Scenario Planning and Participatory GIS for Place Research on Rural Transformation

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Several transformations are taking place in rural areas, emphasizing the significance of comprehending the people's perceptions of place. This paper outlines a methodical strategy that integrates participatory GIS and scenario planning workshops to investigate transformations and potential impacts in rural areas. The methodology comprises an open-ended, inductive knowledge process utilized in two workshops. Workshop 1 involves the development and aggregation of driving factors into potential scenarios, whereas Workshop 2 includes the mapping and weighting of scenarios based on the probability of occurrence and strength of impact on the rural area. Although the outcomes are rooted in a relational comprehension of human–environmental factors, a theoretical framework of location-based information is required for further research to entirely understand the mechanisms supporting the emergence of transformative rural areas.

1   Introduction

Crises, such as global warming, can destroy livelihoods, displace people, exacerbate conflicts, and even trigger wars. In the Western world, our growth-driven society is exacerbating socioeconomic crises, such as unemployment and rural exodus, and demographic changes, such as declining birth rates and aging population (Fina et al., 2019; Schröder and Feldhaus, 2010). In addition, some rural areas are undergoing overlapping changes that challenge sustainable spatial planning. To identify these changes, it is critical to understand how people perceive their environment and spatially differentiate their actions (Wardenga, 2002).

The use of scenario analysis is a common and flexible method for predicting possible future developments. Several studies used scenario analysis for strategic spatial planning in business landscapes, natural resources management, agricultural land use, and hazard mitigation (Couture et al., 2021; Pasqualino et al., 2021; Raji et al., 2022). While there are various potential uses for scenario analysis, the integration of people and their environments through the use of geoinformatics is relatively rare. Approaches include the ones presented by Schaffert (2011, 2015) and Haslauer et al. (2012), which incorporate local participation. However, scenario analysis still works with limited space concepts and emphasizes structural factors, while personal experience and perceptions from different stakeholder groups remain a secondary factor. To fully understand a place, it is necessary to comprehend its meaning, which is to some extent embedded in daily personal experiences. Structural factors are related to these experiences, which influence the meaning of place as a perceived phenomenon.

In this paper, an adapted workflow for scenario analysis is presented, which uses an open inductive and participatory approach. The combination of individual, group-level, and structural patterns not only enables us to make contributions to transformative places regarding spatial development, but also to comprehend these spaces with regards to their future potential impacts.

2 Methodological Approach

To analyse future transformations in rural places, we propose a systematic approach that combines participatory GIS and scenario analysis. Scenario analysis is a predominantly qualitative set of methods for the structured and systematic generation of conceivable future situations known as scenarios. In this regard, we expand the techniques that integrate scenario workshops with GIS (Schaffert, 2015) to include participatory mapping. To incorporate the human–environment concept, we use two workshops (each of two hours' duration) that include a multi-step process consisting of a preparation phase, a workshop phase, and a synthesis phase. The process begins with the problem identification and visualization, which includes defining indicators and conducting GIS analysis of future population changes. Next, stakeholders are selected, and on-site workshops are scheduled with institutional stakeholders. The initial knowledge is adapted and condensed into multiple scenarios in an open inductive approach. The goal of the subsequent scenario workshop is to map and weight the main scenarios based on expert and citizen knowledge in an anonymous approach by using an online mapping tool (Figure 1).
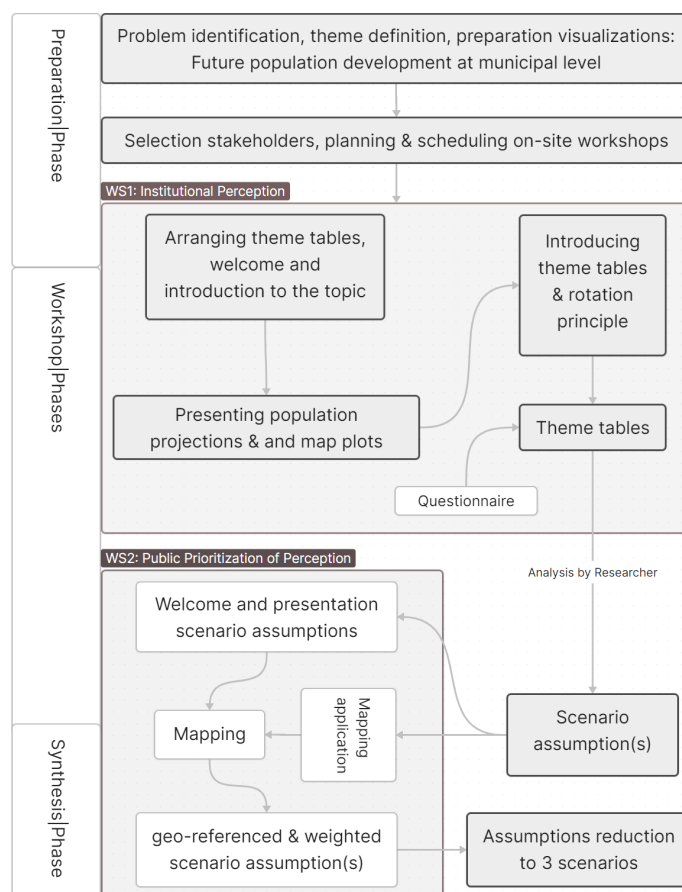

