

UPSS, a multi-level framework for improved resilient regional planning

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Resilient regional planning is a critical aspect for a sustainable development at national and subnational scales, which requires not only the planning of actions, but also the planning of its implementation. In the case of multi-level political-administrative systems, as most of OECD countries are, decentralization has been fostered in order to promote adaptation capacity at local scale, and in consequence strategic plans at national scale are usually implemented at subnational level. In the case of multi-level infrastructure systems, therefore, implementation plans should simultaneously preserve decentralization for the promotion of adaptation capacity at local scale (bottom-up planning), and at the same time, pursue the achievement of global objectives and the reduction of structural vulnerabilities and imbalances between regions (top-down planning). Though several authors have pointed out the need of balancing bottom-up flexibility with top-down hierarchical control for a better plan's implementation, very few methods have yet been developed with this aim, least of all with a multi-objective perspective. Our work addresses this lack through UPSS (Urban Planning Support System), a resilient planning process in which both actions and its implementation are planned for a controlled sustainable development of a national road network. UPSS's planning module generates plans of actions over the road infrastructure network aiming to contribute the mitigation of urban vulnerability, the improvement of the road network condition, and the minimization of the economic cost, and affords the selection of the most suitable planning alternative. Then, UPSS' implementation module formalizes local adaptation capacity as the right for varying at local scale (provinces) the selected planning alternative within certain limits, and global risk control as the duties that should be in exchange achieved to avoid deviations at top scale (national). Finally, multi-objective optimization reveals the trade-offs between local adaptation capacity, global risk, and rights and duties at local scale, providing deeper understanding for a better informed decision-making. With this information, the decision-maker can select an implementation plan where a set of rules are defined for each province for the adaptation of the masterplan to their specificities. These rules define the range of variation allowed for each province in the quantity of each of the actions (Preservation, Maintenance, Reinforcement and Construction) planned at top scale, and the range of performance that should be achieved in the adapted plan. This way, local entities (provinces) are allowed to explore different combinations in the quantity of possible actions for building their adapted plan provided they meet the performance requirements specified in the implementation plan for each and every objective (mitigation of urban vulnerability, improvement of road network condition, minimization of cost).

Keywords

Regional Planning; Adaptation capacity, Hierarchical relational modeling, Decentralized road network