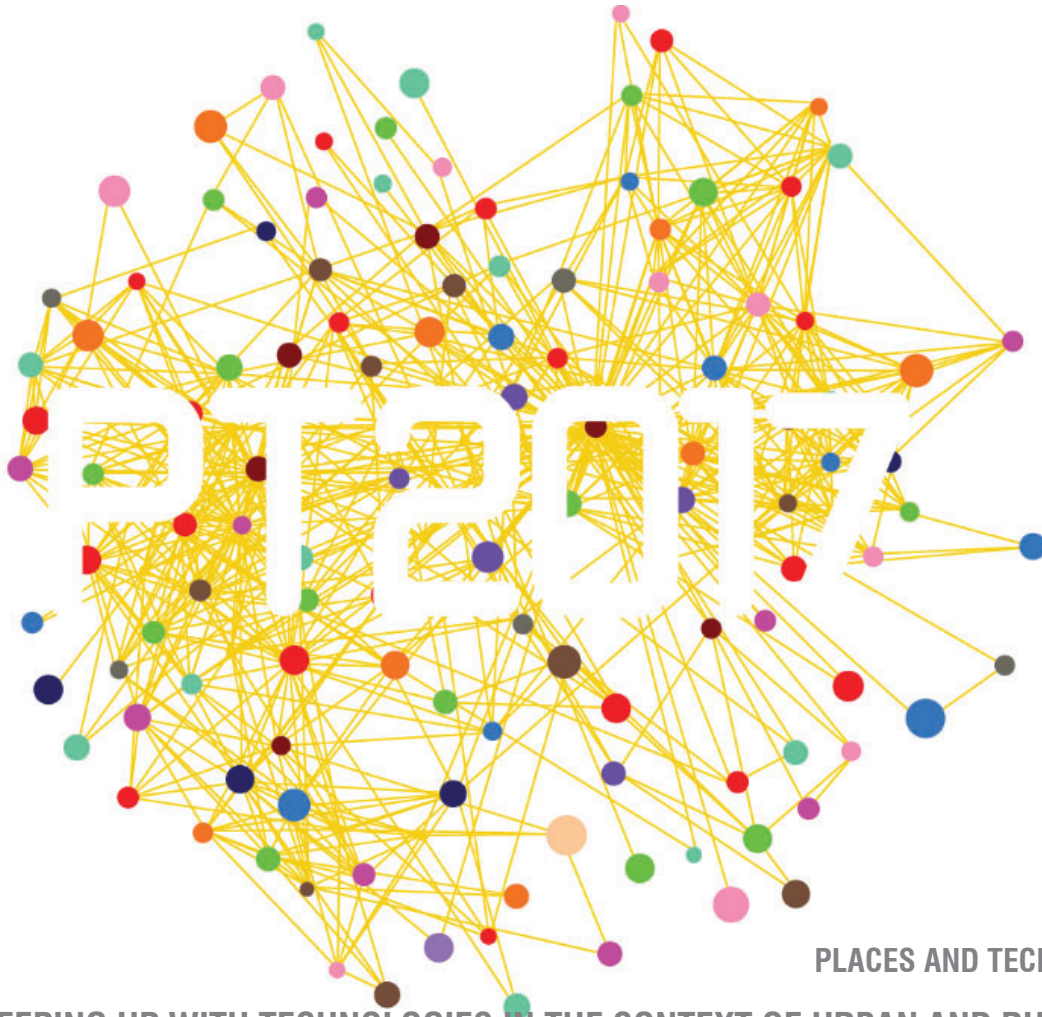


4th International Academic Conference



PLACES AND TECHNOLOGIES 2017
KEEPING UP WITH TECHNOLOGIES IN THE CONTEXT OF URBAN AND RURAL SYNERGY
Book of Conference Proceedings