Figure 1: Implementation concept of the presented approach with three successive phases. The preparation phase includes the creation of visualizations and the selection of stakeholders. Then, in the first workshop, participants discuss at topic tables (see Figure 2 for details) to identify current and future scenario drivers. Between workshops, the results are condensed into scenarios, which are presented in the second workshop, where the citizens can map, rank and weight the scenarios (see Figure 3 for details).
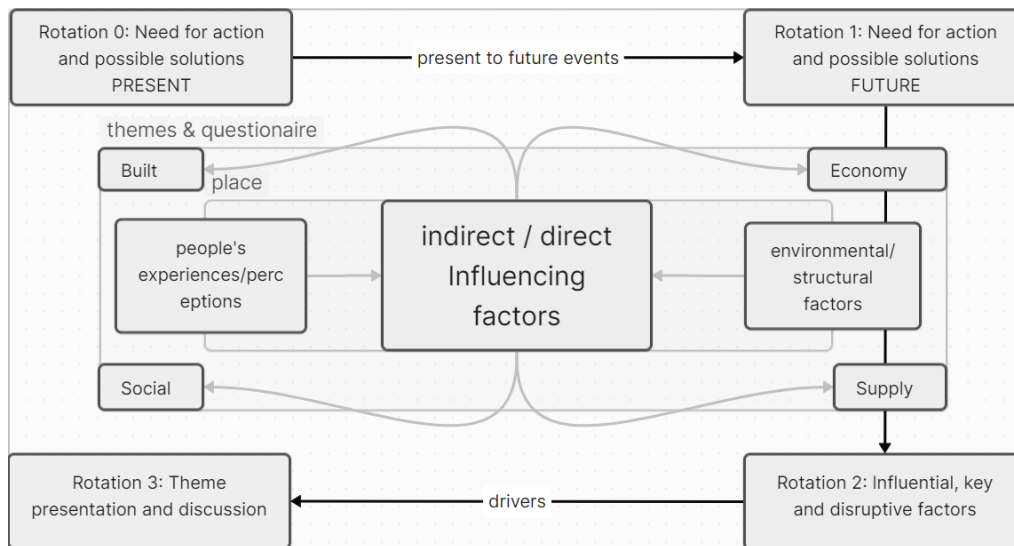
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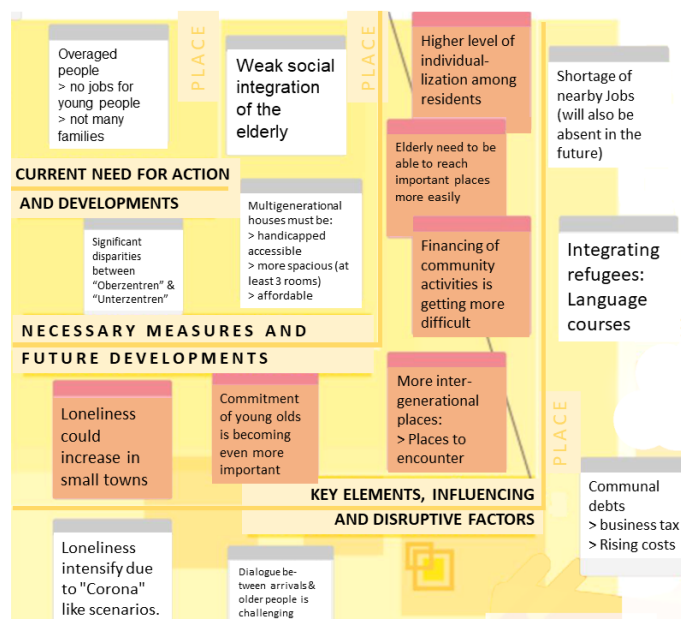
(b)

