio, from time to time, as external consulting experts. This model is closest to the standard architecture practice. Result: Improved single disciplinary design.

2. Working at the same place model. Architecture and other disciplines students working side by side on the same project, each producing their own proposal. Result: Improved single disciplinary design.

3. "Real team" collaboration model. Students work in multidisciplinary teams, each encompassing architecture and other disciplines students to collaborate on joint individual projects, gaining as a result integral design.

Inclusion of the students from various disciplines into the process of creating

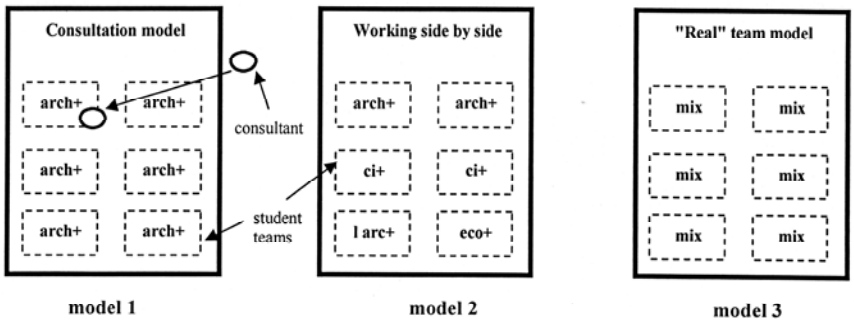

Figure 1. Options of working model in an integral studio – student teams differ in composition, i.e. type and level of cooperation. Key: arch + : students of architecture improved their design through the process of consultation (model 1) or working side by side (model 2) with students of other profession, ci: students of civil engineering, l arch: students of landscape architecture, eco: students of ecology, etc.; mix: multidisciplinary teams of students (model 3). Design: Danijela Milovanović Rodić adapting Lehman's model, (Lehman, 2006:93-95)

solutions requires a special pedagogical model that results in a particular type of learning situation. Collaborative model is successful in cherishing an interdisciplinary attitude, while simultaneously enabling creative design solutions and broaden social awareness (Lehman, 2006).

CONCLUSION

Key changes in contemporary architectural education should be generated from the shift in understanding of the role and the position of architects in the social processes. It is necessary to re-actualize social responsibility of architects and importance of their engagement in social life. Starting point should be redefinition of the quality of life values: relations among people, material, emotional and physical welfare, social inclusions, civil rights, possibilities of personal developments etc. An architect has to have a feeling of belonging to the community he works for. He has to understand the reciprocal link between himself, his actions and the context in which he works. In architectural education, both teachers and students should be socially aware and engaged people who perform a professional commitment to ethical practice on a daily basis. In that sense, development of affective psychological domain has great importance and should be included in the curricula.

An architect as a professional has to establish and interpret multiple relations within his/her working enviroment. These relations should not be only interpreted by scientific-technical language but also through socialy recognised moral principles, values and ideas. The quality of architectural solutions should not be measured only in regard to achieved profit, fame or power, but first of all in regard to the improvements of the quality of life; not only of those the work has been done for, but all that are inlcuded or affected in the process of creating solutions, including the architect himself as well. This understanding of education and discipline indicates that viable solutions can be created only through an interdisciplinary and trans-disciplinary work and learning from each other.

Education of architects has to become a platform for enabling future effective and efficient collaboration between disciplines in dealing with the space. In order to achieve this, the broadening of the knowledge basis in curriculum is necessary, as well as the development of effective communication and collaboration skills. We believe that collaborative model of Integral design studio can be successful in fostering an interdisciplinary and trans-disciplinary capacities of students and in raising their social awareness, without limiting creativity and imagination.

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1) These are some of the questions opened during the conference titled: „Lets not talk about architecture" held in Singapore in the beginning of August 2010. For more see: http://www.expeditio.org/benefit-living/index.php

2) The Berkeley Prize focused on the social art of architecture; The Core77 Design Awards program - categories: "service", "social impact" and pro bono (for good) projects; The Curry Stone Design Prize - designers for social change; The Lewis Mumford Awards-Architects/Designers/Planners for Social Responsibility; The Rudy Bruner Awards - urban projects, distinguished by their design and social contribution; The Social Economic Environmental Design (SEED) Awards - excellence in public interest design.

3) AIA, Architectural League of New York, American Society of Interior Designers, The Royal Institute of British Architects, The South African Institute of Architects, etc.

4) 2001 Samuel Mockbee posthumously honoured - AIA Gold Medal; 2006 Cameron Sinclair won TED Prize for humanitarian design work; 2010 "Public Interest Practices in Architecture" awarded the $100,000 Latrobe Fellowship from the AIA College of Fellows, etc.