Sarajevo, Bosnia and Herzegovina, June, 08th - 09th, 2017

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SARAJEVO

BOSNIA AND HERZEGOVINA

BOOK OF PROCEEDINGS

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SYNERGY

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Dženana Bijedić, Aleksandra Krstić-Furundžić, Mevludin Zečević



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University of Sarajevo, Faculty of Architecture, Bosnia and Herzegovina



TOPIC III:
SUSTAINABLE COMMUNITIES AND PARTICIPATION

COOPERATIVE GIS PLATFORM FOR IMPROVING RESILIENCE TO HOUSEHOLD RISKS – CASE STUDY OF ADA MEDJICA ON SAVA RIVER IN BELGRADE

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ABSTRACT

Flooding is estimated to be most serious possible potential shock for Belgrade due to heightened awareness after the floods in 2014. Heavy rainfall and raised level of the rivers Sava and Kolubara in municipality of Obrenovac within the City of Belgrade region, located 30 kilometers southwest of Belgrade's city center, caused flooding in an estimated 90% of the urban area. Flooding greatly affected buildings, infrastructure and agricultural land, especially in the areas situated along the Sava and Danube rivers. The floods had a particularly damaging effect on hygiene, public health and water supply. The impact of flooding on the productive activities of agriculture, trade and industry and housing negatively affected economic growth, with a corresponding impact on livelihoods, income and employment, and a significant decline in living conditions in the affected areas. As a response to lessons learned from the flooding City of Belgrade identified several priorities. Except the necessity to conduct a comprehensive Belgrade Risk Assessment and establish flood prevention systems and systems for mitigation of post-flood environmental, health, and economical risks, it was underlined the importance to establish better risk disaster management and communications, and to enhance and equip civil protection. The post disaster experience showed that many of these priorities are tightly correlated in a numerous ways with smallest social units – households. Therefore, starting with the assumption that use of smart information and communication technologies and motivating collaborative techniques enables development of cooperative instrument for efficient improvement household resilience, the academy team performed action research with a small community of Ada Medjica. Aim was to develop and test the model of this instrument enacting, and to evaluate its potential uses in all phases of potential shock or disasters. This paper represents the overview of methodology and experimental results achieved by the joint efforts of students, teachers and community.

Keywords: cooperation, resilience, GIS

⁷⁸ Corresponding author

INTRODUCTION

Resilience has emerged as an overarching concept within urban sustainability framework in response to complex challenges faced by cities in the 21st century. Launched for the first time in 2010, through the UNISDR's Making Cities Resilient Campaign, concept of resilience was initially aimed to bridge the gap between disaster risk reduction and climate change adaptation. Disaster events recorded over the globe in the past decade have been 90% climate-related, and according to the Dr. Robert Glasser, the Special Representative of the UN Secretary-General for Disaster Risk Reduction, have affected almost two billion people and cost the global economy trillions of dollars: "The world has learned the hard way that assumptions about what creates hazard have to be constantly assessed and revised in line with the pace of social and economic development. National governments, local government associations, international, regional and civil society organizations, donors, the private sector, academia and professional associations as well as every citizen need to be engaged in reducing their risk to disasters. All these stakeholders need to be on board, take on their role and contribute to building disaster resilient cities." (CRPP, 2016). Key efforts of the global resilience movement are directed toward development of a global community of practice focused on generating and providing support to building resilience in cities around the world (UNISDR 2005). Local governments are in focus as they are responsible to ensure the delivery of essential life support services to their citizens and carry key role in mobilizing and coordinating local social forces in responding to crises and emergencies. Local government officials are faced with the threat of disasters on a daily basis and need better access to policies and tools to effectively deal with them and transform urban planning, development and city governance enabling building resilient human settlements strengthened by partnership networks.

