URBAN MENUS:
ENHANCING DECISION-MAKING IN EARLY-STAGE PROJECTS

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Abstract

The URBAN MENUS algorithm is a novel approach to support stakeholders in urban/regional development projects by providing a 3D planning view combined with a smart analysis framework. Users can choose objects (e.g. buildings to place) and walk around in the digital tool. The real-time impact analyses integrate ecological, social, and economic considerations from different perspectives, enabling impact oriented as well as participatory approaches.

This paper presents the methodology when applied to early-stage urban/regional development projects allowing users to identify potentials and visions paving the way for next steps.

The impact analyses are based on a dynamic system of several up to hundreds of quantitative and classified parameters, aligned with the EU Green Deal, UN-SDGs, Leipzig Charter, Biodiversity 2030 targets and aspects of diversity and gender. The parameters are combined and aggregated to impact indicators e.g. expressing qualities to be achieved for a planning area: Happiness, Safety, Innovation, Profitability, and Circularity.

The paper highlights some of the latest key features of the URBAN MENUS algorithm:

- **Simplify decision-making**: The algorithm “Quick Snoop Mode” uses a simplified scale of small, medium, and large to evaluate a short list of parameters, making it intuitive and easy to understand impacts and their relation to scenarios. Using meaningful weightings**,** the outputs are focused on the value of planning options for different target groups (age groups) by introducing the novel unit of “Person-Hours Benefits”.
- **Focus on the participative and educational process:** The method comes with an educational path involving several features and smart graphical representations to enable equal involvement of stakeholders.

The paper goes beyond theoretical analysis also presenting the results of pilot projects, demonstrating the effectiveness of URBAN MENUS in supporting sustainable urban/regional development. The ability to improve decision-making and enhance stakeholder participation makes it a valuable tool for urban planners, developers, investors, policymakers and the according educational sectors.

Keywords: Decision-making, urban development, urban planning, regional development, sustainability, stakeholder participation, 3D city models, community empowerment.

1 INTRODUCTION

1.1 Research Focus

This paper centers around decision-making support by impact assessment and stakeholder involvement in smart combination. The application focus are projects in their early stages—especially projects in urban and regional development (e.g., enhancing a city quarter’s living quality, improving circular metabolisms in a region). Stakeholders from different disciplines and knowledge levels come together, often with conflicting requirements. To facilitate decision-making under such circumstances, the URBAN MENUS tool and its algorithms provide meaningful impact analyses enabling joint visions for the development area involving all relevant stakeholder domains.

1.2 Insight into International R&D on the Topic

Already in the 1970s, research was being conducted on support tools for decision-making (Decision Support Tools, DSTs) (see, for example [1] and [2]). Yu coined the term "Utopia Point" ([2]) to describe the process of finding an ideal solution that meets the needs of all parties involved. By 2005, a research team from the University of Exeter had already identified over 150 Decision Support Tools (DSTs) for sustainable urban development, highlighting room for improvement particularly in the following areas:

- A higher degree of integration of all important sustainability areas and issues
- Systematic risk and uncertainty modeling
- Broader use of ranking/optimization methods
- More precise impact assessment models for interdisciplinary impact evaluation
- Expanded and better use of advanced visualization techniques
- Better support for decision-making and communication in groups
- More systematic calibration and validation of models

Only two "good solutions" for group decision-making were listed: Council and WebCouncil (covivison.com) and Citizen Science Toolbox (coastal.crc.org.au/toolbox/index.asp), both inaccessible at the time of writing the paper. [3]

Later research projects often focus on a single key (sustainability) aspect, usually in detail—for example, climate-related planning and implementation. [4] Many of these are highly scientific and expert-oriented, such as the CIL City Intelligence Lab of the Austrian Institute of Technology, which simulates aspects like microclimate, wind comfort, solar potential, and noise for different planning scenarios in a 3D environment. A commercially available, application-oriented tool is Greenpass, however, focused on ecological topics (in combination with costs): climate change, water, air, biodiversity, and energy. Participation functionalities are mostly rare as well as useful architectural representations.

