Using Geodesign Studio to Explore Alternative Local Spatial Development Scenarios in Serbia

Tijana Dabović(✉), Bojana Pjanović, Bojana Ivanović, and Dejan Djordjević

Faculty of Geography, Department of Spatial Planning, University of Belgrade, Studentski trg 3/III, 11000 Belgrade, Serbia
tijana.dabovic@gef.bg.ac.rs

Abstract. Sustainable Developments Goals (SDGs) in Serbia are reduced to the pursuit of economic growth and spatial planning in local areas is reduced to a governance mechanism for attracting investment. Similarly, if existing, digital technologies in local spatial planning are mostly used as a source of digital spatial data and not as planning support systems. Planning reforms conducted in the last two decades produce secluded, largely digitized administrative activities and technical documentation elaboration driven by the narrow, mostly national government interests. These sidestep the localization of SDGs and enhance profit-oriented interventions of powerful actors in local areas. The aim of the geodesign teaching studio conducted at the University of Belgrade in 2021 was to engage students in the elaboration of the International Geodesign Collaboration (IGC) project for the Municipality of Ivanjica and use relevant digital technologies as alternative planning themes, methods and support systems. Complying to the IGC conventions, the selection of locally relevant assumptions and innovations for the future sustainable spatial development for 10 systems was made. The Steinitz's Geodesign framework and Geodesignhub were used to design six scenarios, iteratively and collaboratively. Five scenarios differed in the starting year and intensity of implemented innovations, while the sixth reflected the "planning as usual" scenario. Consequently, the scenarios had different performance against the 17 SDGs achievement matrix. By collaboratively exploring Ivanjica's alternative spatial development scenarios and their anticipated SDGs performance, students better understood the process of localizing SDGs and learned how local stakeholders can be empowered to advocate, plan and act towards a more sustainable future.

Keywords: Geodesign education · International geodesign collaboration · Localizing sustainable developments goals

1 Introduction

Aiming at sustainable development implies a social understanding and agreement on what it is, why it is needed and how sustainable development can be localized through policies, decisions and interventions in different sub-national spatio-temporal contexts. In particular, localizing Sustainable Development Goals (SDGs) implies raising awareness, advocating, implementing and monitoring the realization of the 2030 Agenda in

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sub-national communities [1]. The awareness about the importance of SDGs needs to be accompanied with the awareness of the social, political, academic and governance fragmentation and poor coordination. In such a context, local stakeholders should understand, explore, plan and implement locally specific challenges and opportunities that cross boundaries of tiers, territories, sectors, disciplines and time frames [1–4]. Localization can then relate "both to how SDGs can provide a framework for a local development policy and to how local and regional governments can support the achievement of the SDGs through action from the bottom up" [5].

In the European context, mainly since the 1990s, spatial planning has been perceived as an integrative discipline and a governance mechanism able to frame and incite different spatially relevant strategies for sustainable development in a way that is sensitive to the present and future needs of local communities and spatial conditions [6–11]. Moreover, the Charter of European Planning [6] promotes the planning profession and planners as leaders of change, scientists, designers and visionaries, political advisors and mediators, and as managers of territories. Recently, digital technologies have also been identified as crucial in enabling more transparent, inclusive, research-based decision making towards achieving SDGs [12]. With this regard, an integrated digitally enabled approach to spatial planning has been promoted by [13]. It is conceived as a people-centric process enabled by digital technologies which will generate better coordination and "engagement in the plan-making process, enhance efficiency and optimize the value of data, and it will allow stakeholders, planners, designers, and policymakers to think intelligently through an evidence-based decision-making process" [13, p. 4].

These normative standpoints indicate that the actual role of spatial planning, of planners and of digital technologies in framing the localization of SDGs varies across countries and regions in the world. Serbia belongs to the group of countries which experienced communicative self-management socialism with a decentralized and integrated approach to spatial planning (1950s – 1990s) [14] while its recent post-socialist period (2000s – 2020s) reduces the use of spatial planning and digital technologies in local areas to the investments accelerating instruments [15]. In general, planned interventions are not systematically, collaboratively or publicly considered. Investments are mostly promoted as activities of national interest and allocated to the resource extraction, infrastructure, low-tech and labour-intensive industry, tourism development, luxury housing and commerce. In turn, this kind of planning practices are beginning to experience opposition from the public demanding more transparent, locally inclusive and sensitive sustainable planning solutions. Planners in such turmoil can choose to continue doing business-as-usual or offer an alternative integrated digitally enabled approach to spatial planning.

