Indicator-based method to evaluate community resilience

The capacity of a community to react and resist to an emergency is strictly related to the proper functioning of its own infrastructure systems. A better understanding of critical infrastructure architecture is necessary for defining measures to achieve a better resilience against threats (natural and human threats) in an integrated manner. For this purpose, indicators are perceived as important instruments to measure the resilience of infrastructure systems. Many research activities have been focusing on developing reliable indicators that could be applied at different scales, but research on resilience, which is a multidimensional and transformative concept, is still in the early stages of development. Developing a comprehensive, standardized set of resilience indicators is obviously difficult for such a dynamic, constantly re-shaping and context-dependent concept,

Previous studies have highlighted the importance of conceptual frameworks to guide the selection of the indicators, so following the same trend this paper describes the procedure for selecting the proper indicators for community resilience within the PEOPLES framework (Cimellaro et. al 2009). PEOPLES is a holistic framework for defining and measuring disaster resilience of communities at various scales. It is divided into seven dimensions, and each dimension is further divided into several components. An integrated approach is presented that combines both quantitative and qualitative as well as outcome and process indicators, addressing a broad variety of issues such as the security, the geo-politics, the sociology, economy, etc. The methodology classifies the indicators' location within the seven PEOPLES dimensions and provides a structure for creating a condensed list of indicators. Each indicator is linked to a measure allowing it to be quantified. The measures are expressed by serviceability functions rather than scalar values in order to allow a dynamic measurement of the indicators. Finally, the proposed indicators are weighted and then aggregated into a single serviceability function that describes the functionality of the community in time.

The developed methodology has been tested on the critical infrastructures of San Francisco, USA, in order to assess their level of resiliency. Results of the case study show that the methodology introduced to compute the resiliency allows decision makers to derive key-indicators of community resilience that are applicable on a higher level of societal resilience, across different contexts and hazard types (attacks, accidents, etc.). The present work contributes to this growing area of research as it provides a universal tool to quantitatively assess the resilience of communities at multiple scales.