One of the most recent projects on the topic of DSTs for multi-stakeholder contexts, centered around the development of a multi-criteria decision-making (MCDM) tool, comes from France: Des Hommes et Des Arbres. It is location-specific and focuses on a core theme—resilience through innovation—with particular emphasis on ecology due to the site's characteristics. [5] The project, which began in 2019, is scheduled to run until 2026. Results are pending, but it is anticipated that the outcome may not be equally applicable to different locations, and the focus on environmental topics will remain undervaluing the S and G dimension and a participative consensus finding process.

Summarizing, for ecological variant comparisons, the approaches presented are suited, but they are not ideal for joint vision **development establishing fundamental directions** for an area, with a holistic consideration of sustainability aspects (besides ecology e.g., also happiness, safety, innovation, etc.). To date, no tool has been developed that can be applied to various development contexts (urban, peripheral, private, public, etc.), impact criteria, and stakeholders while addressing all the issues raised by, among others, Kapelan (see list above). [3] The early phase, where crucial decisions are made for area development, is particularly insufficiently addressed, obviously because most find it difficult to set up methods to handle situations based on vague and scarce data, despite being fundamentally critical.

1.3 Own (Previous) R&D on the Topic

Originator of the idea—internationally active holistic architect and urban planner Laura P. Spinadel—developed the foundational innovation URBAN MENUS (urbanmenus.com) along with her teams from BUSarchitektur GmbH and BOA office for advanced randomness GmbH, in cooperation with the Austrian sustainability company akaryon GmbH.

URBAN MENUS is a web-based 3D software, aiming to support participatory and impact-oriented urban and regional planning. It is complemented by a portfolio of process management, training, and consulting services, including a Smart City platform for connecting providers of innovative products and services in this context.

To date, tool and methodology have over 15 years of development history: The idea emerged during the master planning for the new campus of the Vienna University of Economics and Business (2008-2015). A former demolition site was transformed into a university campus that combines economic, ecological, and social advantages, attracting students, professionals, and people spending their leisure time there. [6] First approaches of URBAN MENUS were already prototyped during this project.

The initial development of URBAN MENUS, particularly its creative and architectural representations, was co-funded by Austrian innovation promotion program Impulse XL by Austria Wirtschaftsservice (AWS). A Smart City platform connected to URBAN MENUS and new algorithmic approaches were researched within the two projects co-funded by the Austrian Research Agency (FFG).

Laura P. Spinadel was responsible for key aspects of parametrics, visual dynamics (rendering), and user interface design, akaryon GmbH contributed to software architecture with a focus on backend development and was involved in the impact methodology and its mathematics.

The technology and concept have been tested and refined in various contexts: Pune, India (with focus on regional development, heritage protection, tourism, urban expansion, training, support and consulting, 2021-22), Ukraine (with focus on tourism perspectives for the coastal city of Kobleve, 2021), Venice, Italy (construction pedagogy workshop at the Biennale, 2018), and Austria (including the award-winning master planning).

Early on, basic city models were relevant. They still exist in the current tool as “Urban Dreams”, which can guide impact analysis of individual visions: Five city models understood as differentiated ways of life covering a wide spectrum of urban spaces. By identifying invariants [7], each city model is shaped to some extent by ecology, urbanity, and density. The spatial fragments address topics such as mobility, renewable energy, dietary habits, education, and working conditions.

With each pilot project, URBAN MENUS grew in functionality and dynamic. Objects, groups of objects, and areas can be analyzed. Elements within the system are assigned economic, social, and ecological impact parameter for analysis purposes: Parameters are tagged—e.g. by their SDG relation or to which extent they refer the following five societally consensual life quality dimensions: Happiness, Safety, Innovation, Profitability, Circularity.