From our perspective, the emancipation of the planning profession towards the mentioned normative roles obliges planning educators to teach planning not only as it is, but as it alternatively should and could be. We consider Geodesign within the International Geodesign Collaboration (IGC) conventions to be an appropriate pedagogical tool for such a teaching exercise. According to [16], geodesign is an interdisciplinary field with a focus on spatial thinking, geospatial technologies, the future, design as a force for good in the world, and multi-disciplinary collaboration. It has proven to be a promising pedagogical tool for exploring alternative future spatial development scenarios in the past

[17–20]. In addition, the IGC conventions aim at exploring the performance of different spatial development scenarios against the SDGs by changing not only the time-horizons of innovation adoption, but also attitudes towards current/business-as-usual planning practices. Consequently, we included the geodesign teaching studio and course in the new spatial planning curriculum as a pedagogical tool that enabled acquiring more innovative and integrative knowledge, skills and attitudes than the conventional methods used by spatial planners in the current planning practice in Serbia. The aim of this paper is to showcase this pedagogical experience and contribute to the wider consideration of Geodesign and the IGC conventions as tools for exploring the normative roles of an integrated digitally enabled approach to spatial planning [13, 21], as well as the roles of spatial planners in the process of defining the localization of SDGs.

2 The 2021 International Geodesign Collaboration Project Conventions

Geodesign is an emerging discipline usually associated with integrated land use planning, where science, system thinking and value-based spatio-temporal contexts can be interrelated. It performs as a collaborative platform for integrated spatial guidance and expression of policy areas in the study area (e. g. agriculture, infrastructure, industry, commerce and residence) crucial in meeting community's goals. Commonly, Geodesign implies that different scientific and professional place-related disciplines, IT professionals and people of the place (Fig. 1) will share their competencies in different assessment and simulated intervention processes [3, 22].

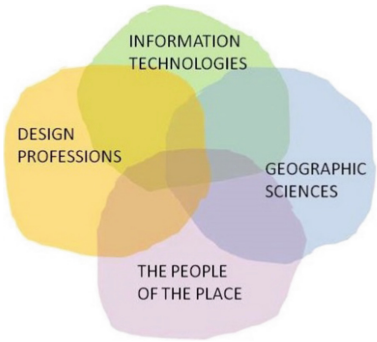

Fig. 1. The four necessary components of Geodesign. Courtesy of Carl Steinitz.

Processes are interrelated through three iterations and aim at answering six key questions: 1. How should the study area be described? 2. How does the study area function? 3. Is the current study area working well? 4. How might the study area be altered? 5. What difference might the changes cause? 6. How should the study area be changed? They enable collaborative making and exploration of alternative spatial development scenarios and understanding of their impacts before the decision on the preferable scenario is made [2, 22].

Placing geodesign in its core, in 2018 IGC was established. It is an international academic network seeking to understand how geodesign can better address design challenges in settings that are widely dispersed, differ widely in scale and in the extent of resources available to find geodesign solutions [23]. With this regard, the IGC project conventions offer a unified language and methodology for well-structured collaborative, research-based spatial development scenarios making structured in a geodesign workflow, based on [22] (Fig. 2) and supported by digital technologies and software such as Geodesignhub, GISColab and ArcGIS. As stated on the IGC website, the central aspect of effective collaboration and eventual action in the IGC project elaboration is public understanding of complex issues, which can be done without professional jargon, artistic obscurity, and scientific myopia [23].

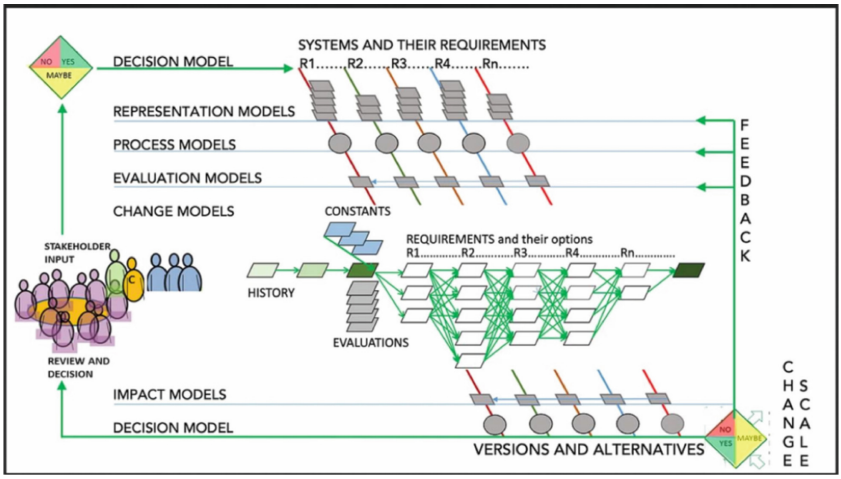

Fig. 2. Geodesign workflow. Courtesy of Carl Steinitz.

