COMMENTARY

Innovative Geographic Visualization for Improved Understanding and Effective Public Participation in Environmental Policy Making and Implementation.

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Public participation refers to involvement in knowledge production and / or decision-making of those involved in, affected by, knowledgeable of, or having relevant expertise or experience on the issue at stake (VabAsselt and RijkensKlomp, 2002). Public participation involves an element of control over decisions, through the decision making process. It is sometimes assumed that conflicts over public policies and science are caused by citizen ignorance – a gap between citizen and expert knowledge, also known as a ‘‘knowledge deficit” (Stoutenborough and Vedlitz, 2014). And providing more detailed information to citizens about science and policy should increase citizen knowledge, which in turn will make citizens to think in line with natural scientists, economists and policy experts (Rhodes et al., 2014). The major challenges faced in building awareness and bringing in local participation to the policy making process are

1. The predominantly global nature of the issue and the information is not relevant for local users or communities.
2. The available scientific data is too complex for a common man to understand.
3. The available information is of a biophysical nature, little of which is converging on socioeconomic and other livelihood scenarios.
4. The very few effective structured processes for public participation in the policy making.
5. Nonexistence of infrastructure and capacity to visualize the scientific data into more understandable 2D and 3D output.

With the alarming threats from climate change and other extreme events, the major portion of the Asia-Pacific region is facing a challenge of escalating exposure and vulnerability to changing climate and other related hazards (Velasquez et al., 2012). Developing countries, particularly are chronically vulnerable and at risk to climatic hazards

due to the high agglomeration of population, non-conducive economic activities and improper development encroaching onto hazard-prone areas (Mendelsohnand Dinar, 1999; Adger et al., 2003). Although the policymakers understand the immense importance of public participation, it is not always practiced and if practiced, it has minimum public influence over the policies made. Policies that ignore the input of those affected will often have ineffective outcomes, poor implementation and can even result in the violation of human rights. Participation also increases the level of awareness around an issue, stimulates public debate and enhances knowledge.

Engagement of non-academic stakeholders does not simply mean transferring information, but needs to occur through an interactive, participatory process to create ownership, accountability, and a willingness to act. Progress towards public participation in policy making seems to be more likely if information is localized, visualized, and co-constructed which can be achieved by Geovisualization.

Geovisualization Tools

The ability of visual images to communicate messages quickly and powerfully has long been recognized and utilized as an instrument for data exploration and analysis. Among the various forms of visualization, geovisualization have some unique characteristics which could bring a consensus of the public in decision making. Landscape Visualization (Geovisualization) attempts to represent actual places and on-the-ground conditions in three-dimensional (3D) perspective views, with varying degrees of realism (Sheppardand Salter, 2004). There are many emerging technologies that need to be evaluated as to their suitability in assisting decision support and participation where geographical information is vital.

There exists exciting possibilities for utilizing the new visualization techniques to facilitate community participation through (a) Informing: creating interactive web sites to educate the public; (b) Consulting: generating feedback mechanisms at crucial stages in the design and development process in the policy making; (c) Involving: exploring alternative scenarios and comparing the outcomes of different scenarios and (d) Empowering: influencing final policies through ‘citizen juries’ and online ballots through visualization outcomes (Pettit et al., 2006).

In the context of public participation in the decision making process, the potential benefits of geovisualization include:

1. The future predictive capabilities of GIS with realistic representation in the 2D and 3D form can provide ‘windows into the future’ for the public.
2. The ability to depict recognizable and familiar sites will help in localizing the information for better understanding of the future changes.
3. As per the audience’s visualization needs, the data can be highlighted or simplified to provide different levels of realism.
4. The alternative solution can be tested alongside with the proposed solution.
5. Attractiveness due to novelty, dynamism and interactivity of the medium.

Anappreciable amount of research has been carried out to evaluate the impact of visualization in public participation and there is already considerable evidence for effectiveness of communications and usability of visualization in planning and decision support, including the ability to engage common people (Appletonand Lovett, 2003; Sheppard and Meitner, 2005; MacEachren, 2001; Lewis and Sheppard, 2006). Realistic, immersive, and/or interactive systems have demonstrated high levels of engagement with users (Winn, 1997).