URBAN MENUS can be used for characterizing the current state, identifying development potentials through integrated analyses, and participatively developing optimal solutions based on informed decision-making, exchange, and consensus. All involved can explore own visions in comparison with those of other process participants—whether for an urban district, an expansion area, or a village square.

Figure 1. URBAN MENUS algorithm: Impact analysis of 3D-visualized scenario.

1.4 Reason for and Objective of Further Innovative Solutions

Contemporary planning and architectural projects are often spectacular but risky in terms of costs, practical politics, acceptance, and impact. Often, only individual stakeholder interests are considered at different stages of the process, some are completely overlooked, goal definitions are unclear, and conceptual definitions are equally vague, resulting in a lack of a comprehensive view. This is evident in global construction boom hotspots. Processes are frequently marked by uncertainties and delays or the need for corrections (often through lengthy follow-up processes), leading to cost increases or profit losses on multiple levels—a disadvantage in a fiercely competitive global market or for public budgets. What also complicates the situation is that new developments do not arise on a blank slate; they often need to be integrated into areas that appear pre-defined, where not only unprecedented but also particularly typical and seemingly insurmountable challenges must be managed.

On the range of sustainability aspects, URBAN MENUS always has provided solid responses, if enough data was transferred into the model. However, as we recognized during pilot projects: The highly complex URBAN MENUS algorithms were not sufficiently organized by stakeholder interests. The interpretation of output data and conclusions were too much left to the users, which proved to be quite challenging. Furthermore, analyses should also become possible with limited or rough data.

Especially in the early phase of projects, stakeholders in development projects think within their respective planning-related "system categories" (transport, energy, architectural planning, etc.). Impact logics (e.g., from sustainability certifications) have different structures—specifically concerning impact indicators (output side) and relevant parameters for their calculation (input side).

To present stakeholder-specific impact relationships that effectively aid critical thinking even at this stage, algorithms would be helpful for automatically identifying and presenting output-side weaknesses and strengths, as well as for transferring input-side stakeholder needs into the system. For example: Instead of showing “CO2 emissions above average”, the system could indicate that changes need to be made in the transport sector. Instead of users having to tell the system “Please, plant 10 more trees in the main square”, users should be able to select “public spaces with a pleasant climate”. Yet, the support provided shall not lead to user passivity, but rather involve them and actively promote participation.

Novel key features of the URBAN MENUS algorithm, centered around decision-making support, aim to address these challenges and facilitate the participation of an ever more diverse range of stakeholders—from professionals, municipal representatives, and investors to residents. Consideration of stakeholders and their motivations, simplified representation of stakeholder-related impact data and innovative ways of offering decision-relevant information integrated in more usability-oriented analysis paths are intended to facilitate the critical thinking necessary for consensus-finding. And we keep in mind, that the aim still is never to take the decision away from the user, but to make it easier for them to make it.

2 METHODOLOGY

2.1 The Elements of the Participative Decision Support-Centered Algorithms

An originally planned decision tree mechanism was ruled out due to its deterministic nature. Instead, algorithm prototypes encourage users to continually refine their data, inputs, thoughts, and knowledge about their area as well as about planning implications. Decision-making without a need to follow predetermined paths is supported. The solution builds on the following algorithmic elements:

Measurable elements: Objects (of various types), object groups, and the overall system (area) are assessable. Consideration was also given to how and which objects *need* to be grouped together and where optional combinations can be made.

Parameters: In addition to direct parameters (i.e., absolute numbers represented in quantitative units e.g. energy demand), a variant of parameters that work with scales (e.g., S/M/L) was introduced. The assessment of these parameters for each object in the project works based on classification rules, which can also be determined together with the users as part of the participatory process. Efforts were also made to tag parameters in relation to stakeholder domains (e.g., transportation, energy, architectural planning) and facilitate the start of analyses and system navigation.