Under these conditions, the IGC project conventions intend to strike a good balance between flexible and prescribed elements to acknowledge international contextual diversity and enable comparability and co-learning from conducted projects which are presented at the IGC annual meetings. In 2021, IGC project conventions implied the following instructions to the participants [23]:

– There are eight key geodesign spatial systems plus two optional (with related color palettes). Eight land systems were pre-defined under consideration in each local study based on an examination of past Geodesign studies: 1. Water infrastructure (WAT), 2. Agriculture (AGR), 3. Green infrastructure (GRN), 4. Energy infrastructure (ENE), 5. Transport infrastructure (TRAN), 6. Industry and Commerce (INST), 7. Residential and Mixed-use Development (RES) and 8. Institutional Uses (INST). Two optional systems participants choose with the regard to the specificities of their case study.

– Global assumptions and design changes are proposed within the mentioned systems. The global assumptions and the associated specific concerns reflect current projections, forecasts, and predictions (Fig. 3). The global assumptions and system innovations were written with the awareness that individual nations and municipalities do have such goals and describe ideas that may be relevant to particular projects. Still, they will not be suitable for all projects.

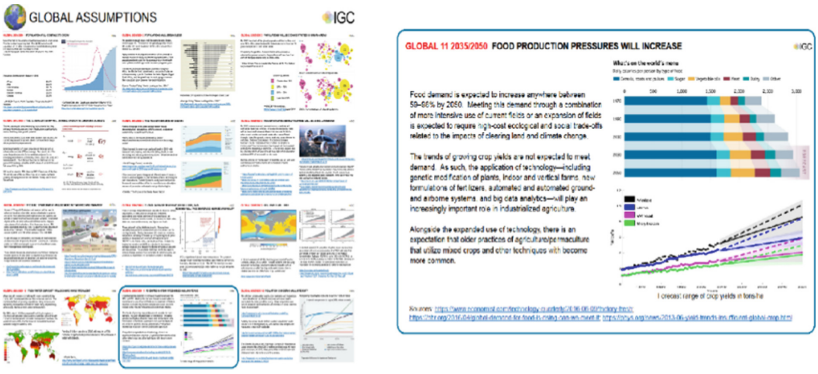

Fig. 3. Global assumptions. Source: IGC, 2021.

– All project contexts are to be defined as square spatial data "clips". With the aim to enable the direct comparison of evaluation and impact model outputs common spatial formats were established. Participants choose nested project sites at scales adhering to a square format: 0.5, 1, 2, 5, 10, 20, 40, 80, and 160 km on a side. Project goals and outcomes remain locally determined but participants are encouraged to undertake bigger-sized and nested-scales projects.
– Three design scenarios with three common time stages should be made with two future planning horizons - 2035 and 2050, and paths to achieve scenarios for those. "Early Adopters" initiate design interventions in 2020. "Late Adopters" in 2035 and "Non-adopters" continue with business-as-usual (Fig. 4).

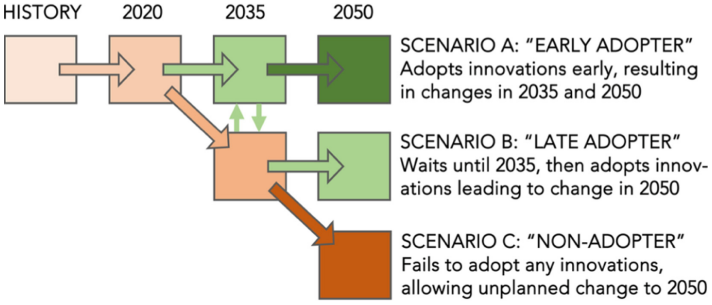

Fig. 4. IGC scenarios and time horizons. Source: IGC, 2021.

– A common impact evaluation framework based on the UN SDGs (Fig. 5), should be presented in a common format, i.e. SDGs achievement matrix (Fig. 6). IGC projects should indicate how well their design scenario outcomes would address the SDGs as a step toward addressing global sustainability truly. The assessments of performance against any SDG can be achieved by the expert judgments of the project team, or by model-based assessments [23].



Fig. 5. Seventeen SDGs, seven directly affected by biophysical design and planning (green tabs), and five indirectly affected (orange tabs). Source: IGC, 2021 based on UN SDG, 2022. (Color figure online)

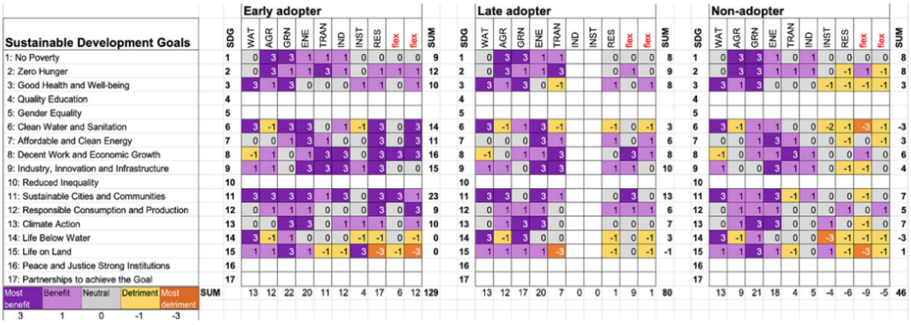

Fig. 6. SDGs achievement matrix. Source: IGC, 2021 [23].