Sheppard et al. have described the importance and effectiveness of visualization in achieving community engagement in the framework for climate change policy making (Sheppard et al., 2011). The Local Climate Change Visioning Project (LCCVP) was conducted by British Columbia University to understand the outcomes of localizing climate change scenarios, in the context of community participation in planning and decision-making. The aim of the project was to integrate the available global, regional, and local scale climate data with geographic information science and existing local climate change studies to visualize potential climate change impacts to the communities and stakeholders. The products of this visioning project were tested with the stakeholders and the results shows the effectiveness of geovisualization technology to increase engagement, build awareness of complex environmental issues related to local climate change, and foster participant’s support for climate change policy. Despite the complexities, including high technical capacities, high set up cost and addressing multiple considerations, the visualization tools can bridge the gap between complex scientific modelling outputs and local level realities on the ground to engage the community in decision making process.

The future of geovisualization in public participation

The influence of visual media of global problems, including climate change, natural disaster, terrorism, poverty and others, affects the respondents emotionally in local scale rather than global scale. Based on many observational research on audience response during visualization workshop, it was clear that the extensive use of realistic visualizations maintained a high level of engagement among the public participants. There is a better prospect for mobilizing stakeholders and include common people's interest and concern, if the impact of the effect of the policies can be demonstrated 'on the ground', in familiar locations and upon landmarks and businesses. Linking global science to locally significant places with visualization, serves as a powerful tool for decision-making (Burch et al., 2009). Visualization tools are potentially too powerful and can bring the impacts of policies to home, to people in their back yard and making it personal through realistic views of their familiar landscape under possible future scenarios (Sheppard, 2006). This would ensure effective and well-informed stakeholder participation in the development of new policies and decisions.

Visualization solution in Indian context

The importance of 2D and 3D visualization is well recognized by the Government of India for mainstreaming public participation in the decision making process. As a result, the National Mission for Sustaining the Himalayan Ecosystem (NMSHE), a programme is being coordinated by the Department of Science and Technology (DST) wherein six Task Forces have been identified and are being implemented by six national research institutes. The task force on "Micro flora and fauna, Wildlife and Animal Population" is being implemented at the Wildlife Institute of India under the project entitled "Assessment and Monitoring of Climate Change Effects on Wildlife Species and Ecosystems for Developing Adaptation and Mitigation Strategies in the Indian Himalayan Region". One of the objectives of this project is to set up visualization lab to simulate various climate change scenarios and to visualize potential effects on fauna and their habitats in the Indian Himalayan Region. The aim of this center will be to educate the stakeholders and to communicate to the public through 2D and 3D visualization outputs to influence the policy and decision making. This will have a huge implication on natural resources management policy making by bringing in the participation of multiple stakeholders and effective implementation of conservation actions in the current and future context.

Under NMSHE, the Wildlife Institute of India is in the process of establishing a Landscape Ecology and Visualization Laboratory (LEVL) to host the database system, which will include both spatial and field data, for the purpose of implementing decision support system. In addition to being pionner in nature, this facility will have state-of-the-art technology in hardware and software, where researchers can use visualization and interactive displays to apply field studies, geospatial analysis, and simulation modelling in a synthetic approach to solve environmental problem at large spatial scales. The LEVL will serve as a research hub to support the tasks of understanding landscape level changes, analyzing and making decisions based on the larger dataset. The laboratories visualization capability will enable the research community to engage with the public and the policy makers within an immersive visualization environment to review and design of adaptive management policies, explore scenarios, and conduct "What If ?" analysis.

In order to meet the visualization needs, an advanced scientific visualization environment will be created, ranging from desktop visualization through to large-scale immersive 3D visualization. The technological centerpiece of the LEVL will be the Presentation Studio with a seating capacity up to 20 users with the screen that can display large-scale, high-resolution, simulation models using immersive 3D stereoscopic visualization technology. Once established the lab will support the world-class research being conducted at the Wildlife Institute of India by specializing in the use of Remote Sensing, GIS and related advanced information system technologies for environmental assessment, management and planning. The proposed solution involving visualization tools and scenarios will mark beginning of new era wherein the benefit of evidence based environment management will transcend multiple stakeholders through the simplified communication mechanism this tool offers.

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