A particular innovation in the integration of qualitative parameters was developed: Objects can be linked with functional properties, such as the maximum or optimal number of people per function type, using the basic functions of existence, a concept from social geography that allows for the analysis of how the characteristics of a living environment align with fundamental human needs and how this alignment is perceived on an individual level [8].

Indicators and calculation: Finally, the algorithm determines output indicators (e.g. Resilience or Happiness, Degree of Innovation, etc.) using the parameters (assigned to indicators) and weighting Person-Hours Benefits in combination with the impact parameters. The concrete formula for indicator calculation depends on the mathematical model to depict the relation of the parameters to the indicators chosen. The impact of objects with high levels of user benefits counts more for the total impact indicator values in order to reach joint scores that allow comparing different versions of the future.

Based on these principles, with suitable parameters and indicators (formulas), new topics can be easily incorporated into the algorithm.

A stakeholder and case analysis were conducted to align the system logic with industry requirements, including interviews covering a range of urban and spatial planning challenges. Also, certification and impact assessment systems relevant for different stakeholders were analyzed to suggest the most meaningful short lists of parameters and indicators to involve in the algorithm:

- Criteria catalogues and certification systems in the field of green building & planning
  - Certification by the Austrian Sustainable Building Council (ÖGNI)
  - Certification by the German Sustainable Building Council (DGNB)
  - klimaaktiv building standard
  - Green Building (by ÖGNB) or LEED (Leadership in Energy and Environmental Design)
  - BREEAM (Building Research Establishment Environmental Assessment Methodology)
  - WELL certification for healthy living and working environments
- Goal-oriented systems (Sustainable Development Goals SDGs, Biodiversity 2030 Targets)
- Action-field-oriented systems such as the Green Deal Areas
- Aspects of Environmental, Social, Governance (ESG) and ESG reporting
- Systems specialized in cross-cutting themes such as criteria catalogs on gender & diversity

3 RESULTS

3.1 Innovation for Participation

3.1.1 Participation in the Definition and Weighting of Parameters

Users can participate in defining the parameters and their weighting—or rely on default values (or only start with defaults and get into refining in recurring loops). This allows users to voice their preferences while learning about their area and refining their desires. Collaboratively shaping object characteristics by meaningful impact parameters and Person-Hours Benefits fosters structured, impact-driven thinking, leading to more informed decision-making.

3.1.2 Features for Change of Perspective

Features for digital participation facilitate the collection of input from all stakeholders. In the 3D-visualized environment, stakeholders can navigate through implementation scenarios and discuss and select the best future for all in an interactive process. Each user can toggle 3D elements on and off for perspective shifts. The changes of the resulting impacts are displayed accordingly and made visible to the other process participants. Comparing results helps in understanding various perspectives.

3.1.3 Game Mechanisms

Dynamic modes help users make decisions with a tool that manages to awaken the child in everyone who experiences it.

3.1.3.1 Start Mode

The Start Mode initiates the analysis process with a target value questionnaire to define a base combination of objects in a scenario. Built on 44 questions, stakeholder preferences are surveyed.

Examples

Question 17: What is more important when choosing a place to live?
Proximity to emergency services | *Local farmers' markets*

Question 42: What type of urban green spaces do you prefer?
Protected natural habitats | *Well-maintained parks with exotic plants*

The questions are invisibly linked to their relevance for the five topics Safety, Happiness, Profitability, Circularity, and Innovation. The answers create an individual profile reflecting the weight these five topics hold for the user.

Evaluations can be conducted individually or in groups, with particular relevance given to topics with the greatest deviations in target values. Using subjective target values, comparisons reveal how selected scenarios perform and identify areas with significant deviations, facilitating quick identification of high discussion needs. Evaluations may also consider stakeholder group assignments or other qualitative participatory evaluation approaches.

The game mechanism involves transitioning between scenarios, which adjust automatically based on responses—blending seriousness with a playful Serious Gaming approach.