CASE STUDY CONTEXTUAL BACKGROUND

Resilience is broadly considered as a capacity of individuals, communities, institutions, businesses and systems within a city to adapt, grow, and thrive in the face of both shocks - sudden, traumatic events like earthquakes and floods - and more long-term, chronic stresses, like poverty and housing shortages. "City resilience is about making a city better, in both good times and bad, for the benefit of all its citizens, particularly the poor and vulnerable" (100RC, 2015). Resilience focuses on enhancing the performance of a system in the face of multiple hazards, rather than preventing or mitigating the loss of assets due to specific events (ARUP, 2014). Resilience is promoted as a concept that goes beyond conventional approaches to risk reduction, "delivering a forward-looking, multi-scale, multi-sectoral, multi-hazard, multi-stakeholder model for building resilience that recognizes the complexities and unique value of cities, and the inherent interdependencies of each part of an urban system" (CRPP, 2016). It moves away from traditional disaster risk management, which is founded on risk assessments that relate to specific hazards. Instead, it accepts the possibility that a wide range of disruptive unpredictable events may occur as a result of long term stresses and sudden shocks and local communities should have adequate instruments to perform coordinated mobilisation of all resources and enable synergy of best possible effective responses.



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Serbia, as the other neighbouring Balkan countries, belongs to the SE European region which experiences more accelerated climate change than the global average and it is considered as a disaster prone area according to numerous climate change research results. Especially vulnerable is Region/City of Belgrade located at the confluence of the Sava and Danube (Djurđević & Kržić, 2014). Faced with extreme flooding events in May 2014, Serbia was severely challenged to provide appropriate response on the local level. The Belgrade's municipality of Obrenovac was most heavily affected by the flood events and numerous unfortunate events and dramatic decision making challenges raised a significant social attention. Nevertheless, this experience of confused and semi controlled social response initiated a significant change in overall awareness that broader social transformation has to be undertaken for City of Belgrade future preparedness. Following the 2014 floods experience a significant efforts have been undertaken on a different levels almost simultaneously: adaption of several national documents, several regulatory and normative changes have been undertaken aiming to improve institutional support for emergency situations on a City of Belgrade level. On the other hand, issues of unimplemented pre-disaster activities and high vulnerability of many urban assets and life support systems raised brother public discourse around crucial question: what could have we been done better before? That was the seed of Belgrade's resilience initiative. City of Belgrade officially applied 100 Resilient Cities (100RC) in 2014 and was selected as the first city in Eastern Europe from among 300 city applicants to participate in the second 100RC challenge.

During the 2014 floods numerous non-governmental organisations and volunteers expressed willingness and motivation to be part of the systematic response to shock. Unfortunately, many of them were not mobilised and got the role of the passive observers. One of such examples, was the volunteering proactive initiative of students of Faculty of Architecture University of Belgrade (FABU), with academic institutional support, that was not recognised by the governance system as useful and contributing at the moment. However, fortunately the initiative didn't fade, on the contrary it was transformed much in deeper social phenomenon. Starting, with the "New Housing Models for People Threatened by Floods" initiative at 2014 mobilizing academic attention toward basic resilience issues, and continuing with the first pilot project of "trilateral" cooperation had been undertaken in Serbia (RC, 2016): academy /international support / local government FABU continued to keep proactive role in overall social transformation toward resilience. Except the upgrading the curricula with contemporary research questions and introducing the new learning model (Lalović, 2015) within the Master academic studies programme Integrated urbanism a new approach to scientific research was also introduced aiming to discover and test new models in field neglected by the official governmental efforts – strengthening social cohesion among all stakeholders and building their capacities to cooperate in the process of Belgrade resilience development.