In addition to the primary determinants of the IGC towards encouraging global thinking, one or two actual topics are highlighted every year. In 2021 the IGC projects were supposed to address projected changes in the *Human Climate Niche* and included an assessment of how each project could contribute to carbon sequestration, slowing climate change, and as a facet of that, to the *Trillion Trees* initiative – a vision embraced by the World Economic Forum, the United Nations, and numerous national governments as an important way to capture carbon.[1] Graphic conventions, colour codes, and web-based

[1] In this paper we will focus on alternative spatial development scenarios and SDGs achievement matrix and showcase contribution to the Trillion Trees Initiative in the Municipality of Ivanjica in another publication.

communication, were founded to enable coordination and collaboration. Substantial contributed technical support from Esri and Geodesignhub was secured as these are two principal digital technologies (platforms) for Geodesign to create common datasets, data protocols, and geodesign workflow [23].

3 The 2021 Geodesign Teaching Studio of the University of Belgrade, Faculty of Geography

After a significant period of teaching the core courses[2] at undergraduate, graduate and PhD studies of the Spatial Planning programme at the Faculty of Geography in Belgrade and being introduced to Geodesign workshop in 2019 it was evident that the 2020/2021 national accreditation cycle of higher education institutions should be used to introduce a more innovative and integrative pedagogies into the new programme. Since the new programme was not accredited[3] and the onsite teaching was prohibited due to the COVID – 19 pandemics, all participants of the 2021 spring semester voluntarily participated in the 70 h online Geodesign teaching studio. In total there were 22 participants - 14 students from different stages of the undergraduate and graduate studies of Spatial Planning and graduate studies of GIS, and 1 PhD student in Geosciences with three planning educators which are co-authors of this paper. The main software used were Esri ArcGIS Pro, Geodesignhub and Microsoft Teams. In the following sections, the selection process of the case study and the IGC project elaboration for the Municipality of Ivanjica will be presented.

3.1 The Municipality of Ivanjica – An Exemplary Case of Impeded Localization of the SDGs

Even after the three decades long EU integration process and transition towards the democratic capitalism, social understanding and legitimization of sustainable development goals (SDGs) and of local spatial planning as an integrative tool for SDGs localization in Serbia is still poor. Most of the system reforms are conducted as needed governance fix for accelerating long-awaited investments aimed at economic growth. Similarly, if existing, digital technologies in local spatial planning are mainly used as sources of digital spatial data and not as planning support systems.

The Municipality of Ivanjica was chosen as the case study because of three reasons. Firstly, as a large, mostly depopulated municipality with a small municipal centre and scattered rural settlements and with a significant potential for afforestation it presents an exemplary case for most of the municipalities/local tier in the Central Serbia region.

Secondly, infrastructure development is a paradigmatic form of spatial interventions in the country. This is mostly enforced by the national interest and promoted and as an overall-beneficial development and space-activation instrument. Spatial planning for

[2] Courses of: Foundations of Spatial Planning, Planning History, Planning Theory, Process of Spatial Planning, Spatial Planning of Special Purpose Areas and Land Use Planning.

[3] Both Geodesign course and studio were officially accredited by the National Accreditation Body in 2022.

special purpose areas is the government instrument which enables faster land acquisition for infrastructure development as well as other interventions of "public interest". It has been the most used type of spatial plans in the last decade in Serbia [7]. There are three types of infrastructure development planned for the territory of the Municipality of Ivanjica: a highway (north-south transversal), ski resort infrastructure development on the Golija Mountain and construction of 57 small Hydro-Power Plants (SHPPs) scattered mostly in the rural hinterland. Even though, Strategic Environmental Assessment (SEA) is an obligatory instrument of all planning documents, the assessment of infrastructure development's negative impacts are usually poorly elaborated and/or reduced to one-two particular impacts. For the three indicated types of infrastructure development in Ivanjica we found the SEA contents to follow that rule. There is the poorly elaborated noise increase and pollutant assessment by the highway and other road transport infrastructure on the Golija Mountain; while there is no obligation for conducting SEA before the SHPPs construction. In the case of ski resort infrastructure development in the Golija Mountain, conducted environment impact assessment gives only general information and recommends investors to follow the guidelines from the relevant legislation and planning documentation.

Thirdly, almost two-thirds of the municipal territory consists of the natural areas under a different protection levels designated by the national institutions. This practically means limited possibilities of the local population in deciding about the future land use and spatial development. Also, the current approach to the natural protection land regime in Serbia has been questioned by experts and public as too strict for the local population activities and very loose for the construction by investors. It also ignores the necessity of natural areas/ecosystem connectivity which is needed for building the capacity of ecosystem services. In the case of Ivanjica, mentioned ski resort infrastructure and tourism development is planned on the Golija Mountain. The planned areas for ski resort are located in the areas of the second level protection, surrounding the areas of the first level protection. This will make especially first level protection areas mutually disconnected and fragmented.