Advantages of the start mode:

- Capturing user opinions and preferences: Subjective questionnaires allow for the collection of opinions, preferences, and needs related to various urban topics (e.g., quality of urban services, quality of life in specific neighborhoods, traffic situations, availability of recreational facilities).
- Information for decision-making: The results of subjective questionnaires can serve as a source of information for city planners and decision-makers, helping them make informed decisions that align with the needs and desires of the population.
- Creating problem awareness: The diversity of questions draws attention to various areas, interactively making users aware of the range of challenges that need to be considered

3.1.3.2 Hint Mode

The Hint Mode provides suggestions, also referring to sustainability-related weaknesses. It has multiple input options for enabling/disabling objects. It displays the imbalance and the scenario indicator with the lowest performance value. The simulation continuously runs as there is always a lowest value.

Example evaluation result: "You have an imbalance in green_area."

The Hint Mode specifically shows which 3 options are available to improve the indicator. Technically, the user interface highlights the 3 objects that perform best for the respective indicator, for example, those with the greenest space. The Hint Mode can be toggled on and off.

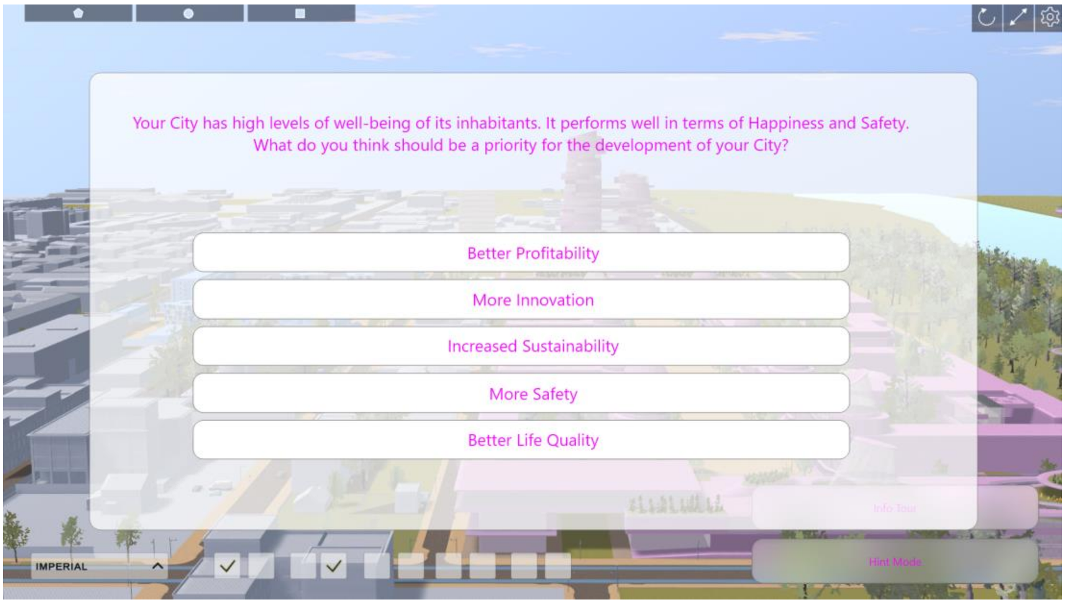

Figure 2. Establishing a dialogue with users through graphical overlays.

Advantages of the Hint Mode:

- Fostering creativity and idea generation: By inspiring and encouraging reflection, Hint Mode helps stakeholders develop new perspectives and innovative ideas.
- Enhancing decision-making competence: Transferring expert knowledge helps stakeholders make more informed decisions, improving the quality and sustainability of their choices.
- Improving analytical abilities: Through "guided thinking," Hint Mode strengthens stakeholders' analytical skills, leading to a better understanding and evaluation of complex interrelations.
- The mode emphasizes active learning and involvement in decision-making.