RESEARCH CONSTRUCT

City resilience and its practices have been emerging from disaster recovery, responses and climate adaptations through multi-level territorial actions which are lean on a range of existing expertise and knowledge from engineering to risk management. Urban resilience is increasingly fed by different disciplines and theories in order to provide an

integrated view of urban challenges and the for file the need of a more comprehensive and multidisciplinary framing retrofitted by practices (ARUP, 2014). Within the Hyogo Framework for Action 2005-2015 future challenges were identified in areas of: - governance: organizational, legal and policy frameworks; - determination of risk assessment, monitoring and early warning; - knowledge management and education; - reducing the risk of fundamental factors; - readiness for effective response and recovery. Examining the listed areas in case of Belgrade there are many factors of Belgrade's 2014 unfortunate flood events: - outdated institutional and organisational instruments, - lack of awareness of risk assessment necessity, poor data condition and inaccessibility to the relevant information, outdated early warning systems, - low level of public awareness of potential shocks and practical knowledge of how to react and behave in relation to them. Since the government administration focused on the first, we decided to focus our research on other factors with a key questions: - how to enact comprehensive model of social interaction that would enable reaching the common understanding of basic resilience issued while in the same time producing ready to use practical solutions? Who should be included in this process and what role they can play? What results could be achieved with no material resources available?

Theoretical framework and methodology

In order to answer questions we decided to perform an experiment on a concrete research polygon. In the context of Serbia, we have witnessed the emergence of numerous building capacities programs within local communities. However, transformation initiated trough formal educational model in best case became part of the real life of the community after a long period of time. Therefore, the initial assumption of this study is that the way of transferring knowledge within community have to correspond to the cognitive profile and needs of the people, so people at the end recognise its applicability and usability in everyday life. Therefore, as base to tailor collaborative process of knowledge transfer we used previously developed learning model based on integral theory AQAL methodology (Wilber K., Brown B., Esbjörn-Hargens S.) and 4MAT learning methodological approach (McCarthy B.), which was already tested trough several experimental cases within the context in Serbia (Lalović, 2015). On the other side in order to foster not only knowledge transfer but also enactment of a new one contextually practically applicable we used previously model of information support to urban sustainable development in context of Serbia (Lalović, 2014). The main assumption is that usage of contemporary GIS technologies enables not only efficiency in information supports enactment but also enables tailoring the its structure in line with context specificities. The model was enacted from integral theory approach applied on geosciences achievements in territorial development (Brail R., Klosterman R., Batty M., O'Looney J.) and already experimentally tested within six local communities (Lalović, 2013). But in this situation we added another challenge to this experiment initialising the development of city navigating intelligence. According the M. Hamilton it represents the concept of a comprehensive feedback process, reporting mechanism for monitoring vital signals of community and publishing the "health" of the city's system. The assumption is that usage of web based GIS technologies can visually in a easy understandable way present the state of crucial community resilience indicators (Lalović, 2014a).



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Since this experiment is focusing on the solving complex real unstructured problem we choose to Checkland's Soft Systems Methodological approach (SSM), since it is based on a holistic analysis of the ways of understanding the situation of those who are involved in the problem and then applying the method of systematic reviews in the conceptual modelling of the human activities and relationships to achieve a common goal. The basic premise of this approach is that the effectiveness of actions is directly related to the degree of participation of people in the process of finding out about the problem situation and learning about ways to improve it. Since in this case we had to perform in a local community we realized that the system thinking should not only rely on expert led process of understanding the local reality, but also should be open to adapt to the local capacities to conceptualize solutions. Therefore, we decided to include another methodological approach in overall research matrix: action research. In this case, due to the fact that research is motivated by the production of benefits for the community, as a main method we selected community-based critical action research.