Against this background, the Municipality of Ivanjica was chosen as the case study for the IGC project.

3.2 IGC Project Elaboration: *Ivanjica - Nursery Garden of Trees and Alternatives*

The Municipality of Ivanjica (1090 km^2, 30 800 inhabitants in 2020) is a mountainous, poorly accessible and interconnected municipality located (NW point: 43° 53′ 47" latitude 19 ° 47′ 56" longitude) in the Central Serbia region and surrounded by more developed municipalities. The region covers the surface area of 55 968 km^2 - 63% of the entire surface area, and with 4 909 000 inhabitants in 2020 - 71% of total in the Republic of Serbia without Kosovo and Metohia.[4] Before entering the IGC project elaboration of the Municipality of Ivanjica in the spring semester, students had the opportunity to

[4] By the Constitution of Serbia, Kosovo and Metohia is the integral part of the national territory. Multilateral negotiations about its future status are a stop-and-go processes lasting for more than 20 years. More of the general information can be found https://en.wikipedia.org/wiki/Political_status_of_Kosovo.

reflect and consider wider context, challenges and opportunities of the Central Serbia region during three days in the autumn semester and using the Geodesignhub as a digital technology. This enhanced the understanding of the Municipality of Ivanjica's nested context and served as an input for identifying relevant assumptions and innovations. It also placed the special focus on mitigating negative effects of the planned infrastructure development in the Municipality of Ivanjica within larger 2021 IGC themes related to the Trillion Trees Initiative, CO_2 sequestration and SDGs. Also, having in mind the spatial specificities and the planning context in the Municipality of Ivanjica students identified residential rural and tourism as additional two systems to be considered in the project elaboration.

In the next step, students were offered to use the list of global assumptions, *Human Climate Niche* and *Trillion Trees Initiative* sources from the IGC website, but also existing local and national planning documents[5] and studies relevant for the Municipality of Ivanjica to identify its main challenges and opportunities [23, 25–27]. After the reading, and consulting the data from the Statistical Office of the Republic of Serbia and the Corine Land Cover Data Set the following assumptions were selected: the population will grow older and will be concentrated in urban areas, transportation will become more automated, the built environment will be more networked and smarter, global temperature will rise, climate variability will increase, freshwater scarcity will become more prevalent, food production pressures will increase and pollution concerns intensify. In addition, national tendencies relevant for the local spatial processes were identified: rural exodus, deforestation, agricultural intensification, especially in the surroundings of the local transport infrastructure, expansion of the built-up areas as urban sprawl, but also within protected natural areas, afforestation within the protected natural areas, energy instability, more frequent and intense heavy precipitation events which together with more frequent heat waves and changing terrestrial ecosystems.

For these purposes and following the Geodesign framework tables for ten systems were prepared with three main questions: How the system can be defined? How does it function? How it should be changed?

Within a given context, students identified main requirements for the future sustainable spatial development:

- Improve population's capacity for reforestation processes, SDGs, circular economy and cross-section of activities, use of digital technology, dealing with urgencies and future needs;
- Enable decentralization of institutional and infrastructure services;
- Improve water management (floods, SHPPs and waste);
- Improve ecosystem services of natural areas;
- Apply sustainable technology for energy, transport and housing;
- Orient industrial production towards the use of local resources (herbs, berries, superfood) and recycled material (e.g. use of recycled wooden artifacts instead of clear cut trees);

[5] Those were: Spatial Plan of the Municipality of Ivanjica; Strategy of sustainable development of the Municipality of Ivanjica; Spatial Plan of the Special Purpose Area Golija Natural Park; Spatial Plan of the Special Purpose Area of the Belgrade-South Adriatic highway.

- Make agriculture and tourism more eco-friendly and resilient.

Subsequently, an integrated approach to the literature and IGC sources review resulted in identified innovations:

- INST Transdisciplinary innovation centres (circular economy, reforestation etc.); Education for urgencies and future needs; Multifunctional community centre & Coalition for Sustainable Development
- WAT Water retention & Decentralized waste management
- GRN Connectivity for resilience & Rewilding Europe Initiative
- ENE Renewable energy sources
- TRAN Electric public mini buses & Transportation with energy production
- RUR Adaptable modular housing & Natural construction and materials
- RES Urban green renewal & Communication-mediated society
- IND Wood waste recycling industry; Super food & Health cosmetics
- AGR Food forest & Shared & digital urban/rural agriculture
- TOUR Eco friendly, safe and seamless tourism & All seasons digital & green mountain

While some of these had an implicit spatial expression, as in the case of *All seasons digital & green mountain* located on the Golija Mountain and *Urban green renewal* in the municipal centre, other innovations needed to be allocated having in mind municipal spatial conditions, requirements and assumptions. For these purposes, evaluation maps needed to be prepared. With this aim, mentioned tables for ten systems were revized to resemble the one presented by [11, p. 10]. As a result, each system was assigned with the evaluation table (Table 1). Tables were then used to digitalize evaluation maps using Esri data processing software.