3.1.4 Qualitative Participatory Evaluation Approach for Faster SWOT Analysis

In a group setting, during or after creating their scenario, users can indicate details on living situation and usage preferences by answering (mostly) multiple choice questions.

Essential preliminary information:

0. Living situation

Age | Gender | Household (number of people; partner, younger generation, older generation) | Life stage (in education, employed, neither [e.g., on leave, unemployed, at home, retired])

Follow-up questions:

1. **Subjective quality of stay** based on the concept of basic functions of existence [8]:

   Would you like to live | work | study/attend training *(original function OF: "self-education")* | shop *(OF "self-supply")* | spend leisure time *(OF "recreation")* | drive your vehicle here? *(Not directly covered are the functions of "participating in traffic," "communication," "community living," and "waste disposal" according to Partzsch.)*

2. **Mobility question**: How would you prefer to move around this area?

   By foot | bicycle/e-bike | scooter/motorcycle | own car | public transport (bus, tram, subway)

3. **Subjective quality of living for specific life stages** (only for living)

   Would you like to live here in old age | live here with children | live here as a child?

4. **Questions on the comfort level**

   - **Temperature**: Do you think the area always has a pleasant climate | it is too hot here in summer/noon | it is too cold here in winter/evening | it is too windy or drafty here?
   - **Lighting conditions:** Do you find the area pleasantly lit | too bright | too dark?
   - **Crowd levels:** Do you find the area too crowded | too empty?
   - **Quality throughout the day:** Does the area seem like a pleasant place in the morning | during the day | in the evening | at night?

3.2 Support for Decision-Making

3.2.1 Quick Snoop Mode & Evaluation Results Displayed in Scales

The Quick Snoop Mode enables a fast start with URBAN MENUS. It builds on a short list of 20 parameters—four representative parameters for each of the five URBAN MENUS indicators Happiness, Safety, Innovation, Profitability, and Circularity, correlating to the final output indicators: “Key to Consensus”, “Degree of Resilience” and “Chances of Success”. They are assessed using an S/M/L scale guided by easy questions. Users can calibrate the questions and the definitions of S, M, and L.

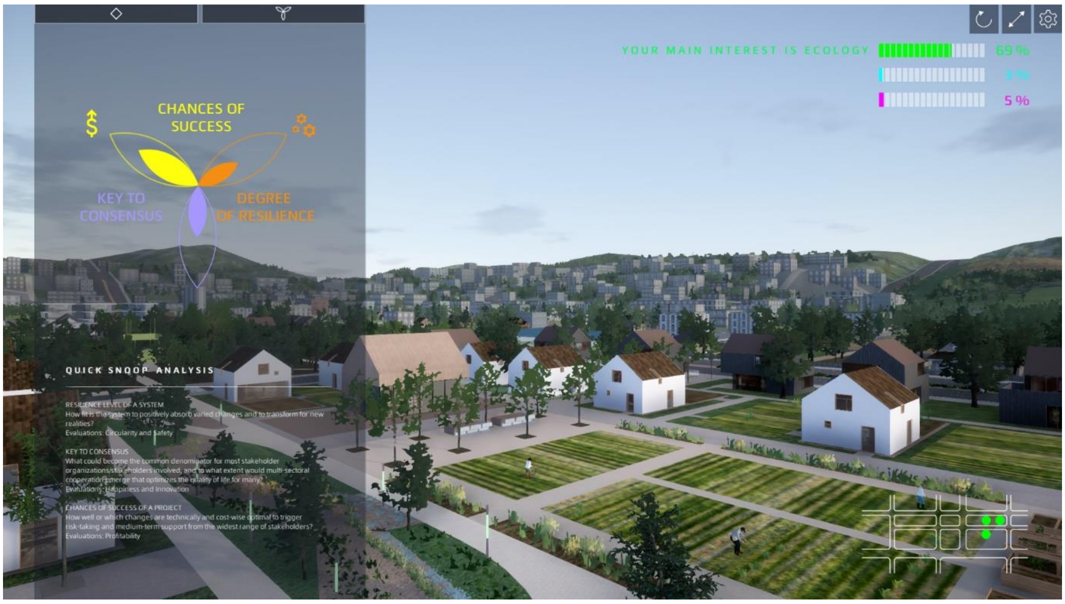

Figure 3. Quick Snoop Mode—results view considering chances of success, consensus and resilience.