Figure 2: Theme tables and 10 minutes rotation principle and whiteboard. (a) Participants spread out and rotate to a different table every 10 minutes. In Rotation 0 (R0) they discuss current needs for action and developments, in R1 they discuss necessary measures and future developments and in R2 they discuss relevant influencing factors, key elements, disruptive factors, and possible solutions in relation to their respective topics. (b) An assistant conducts interviews to capture spatial perceptions and records them on a whiteboard as shown in the example for social themes.

2.1 Preparation Phase

The preparation phase involves selecting and assigning stakeholders to expert groups, creating future population development maps, and organizing the workshop. The selection of stakeholders is crucial for understanding the relationship between humans and the environment, as they play a distinctive role as social actors. The socio-spatial interpretation patterns of the stakeholders and their perceptions are influenced by their social position, which is shaped by norms, rules, and resources. To combine different points of view in the synthesis phase while taking into account situational overview, asymmetric knowledge, and social position, it is important to involve different social actors as stakeholder groups in the workshops. In the first workshop, regional political and spatial planning stakeholders will be invited, while the stakeholder groups will be complemented by the general public in the second workshop.

Official statistics can be used to illustrate the current demographic status of the study region and its potential development, and maps showing short, medium, and long-term changes in population characteristics can help to predict future population shifts. The maps are to be presented during the first workshop as an informative foundation for all participants about their region, and to stimulate discussions about current and future impacts on infrastructure needs and public services.

2.2 Workshop Phase

Workshop 1: Institutional Perception. The open-inductive approach aims to engage participants by providing practical experiences and facilitating comprehensive and detailed discussions with the goal of increasing participation. Hence, the initial workshop is divided into two sections: a thematic introduction and a subsequent interactive part. Following an introductory round, the methodology and its applications in spatial planning will be presented by a moderator. Future population maps will be employed to illustrate demographic changes in the region. Next, theme tables will be presented, both in terms of content and as part of the interactive session that follows.

Participants are invited to join one of the theme tables to discuss multiple transformations that are actually and potentially occurring in their rural places, and rotate to another table after 10 minutes. Each table represents one of the four themes based on transformative research studies conducted in rural areas (e.g., Moore et al., 2018; Skinner et al., 2021): built environment, economy, supply, mobility, and social (networks). The 'built' table focusses on factors such as the structural conditions of residential areas, while the 'supply' table deals with the assessment of infrastructure in terms of availability and accessibility. Factors such as mobility options, provision of basic services, health facilities, and barriers are important in this context. The 'social' table includes factors such as loneliness, well-being, social relationships, integration, and health as well as the importance of the places where these factors may occur. The 'economy' table takes into account average income, (un)employment rates, the costs of education, housing, public services, and the financial situation of the municipality. After 10 minutes, the groups rotate from one table (e.g., the 'social' one) to another thematic table (e.g., the 'supply' one) to discuss needs for action and future developments. Then, the participants move on to discuss relevant influencing, key, and disruptive factors (Figure 2b). After a short break, each scientific assistant briefly summarizes the responses of the group and presents them to the audience for discussion, allowing the summaries to be supplemented with additional information.