Selecting the research polygon

In line with the scope of research resources, available human capacity and time, we defined three main criteria for selection of research polygon: - vulnerability of assets and community of higher value for the city, simplicity in urban structure and participants/stakeholder structure, expressed motivation and interest of stakeholders to resilience issues. We have selected Ada Medjica as a case study area because it is one of the most exposed areas in Belgrade in terms of flood risks but with a relatively small coherent community willing to cooperate. Ada Medica presents an island with specific way of life manifested through the existence of 450 raft houses and 86 plots with pile dwelling houses, river transportation and the existence of the local community group "Lovers of the Sava and Danube - Ada Medica". This community was established in the early beginnings of island development and presents the oldest association in Belgrade, active for almost 53 years (Kočišević, 2016). President of the Association pointed out that island development started in 1963, in the moment when association had got plots for temporary use, as well as the permission to set up a raft houses all around the island (Kočišević, 2016). By examining the formal planning documents, this existence of the housing and this community can be barely seen. According to Master plan of Belgrade 2021 the river island was treated as a green area, while in the detailed regulation plan the territory of Ada Medjica is treated as the green forested area with pile dwellings for longer stay. Apart from that, in the plan it was pointed out that this area represents a good of general interest, which implies a special form of recreation in nature with temporary stays in pile dwellings due to the narrow zone of water sanitary protection within which the river island is located. Association is in charge of the river island, both formal and informal, with having its own Statute and Rules for the use of space on the island and the existing natural resources. Preservation and restoration of natural resources has been implemented in cooperation with the institutions in charge for natural resources. Due to the floods risk, every year after flood season, community performs complete arrangement of the island, including plots as well as the public spaces that are in charge of the association (AM, 2016). Most owners of pile dwelling houses and raft houses use their facilities from May to September, but there are also people who live on the island during a whole year, including several members of the Board of the association and president of the association.

Conceptual enactment of Smart GIS platform

Research was conducted during one semester of the Master academic course “Techniques and Tools: Urban Research through GIS” on the first year of Master program Integrated Urbanism at the Faculty of Architecture University of Belgrade. In the research process, professors, PhD students, Master students, private company and citizens took participation and had specific contribution in conducting research. It is important to emphasise that research was supported by leading GIS Company in Serbia- GdiData. Cooperation was formalised through the agreement between Faculty and GdiData Company which resulted in obtaining twenty-three educational licenses for ArcGis to be used in educational and research purposes. The goal was to conduct systematic reviews in the conceptual modelling, to analyse it from different perspective in order to create unique knowledge base for GIS platform and to achieve a common goal of improving community resilience to household risks.

In order to develop cooperative GIS platform with unique geodatabase, several methods and previous researches were necessary. PhD students were included in the process of preparing material for theoretical framework presentation in the form of several workshops. Besides that, they were involved during whole process of the academic course as well. Theoretical and Conceptual framework was based on the analysis of resilience concept, with the focus on UNISDR Handbook (UNISDR, 2012) selected as a guiding book for defining relevant data to be included in GIS platform. The aim of this research process phase was to learn how to develop criteria for polygon research. Data collection was organized through the methods of content analysis of relevant documents, field data collection and analysis, interviews and questionnaires with association “Ljubitelji Ade Medice” and local community in general. The process started with group analysis, and discussion of topics listed in UNISDR's manual, in the context of resilient cities, relevant actors, but also in the context of the Ada Medjica Island, taken as a case study .



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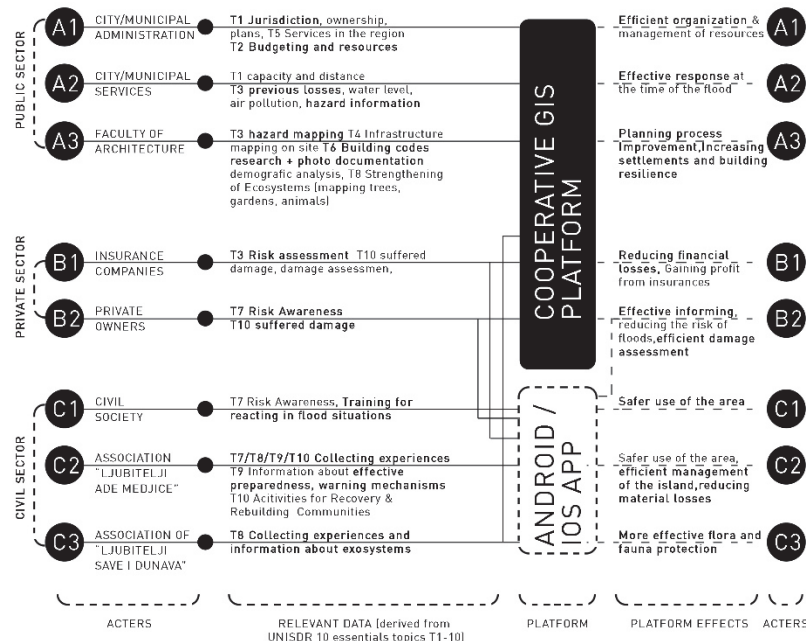