Table 1. Evaluation tables structure for each system

How the system can be described? Description	How does it function? assumptions		How it should be changed? requirements & innovations		
Levels of intervention	Existing	Not appropriate	Capable	Suitable	Feasible
Classification					
Description					
Data					
Operators					

Apart from following the instructed IGC workflow, participants made several independent steps before entering the scenario making workshop in Geodesignhub. Firstly, participants submitted an objection against the publicly displayed plan for the SHPP construction to the Municipality of Ivanjica's local authorities. Secondly, they defined the metaphor for its sustainable spatial development. Namely, by associating the purpose

of the project elaboration with *Ivanjica* - the toponym, meaning *nursery garden of Iva*, a riverside willow, the project was entitled *Ivanjica – nursery garden of trees and alternatives*. This metaphor could inspire the change of the current reductionists' perceptions of forest benefits which result in deforestation and become a "showroom" of alternatives to current planning practices and local spatial development in the region. Also, the process of documentation review and map elaboration and interpretation enabled general spatial diversity recognition in the Municipality: agricultural area in the northeast, green northwest - southeast axes, tourism development in the northwest and southeast (Golija Mountain), industrial and institutional areas in the northern central part of the Municipality along the main transport corridor. These were important steps before entering the workshop for collaborative scenarios making.

From a more technical aspect, students needed to be trained to use Geodesignhub software. During the scenario making workshop, Green and Developers teams created their decision models, land change and innovation diagrams for each system having in mind the basic mindsets of six scenarios. Mindset behind the Early Adopter scenario(s) was: prevention i.e. there is a sense of urgency, but also political and economic uncertainty for implementing spatial innovation which will mitigate negative effects of the national spatial planning practices. Late Adopter scenario was made as a curing, more viable scenario of implementing needed spatial innovation after the implementation of the national spatial interventions i.e. when their negative and positive impacts became obvious. Non-adopter scenario reflected the mindset of the current planning approach which militated against the local sustainable spatial development. Required scenarios were made by using "pre-" scenarios instead of updating the evaluation maps. The process and its anticipated duration are presented in the Fig. 7.

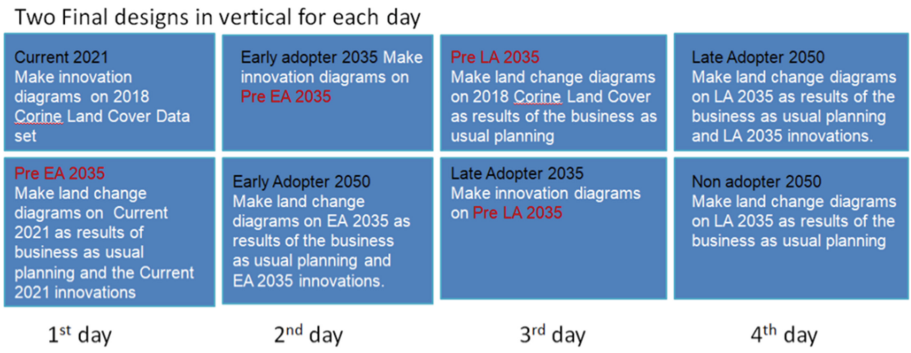

Fig. 7. Workflow and time frames for scenarios making. Source: Authors.

Once first versions of scenarios were negotiated and made, several revisions with new innovations (projects and policies) and different anticipations of resulting land use changes were drawn. For the Rural (RUR) system 33 diagrams were drawn; for Green infrastructure 51; for Water infrastructure (WAT) 33; for Energy infrastructure (ENE) 24; for Transport infrastructure (TRAN) 23; for Industry and Commerce (IND) 31, for Residential and Mixed-use Development (RES) 29; for Institutional Uses (INST) 37; for Agriculture (AGR) 38; for Tourism (TOUR) 46 diagrams were drawn. The

most interesting part of the negotiation process was the role play between Green and Developer teams. Students at some point were encouraged to take these roles to the extreme and had confidence to propose and draw diagrams which they imagined could become real interventions if the current planning practice continues to deteriorate and opposition continues to grow, e.g. skyscrapers in the municipal centre vs. hobbit-like houses in the rural areas. These diagrams however, as well as some others (e.g. erroneous or redundant), were not selected in the final scenarios (Fig. 8). Final scenarios will be described in the following section.