Example parameter "CO2 emissions/climate impact" for the circularity indicator:
What are the annual CO_2 emissions per resident?

- *S: Low fossil energy usage, minimal losses*
- *M: Standard technologies/energy mix*
- *L: High proportion of fossil energy usage or inefficient technologies*

Advantages of the Quick Snoop Mode:

- Quick start: Users can quickly achieve initial results. The fact that this is also possible with minimal prior knowledge is made easier by brief explanations of each parameter for example.
- Clarity: With a focus on a few key parameters, the assessment prevents information overload.
- Simplicity of evaluation: Using the categories small, medium, and large simplifies parametrization and makes the method and also its outcomes intuitive and easy to understand.
- Multi-criteria analysis: The S/M/L scale is universal for all parameter types, allowing the combination of parameters that would have different units if considered in a quantitative way.

3.2.2 Person-Hours Benefits as Unit of Measurement for Weighting of Planning Options

Beside the weighting functionality, Person-Hours Benefits are also direct decision-support indicators.

The logic builds on:

- **Five age groups**, each of which utilizes objects with different existential functions at significantly different levels of intensity: Toddler (0-3 years old) **|** Child (4-12) **|** Adolescent (13-18) **|** Adult (19-64) **|** Senior (65+)
- **Time spent on existential functions according to age** (data from e.g., OECD: Our World in Data): Living/sleeping **|** Work **|** Education **|** Recreation **|** (Commercial) services **|** Health **|** Mobility **|** Communication
- **Primary function per object** (e.g., school—education, residential building—living/sleeping)
- **Operating hours per day and operating days per year**

Advantages of Person-Hours Benefits:

- Before starting the algorithms, each object in the system needs to be assigned which part of the population (age groups) can perform which function for how many hours a year in or by this object. To reduce efforts for the individual data set generation, default numbers have been set up for typical objects (e.g. school, residential building etc.).
- Using Person-Hours Benefits for weighting impacts ensures proper consideration of the relevance of multiple parameters various objects relative to each another.
- Participation: Here too, users can shape the parameters. They gain a better understanding of their target scenario by reflecting on the characteristics of both existing and target objects.
- Users are presented with the most important questions: How many people benefit? Which target groups? Which functions of our area can and do we want to further develop?

3.2.3 New Indicators with Percentage Evaluation

Building on the five key areas of Safety, Happiness, Profitability, Circularity, and Innovation, the following indicators have been developed:

- Resilience = Circularity and Safety, weighted by Person-Hours Benefits
- Consensus = Happiness and Innovation, weighted by Person-Hours Benefits
- Economic success = Profitability, weighted by cost factor (and at the end referenced by Person-Hours Benefits as another cost-benefit-approach)

The indicators are expressed as percentages from the theoretical maximum, which could be achieved if all parameters were set to L in the best-case scenario.

Advantages of these indicators:

- Comparability: Using percentages for the indicators of resilience and consensus allows for comparisons aiming at the maximum benefit of functionalities and target groups to be selected. Urban planners can quickly identify areas that require priorities or improvements.

- Clarity: Percentages concisely summarize data, making it easy to understand and communicate complex information.
- Goal setting and monitoring: Percentage-based targets can be established to track progress towards urban development goals. By monitoring and updating the percentage values, urban planners can evaluate the success of their strategies and make adjustments when necessary.
- Consensus building: Percentages can help build consensus and gain stakeholder support by providing clear goals and progress indicators that are easy for all participants to understand.
- Efficiency: By focusing on percentages and identifying areas with the greatest need for action or highest potential for change, urban planners can allocate resources more efficiently.