Figure 22. Cooperative GIS platform diagram

Framework for the geodatabase enactment were following topics: Institutional and administrative Framework; Financing and Resources; Multi-hazard Risk Assessment - Know your Risk; Infrastructure Protection, Upgrading and Resilience; Protect Vital Facilities: Education and Health; Building Regulations and Land Use Planning; Training, Education and Public Awareness; Environmental Protection and Strengthening of Ecosystems; Effective Preparedness, Early Warning and Response; Recovery and Rebuilding Communities. The aim of this cognitive process was to collectively identify contextually relevant topics and stakeholders that can contribute in further deeper understanding of resilience issues of the island. This process resulted in induced scheme of interrelations between stakeholders and key aspects of residence (presented with numbers between T1 and T10, Figure 1.), and in that way starting knowledge base of cooperative GIS platform was structured. the effects and benefits of cooperative GIS platform for each of them. The idea is that trough web based GIS accessible to all stakeholders and wider public communicative and collaborative process would be initiated leading to the common benefits and effects.

ADA MEDJICA CASE STUDY ANALYSIS

After the conceptual phase we proceeded to data collection though as wider as possible collaboration with all stakeholders. Benefits of this process was in finetuning of geodata base structuring on one side and on the other of deepening of resilience issues understanding. With complete geodatabase containing information about jurisdictions, users, weather, water level, data on urban structure and infrastructure, subjective opinion about risk exposure and preparedness, it is possible to conduct wide range of queries that would provide various effects for each of the actors. It gives possibility for all actors to better understand position and capacities of all. It was recognised that for local authorities, this kind of cooperative platform can contribute to efficient organization and management of resources both on a daily basis and long-term one and effective response at the time of the flood. For the public agencies and academy dealing with the territorial planning and design, it can contribute to planning process improvement toward settlement and community resilience. Effective cost management and balance of the financial losses and profits is probably most important deciding factor for insurance companies to provide insurances for property on the island. Besides risk reduction, GIS platform followed by Android and IOS app can provide effective informing for private owners and help them and insurance companies in the process of damage assessment. From the standpoint of civil society, GIS platform can provide a series of information that can save lives and property; provide safer use of the area and to secure ecosystem protection. GIS platform could become one of the main tools used by locally based civil association used for efficient management of the island. Creation of new forms of engagement in collecting, processing and sharing information about flood risks using Geo-media would have multiple indirect benefits for local communities, local government and educational institutions through the promotion of geospatial technologies, networking of stakeholders, raising awareness and motivation and dissemination of knowledge.

CONCLUSIONS

Understanding of the contemporary problems is the key for achieving better future, more stable development and for strengthening the city resilience in relation to natural disasters. This case study shows the potentials of cooperative GIS platform in process of reaching common understanding how key issues of contextual resilience could be reached. It also points the advantages and potentials of the modern technology that are still not used enough due the fact that prominent action is necessary. This kind of research contributes with its methodological construct to the development of the principles of climate sensitive design (□ukić, Vukmirović, & Stanković, 2016), including local community knowledge and initiatives in planning and governance process in the future. Therefore, modern and daily changing and progressing geospatial technologies, beside planning and design, have to be used in the process of efficient response, management and mitigation the hazards and disaster effects in a particular territory as showed in the case study.



TOPIC III:
SUSTAINABLE COMMUNITIES AND PARTICIPATION

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