5) Some of most importanat authors / books are: Boyer, E., Mitgang, L. (1996) Building Community: A New Future for Architecture Education & Practice; Oppenheimer Dean, A. (2002) The Rural Studio: Samuel Mockbee and an Architecture of Decency; Bell, B. (2003) Good Deeds, Good Design: Community Service Through Architecture; Bell, B., Wakeford, K. (eds) (2008) Expanding Architecture: Design as Activism; Polak, P. (2008) Out of Poverty: What Works When Traditional Approaches Fail, Pilloton, E (ed)(2009) Design Revolution: 100 Products that Empower People; Cary, J. (ed)(2010) The Power of Pro Bono: 40 Stories about Design for the Public Good; Aquilino, M. (ed)(2010) Beyond Shelter: Architecture & Human Dignity; Sinclair, C., Stohr, K. (eds) (2006) Design Like You Give a Damn: Architectural Responses To Humanitarian Crises; Sinclair, C., Stohr, K. (eds) (2012) Design Like You Give a Damn 2: Building Change from the Ground Up; etc. Architectural Record dedicates its entire March 2012 issue to "Building for Social Change".

6) Auburn University - Rural Studio, Cambridge University - Shelter Centre, Detroit Mercy -The Detroit Collaborative Design Center, Miami University - Over the Rhine Center for Community Engagement, University of Kansas - Studio 804, MIT - D-Lab; Stanford - Entrepreneurial Design for Extreme Affordability , etc.

7) America's Best Architecture & Design Schools is conducted annually. The research ranks undergraduate and graduate programs from the perspective of leading practitioners. This 13th annual survey was conducted in mid-2011. For more see: http://www.di.net/store/best-architecture-design-schools

8) Research was conducted within the three years - 1998-2001. Firms have noted a number of skill deficiencies in their new graduate hires (respondents were asked to name up to three): 90% Building/structural knowledge, 78% Oral and written communication skills, 28% Practical business and practice knowledge,19% Work ethic, self motivation, 16% Computer skills, including CAD, 14% Sketching skills, 7% Detailing knowledge, 6% Design theory, knowledge and history, 5% Teamwork skills & discipline, 5% Analytical thinking/problem solving, 3% Project management, 2% Knowledge of interiors, 2% Research skills, 2% Design skills, 2% Relationship between design and technology.

9) Importance of integrated / interdisciplinary / de-specialized design process is undelined in architectural concept preceding sustainibilty paradigm. In mid-20th century ekistics occured as a concept of the human settlements design process (embeded in Doxiadis's theorethical and practical work) that postulates scientific approach and its interdisciplinary nature: the process has to involve different professions and disciplines (geography, ecology psychology, anthropology, cultural, political, and aesthetics studies) in order to avoid chaos and to achieve balance between humans (individual and common values and needs) and the environment. In 70s of the 20th century also Buckminster Fuller's advocates de-specialization: "The key problem of humanity is understanding the disappearance of a comprehensive, because specialization leads to isolation, confusion and letting someone else be responsible and to think about the general and the common good."

10) Bloom's main contributions are the classification of educational objectives and the theory of mastery-learning.

11) "There are six levels: 1. *Knowledge* - remembering. Exhibit memory of previously-learned materials by recalling facts, terms, basic concepts and answers. 2. *Comprehension* - understanding. Demonstrative understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas. 3. *Application* - applying. Using new knowledge. Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way. 4. Analysis - analyzing. Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations. 5. *Evaluation* - evaluating. Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria. 6. *Synthesis* - creating. Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions". Bloom (1956:201-207).

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ERRATA

No. 1

In the issue No. 28 of "Spatium" there has been a minor error regarding the affiliations of two authors of the paper "Urban policy in Brazil: Mismatches in the social management of land appreciation", who are **Paulo Nascimento Neto**, Postgraduate Program in Urban Management (PPGTU), Pontifícia Universidade Católica do Paraná, Curitiba, Brazil, and **Tomás Antonio Moreira**, Postgraduate Program in Urban Planning / Architecture and Urbanism School, Pontifícia Universidade Católica de Campinas, Campinas, Brazil. We would like to apologise for this omission.

No. 2

Instead of wrongly quoted name **Priorr**, the sources cited on pages 16, 17 and 22 of the paper "Land use planning for sustainable development of peri-urban zones", which was published in the issue No. 28 of "Spatium", should be attributed to **Dr. Annette Piorr**. The authors of the paper would like to appologise to Dr. Piorr and to readers for any inconveniance that this mistake may have caused.

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- Journal
  Jackson, T., Illsley, B. (2008) Using SEA to mainstream sustainable development: Some lessons from Scottish practice, *SPATIUM International Review*, No. 17-18, pp. 31-37.
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