During the discussion sessions, researchers ask questions related to the topic areas (Table 1) while participants discuss both direct and indirect factors. When conducting spatial planning scenario analyses, direct factors such as ownership structure are often analysed separately from indirect factors such as economic development. Nevertheless, when it comes to a relational understanding of a location, such factors must be open to discussion based on the work or daily experiences of the participants. Furthermore, the scientific staff provides indirect factors such as environmental impacts, climate change, migration, economic crises, and legal situation as a basis for discussion. The participants write their findings on post-it notes during each discussion session, which are then pinned to a whiteboard. The concept of these rotations is shown in Figure 2a.

Scenario Assumptions. Before the second workshop, the researchers combine their initial empirical findings to create different scenarios. Analysing data to identify overlaps and interactions between thematic areas is crucial. Combining the current high unemployment rates (economy theme), lack of generational exchange (social), and vacant housing (built), along with a negative future perspective on demographics (key factors), resulted in the scenario named 'Exodus of Young Generation'. Therefore,

Table 1: Questions asked at respective tables. Examples for the theme 'supply'.

Rotation	Questions
0	Do the population forecasts reflect your current expectations?
	How do you evaluate the mobility services and accessibility of everyday facilities (shopping, health services etc.)?
1	What do you think are the main challenges or opportunities for supply and mobility that the municipality might face in the next few years?
	How might demographic changes affect mobility and care in your community?
2	What external factors and trends (political, economic, or environmental) do you see coming to the region and how will they affect mobility and services?
	What would be unlikely, but path-breaking events?

the researchers developed different scenarios based on their empirical findings. During the second scenario workshop, the researchers presented the synergies to the participants, who then used a guiding questionnaire and an online mapping application to prioritize and map them according to their significance. The output was geo-referenced and weighted scenario assumptions.

Workshop 2: Public Prioritization of Perceptions. During the first workshop, institutional participants discuss future developments in an open environment, while in the second workshop, public participants use an online mapping application to ensure anonymity. The aim is to avoid the risk of institutional bias in evaluating future trends due to asymmetric resources, experiences, and social positions of the institutional experts. Participants can access the online application using a QR code that can be scanned on their mobile phones. A scientific assistant provides the QR code. Furthermore, the application is displayed on a screen visible to all attendees. The participants mark points on the OpenStreetMap base map to indicate locations where they see the presented possible scenarios. The pop-up feature permits users to map a scenario to a point (Question 1), identify whether the scenario is related to a current event, a future event, or both (Question 2), rate the level of uncertainty on a scale from 0 to 4 (0 for low, 4 for high; Question 3), and rate the strength of impact on a scale from 0 to 4 (0 for low, 4 for high; Question 4). Finally, participants can provide contextual comments on the transformative site. They are also encouraged to evaluate scenario quality with respect to thematic accuracy or propose a new and different scenario (Figure 3). In the background, a median is calculated for each question, and the sum of uncertainty and impact strength is calculated for each scenario. Each participant has 30 minutes to assign points and scores for each scenario and question. The results are displayed in graphical form below the map in the web client.

3 Synthesis Phase, Conclusion, and Limitations

This workflow allows the utilization of scenario planning as an empirical method to scale the perceptions and future prospects of distinct social groups. Our intention was to make a methodological adjustment that incorporates a notion of place while shifting from spaces seen as positional relationships between material objects to an understanding of spaces as perceived sites of interaction and activity. A vital aspect of this was acknowledging that the social actor and their social group share distinct experiences, objectives, rules, and norms, which entail diverse socio-spatial practices.

