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Temporal Query Processing for Supporting Sustainable-Innovation-Policy Systems

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Abstract: We propose an innovative method for temporal analysis of scenarios at the basis of policy making for sustainable innovation. This process requires to quantitatively evaluate the impact of possible low-carbon policies on the society and, hence, copying with a multi-disciplinary domain. To this aim, scenarios representing possible future states of the world under plausible conditions and different assumptions are defined and evaluated under various perspectives, such as: energy, environment, economy and societal system. Such scenarios usually integrate projections produced by independent tools (e.g., TIMES, GAINS and the Social Accounting Matrix) on single perspectives; therefore there is a need for new analysis techniques to cope with the complexity of synthesizing possible behaviours of the whole system from a significant number of variables of different nature. We propose a framework to enable execution of temporal queries over a repository of integrated scenarios. As far as we know, this type of analysis is new in this multi-disciplinary sector. Temporal scenario queries aim at detecting specified behaviour(s) for the system over time and, hence, at verifying that temporal properties hold. An example of temporal query involving environmental and economical variables is: "*Select those scenarios such that if gdp increases some time in the future without that CO₂ price has increased, then follows a time period where CO₂ emissions increase*". A preliminary set of queries inspired by temporal formulas from the Linear Temporal Logic were defined by field experts and used in a preliminary experimentation to demonstrate the applicability and the scalability of the approach.

Keywords: temporal analysis, integrated scenario, sustainable innovation, policy making