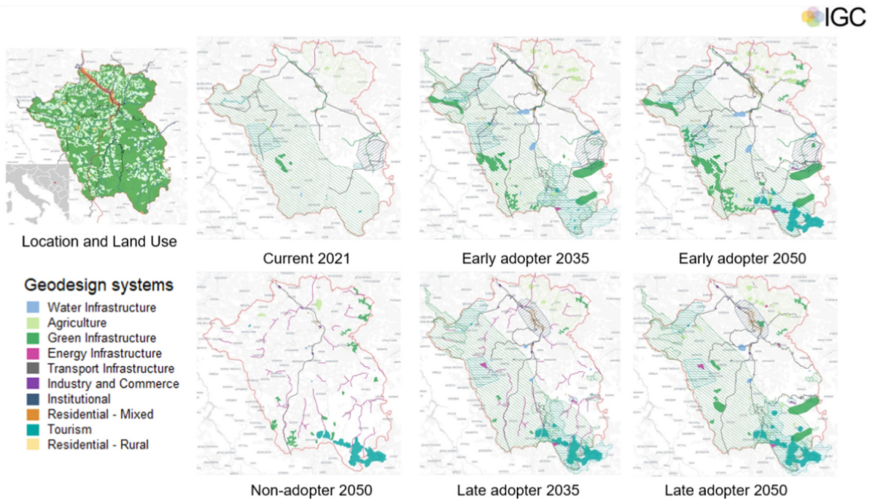

Fig. 8. Final scenarios for the Municipality of Ivanjica. Source: Authors.

Early Adopter scenarios implied complete abandonment of the SHPPs construction by adding energy production from alternative sources. Diagrams students proposed were diverse and distributed in the wider area. Policies focused on tourism, agriculture and forestry were located at the periphery. Reforestation process is a consequence of engineered actions, not natural processes which follow land abandonment. Late Adopter scenarios implied implementation of usual planning until 2035 which forces more concentrated allocation and less diverse innovations because depopulation continued. Reforestation is a consequence of engineered actions and land abandonment. Non-adopter scenario implied continued misuse of nature and local activities which intensified the depopulation. Mountain tourism center on the Golija Mountain becomes a brown-field. Most of the remaining activities are concentrated around the urban centre and the highway intersections. Reforestation is almost entirely a consequence of the land abandonment.

After making final scenarios, participants identified *All Seasons Digital Mountain Tourism*, *Shared Urban/Rural Digital Agriculture* and *Rewilding Europe* as the most significant innovations for the future local sustainable spatial development. *All Seasons Digital Mountain Tourism* implies the use of digital technology which enables tourism during a longer period of the year in accordance with the ecosystem capacities.

It enables "seamless" tourism for the calculated maximum number of the responsible visitors. *Shared Urban/Rural Digital Agriculture* implies that urban and rural actors make alliances/partnerships to share resources, benefits and risks in agricultural production. *Rewilding Europe* is the pan-European initiative with a progressive approach to conservation. The goal of this initiative is to develop and support coexistence, where wildlife comeback is beneficial for local people and socio-economic development. Therefore, it not only contributes to the implementation of the Trillion Trees initiative, but it also contributes to the sustainability of these efforts. In the next step, scenarios were evaluated in the SDGs achievement matrix (Fig. 9).

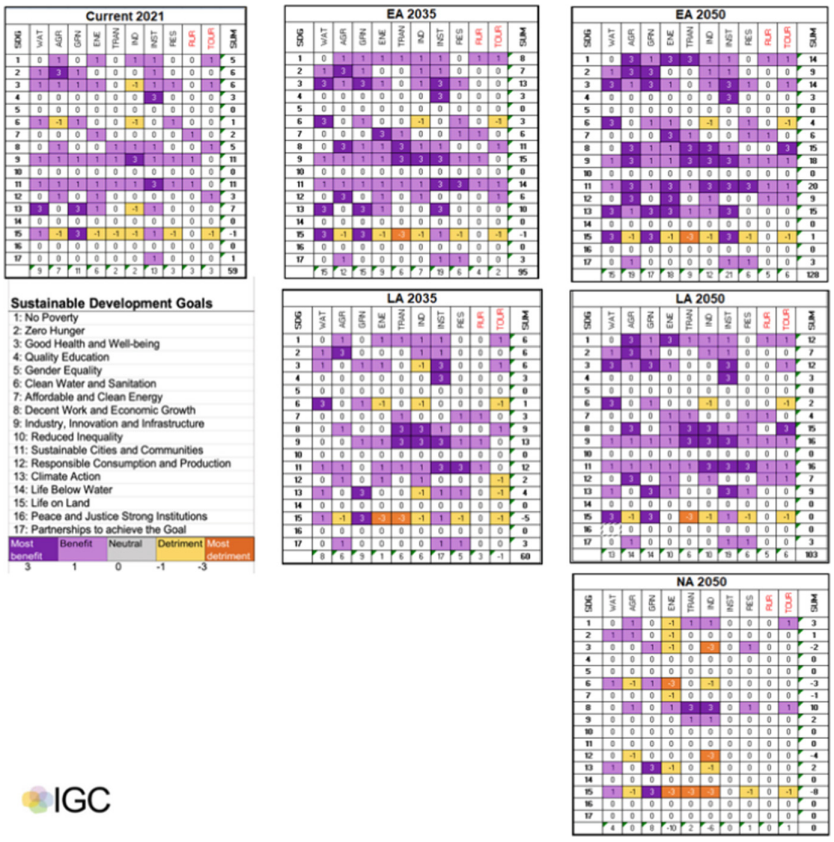

Fig. 9. SDGs achievement matrix for the Municipality of Ivanjica scenarios. Source: Authors.