3.2.4 *Object Labels and Reports*

Labels have been developed that display information about the object being evaluated—helpful for decision-making depending on the development project's phase, target group, or context.

Figure 5. Object labels.

Reports enable users to compare development visions and understand their impacts and implications through detailed analyses from different perspectives. They can be downloaded directly from the tool.

Figure 6. Report including graphical representations of scenario comparison.

4 CONCLUSIONS

The concepts developed and insights gained offer significant potential for decision-making that is both simple and profound. They support a step-by-step approach, applying the right level of detail as needed. They have the potential to enhance mutual understanding, produce more accurate impact forecasts, and guide actions toward building resilient systems—essential in times of changing demands and crisis. URBAN MENUS Decision Support is geared toward multisectoral, proactive, and agile urban and regional development. Competence development can be seamlessly integrated into the participative process to effectively identify an optimal future vision.

The innovation supports urban and regional planners, developers and investors, think tanks, decision-makers at all levels, research and education institutions, as well as citizens in general with this particular civic education of the habitat itself. Example use cases include: Conflict resolution for neighborhood deficiencies, occupancy and vacancy management, addressing land allocation in transportation issues, infill development, designing expansion areas, resilience development.

Stakeholders receive:

- Clear identification of areas for improvement, tailored to their perspectives
- Intelligent evaluation and transparent presentation of development alternatives
- Agility in adapting to stakeholders' multi-criteria catalogues—changing or complementing them
- Balanced dialogue on "Urban Dreams" with all relevant groups
- Targeted multimedia communication materials
- Support in forming alliances by evaluating the added value of different options

There are already follow-up projects: We further develop educative aspects (e.g. involving e-learning, VR/AR technologies and data competence), within the Erasmus+ programme of the European Union ("URBAN MENUS educational – Dialogue with a Resilient Future"; trainingresilience.eu). On the research side, we are working on a circularity extension of URBAN MENUS and application projects in China (co-funded by the Austrian Research Promotion Agency FFG, projekte.ffg.at/projekt/5121684).

REFERENCES

[1] M. Zeleny, "Compromise Programming," in *Multiple Criteria Decision Making* (J. Cochrane and M. Zeleny eds.), pp. 262-301, Columbia: University of South Carolina Press 1973.

[2] P. L. Yu, A Class of Solutions for Group Decision Problems, in Management Science, 19, pp. 936–946, 1973.

[3] Z. Kapelan et al., *CoDeS Scoping Study - WP2 Literature Review: Decision Support Tools for Sustainable Urban Development,* No. 2005/01, Exeter: University of Exeter, 2005.

[4] S. Zhong et al., "A novel decision support tool for climate-responsive urban design," in *Journal of Physics: Conference Series*, 1343, 012011, 2019. doi: 10.1088/1742-6596/1343/1/012011

[5] M. Enjolras, F. Kasmi, L. Morel, L. Dupont, "Toward a systemic decision-making tool of territorial resilience based on multicriteria methodologies: The case of the DHDA Project," 2021 IEEE, pp.1-11, Cardiff, United Kingdom: Jun 2021. doi: 10.1109/ICE/ITMC52061.2021.9570118

[6] BOA, "BOAnet URBAN MENUS 2018," 2018. Retrieved from: youtube.com/watch?v=h_MKrJ0TIic

[7] A. M. Martín Castillejos, "Invariantes arquitectónicas. Notas sobre una antropología del hábitat [en línea]," in *Ángulo Recto,* vol. 6, no. 2, pp. 191-196, 2014. ISSN: 1989-4015.

[8] D. Partzsch, „Daseinsgrundfunktionen, I. Die Raumansprüche der Funktionsgesellschaft," in *Handwörterbuch der Raumforschung + Raumordnung. Band I* (D. Partzsch ed.), pp. 424-430, Hannover: 1970.