Scenario planning is a valuable method for building conceivable future scenarios of places, thereby incorporating personal experience alongside structural factors. We integrate participatory geoinformatics to reduce complex future predictions to a manageable number of possible outcomes. In addition, the use of a participatory web client allows the scenario places to be geo-referenced and made visible for further spatial actions, while ensuring anonymity to include different perspectives on social space in the later analyses. Furthermore, the synthesis workshop provides context for the relationship between direct and indirect drivers in a given place, while the artificial classification of indirect and direct factors is replaced by the prioritization process of already condensed scenarios that are presented in Workshop 2. Moreover, scenarios can be retrieved and mapped, providing a crucial
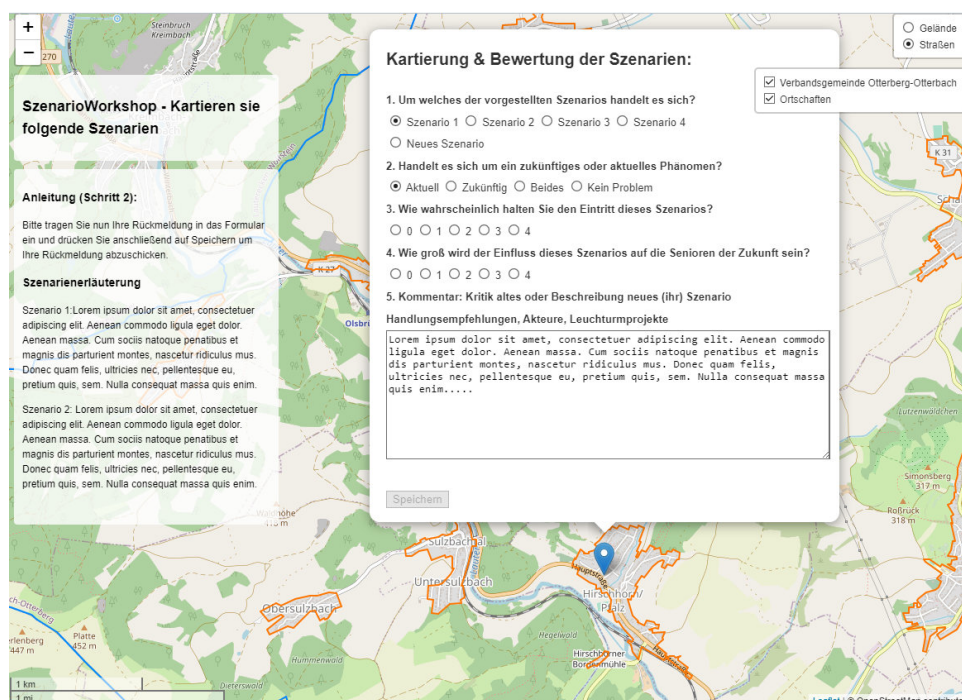
Figure 3: Mapping application. The application is built using Leaflet.js and is connected to a PostGIS database. In Workshop 2, participants evaluate and assign weights to the scenarios identified in Workshop 1. An information window provides descriptions for each scenario. In addition, participants have the opportunity to view the locations where other participants have set points.

understanding of place as a category of sensory perception that individuals use to perceive and classify their environment. Several rural areas are currently undergoing multiple transformations, and a scenario workshop following a multi-stage survey procedure can aid in identifying these changes by utilizing various place perspectives.

However, a theoretical foundation is necessary to fully comprehend place, as even the most sophisticated method is inadequate by itself. The presented workflow enables the integration of the concept of human–environment perception. Nonetheless, the method remains at a descriptive level due to the lack of a thorough elaboration on a comprehensive ontological stance regarding place-based information (Wagner et al., 2020). Moreover, to deconstruct places, it is essential to consider their social, technical, cultural, and powerful (re)production in daily activities (Wardenga, 2002).

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