The results show that Early Adopter scenarios have the best design outcomes in the context of achieving SDGs. Also, adopted innovations are often beneficial for the system to which they directly belong, but also to other systems, which contributes to the progress of all systems within the case study. Best results are achieved in goals 8 (15), 9 (18), 11 (20) and 13 (15). Worst results are in goal 15 (1). The largest contribution have AGR (19), GRN (17), ENE (18) and INST (21).

Late Adopter scenarios have a weaker performance, which is also expected, since interventions against the existing negative trends and planning practices (devastation of rivers by the SHPPs, tourism overexploitation on the Golija mountain) are undertaken after 2035. In this case, goals 9 (16),11 (16) and 8 (15) have best results. Worst results are again in goal 15 (0). The most contributing systems to SDGs are WAT (13), AGR (14), GRN (14) and INST (19).

Non-adopter scenario has the poorest SDGs performance, since innovations were not implemented. Trends continue as usual and they result with 0, which means this scenario does not contribute to SDGs implementation at all. Many goals have negative results, especially goal 15 (–8), while the best result has goal 8 (10). This showed us that the current spatial interventions in Ivanjica are focused on economic development only, and do not consider other aspects of sustainable development.

Our recommended Early Adopter scenario 2050 indicates the need for a radical shift from the current national planning practices, supported by the institutional development and focused on distribution of more diverse benefits of public investments to local population instead of enhancing economic benefits for powerful actors.

Video and Power point presentation of the project are available on the IGC website (https://www.youtube.com/watch?v=ewYmdnXktiQ&t=8s; https://www.igc-geodesign.org/_files/ugd/f24d78_7c607b79cfb04c269c13872dcb701ae4.pdf).

4 Reflections and Conclusions

Framed by the recommendations in the Charter of European Planning, the integrated digitally enabled approach to spatial planning and guided by the IGC project conventions, *Ivanjica – nursery garden of trees and alternatives* project was conducted as a geodesign teaching studio aimed at assessing the current and exploring an alternative – more integrative and innovative approach to spatial planning towards defining the localization of SDGs in Serbia. This aim was largely achieved.

Namely, participants in this pedagogical experiment accumulated knowledge acquired over several years of studies and teaching and were generally frustrated by the current centralized and profit-oriented planning practice in Serbia. They were eager to experiment with the new/alternative approach and seek ways to explore and embed already acquired knowledge and contribute to the joint endeavour using relevant skills, e.g. GIS skills or explaining impacts of ski tourism on ecosystem services or finding location for solar power plants etc. Furthermore, the studio, although conducted in a "politically safe" environment, offered a new research-based and collaborative "toolbox" for making and exploring alternative spatial scenarios and their different SDGs performances.

From the educators' perspective, the IGC conventions enabled a more intensive exposure of students to global challenges, mainly to the SDGs. By understanding how SDGs can provide a framework for a local development policy and how local governments can support the achievement of the SDGs through their actions, students can understand the importance of local spatial planning in the localization of the SDGs. It was also beneficial to engage students in a digital exploration of the ways to cross boundaries between tiers, territories, sectors, disciplines and time frames while remaining responsive to the present and future needs of local communities and local spatial conditions.

In their feedback, students emphasized the importance of collaboration and knowledge sharing, a constructive dialogue for better problem understanding and solving, clear distinction between passive and proactive approaches and a possibility to reflect on the designed scenarios (re-analyze and re-evaluate).

The main constraints identified were technical in nature and were encountered during diagram drawing and/or due to a weak online communication. They were overcome through longer and more numerous revisions and iterations during scenario making than previously anticipated. This indicates that more time should be assigned to training or adequate support to diagram drawing, as well as that proper internet connections should be secured in case digital technologies are used. From the educators' perspective, more revisions and iterations in the digital environment of Geodesignhub improved the understanding of how different local spatial innovations could be synergized and their implementation sequence more logical, so this should also be taken into account when allocating time to different stages of the process.

Finally, these reflections and conclusions will serve as an important input for the formal Geodesign teaching studio at our Department. In addition, they are already used as an important feedback for planning the Geodesign workshop aimed at enhancing the local resilience, which will be conducted in June 2022 with local stakeholders from the Municipality of Ivanjica. During the workshop we will explore the role of Geodesign in enhancing the mentioned normative approaches to spatial planning and opportunities for framing SDGs localization in the Municipality in a collaborative manner. We will also try to identify the professional and academic gaps and bottlenecks which impede these processes.

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