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The true value—and actually, the real beauty—of research lies in its ability to build on previous and ongoing efforts to advance the body of knowledge in domains of interest. To this end, and realizing the growing number of natural hazards, the area of sustainable disaster recovery has been attracting many valuable research efforts. Among multiple and diverse scholarly techniques that have been used in this fertile area, the discussers highlight agent-based modeling (ABM) as well as genetic algorithms (GAs) because of their technical proximity, which allows mutual integration and advancement on the methodological side, and thus the advancement of sustainable disaster recovery. On one hand, ABM has been used to capture the behaviors and interactions of the participating entities in the emergency and recovery phases (Crooks and Wise 2013; Leon et al. 2015; Koch et al. 2020; Miles et al. 2019; Moradi 2020; Nejat and Damnjanovic 2012), and to evaluate the resiliency of the infrastructure systems to shocks and perturbations (Miles and Chang 2011; Grinberger et al. 2015; León and March 2016; Esmalian et al. 2019; Koch et al. 2020; Nasrazadani and Mahsuli 2020). However, the validation of ABM is cumbersome and requires real-life experimentation and/or development of multiple real-case scenarios. On the other hand, GAs have been used in numerous disaster recovery and community resilience research for both housing and infrastructure systems (Asadabadi and Miller-Hooks 2017; Hu et al. 2014; Karamlou and Bocchini 2014; Najafi et al. 2018; Ouyang and Wang 2015; Sharma et al. 2019; Xu et al. 2019; Zhang et al. 2018, 2020, 2017; Zhang and Miller-Hooks 2015; Zhao et al. 2020). Even though GAs are able to search a vast solution space and determine near-optimal solutions, they fail to capture the needs and preferences of the various stakeholders. Thus, despite the mathematical soundness of GAs, they do not always meet the needs of the associated communities. As such, ABM and GAs could complement each other and this discussion is a vivid proof.

In the original paper, the authors integrated an existing social vulnerability assessment model [i.e., the Social Vulnerability Index (SoVI)] into the objective function of a GA’s optimization framework to identify the impacts of integrating underlying communities’ vulnerability and socioeconomic factors in prioritizing postdisaster recovery strategies. As such, and as detailed in their well-developed and well-written paper, the developed framework was applied to a case study of postdisaster modular construction recovery efforts in Louisiana. To this end, in the “Previous Relevant Studies” section of their paper and in order to identify a knowledge gap to be used as a point of departure for their well-commended efforts, the authors stated: “Eid and El-Adaway (2017a) integrated social vulnerability into stakeholder’s objective functions during the postdisaster recovery process. They utilized agent-based modeling to optimize the required budget for disaster recovery as well as residents’ insurance plan choices. Their paper utilized a well-established model for considering the social vulnerabilities of the impacted communities. However, it did not address the postdisaster projects’ prioritization problem or its effects on communities’ social vulnerability.” This statement is incorrect.

Eid and El-adaway (2017a) stated: “The objective of this research was to develop a decision-making framework for disaster recovery to better guide the redevelopment processes toward increasing the communities’ welfare. This paper uses a bottom-up approach that captures the needs of the impacted residents and integrates a social vulnerability assessment tool for the host communities. This study will help identify the recovery strategies that balance the short-term redevelopment objectives and the long-term goal in social vulnerability reduction.” To this effect, Eid and El-adaway (2017a) integrated the very same social vulnerability assessment (i.e., SoVI) into ABM framework to prioritize different disaster recovery projects (i.e., homeowner assistance, elevation grant, and public home assistance) and their associated budgetary funding in three heavily devastated coastal counties in Mississippi. Accordingly, and as was shown in Figs. 5–19 in their paper, Eid and El-adaway (2017a) presented an ABM that successfully provided better social vulnerability at the census tract level as well as an optimized budgetary distribution among the different recovery strategies in comparison with the actually implemented conditions. Consequently, and while noting the utilization of GAs compared to ABM and the associated methodological differences, this has still resulted in similarities between the recently published paper and that of Eid and El-adaway (2017a) in terms of goal, general methodology, and contribution.

The extreme professionalism through which the authors have carried out their work provided an excellent opportunity to validate...
and support the general approach of Eid and El-adaway (2017a) through utilizing the powerful space-search abilities of GAs—compared to ABM, which captures the evolving decisions of the different stakeholders over time—for studying the socioeconomic benefits of their postdisaster modular project. This effort is very much appreciated and provides an addition to the body of knowledge.

Accordingly, the discussers would grasp the opportunity to share with the authors some other related efforts that could feed forward and backward to their valuable research. More specifically, Eid and El-adaway (2017b) combined the Economic Vulnerability Index (EconVI) with the objective functions associated with disaster recovery efforts in impacted communities, and Eid and El-adaway (2017c) integrated the Environmental Vulnerability Index (EVI) into disaster recovery strategies including construction of new wastewater treatment plants in the affected areas. While Eid and El-adaway (2017a, b, c) shared the same general technique in the same area, though each studied separately one component of the triple bottom line, this resulted in explicit differences in the statistical analyses for each component as well as the associated adjustments to the learning algorithms governing the agents in the respective models. Consequently, the value of this independent analytic approach is that it showed what the allocation of resources would be like for a community that emphasizes just one of the social, economic, and environmental vulnerability indicators. Ultimately, Eid and El-adaway (2018) created a more comprehensive ABM framework that simultaneously incorporated all three indicators. In doing so, many important adjustments had to be made to the ABM model itself and various new steps—including, for example, sensitivity analyses—were added. This resulted in a Pareto optimal set of strategies that prioritized and optimized budget distribution for postdisaster recovery efforts and/or projects while increasing recovery rates and decreasing the social, economic, and environmental vulnerabilities. Thus, the integrated approach presented what the distribution of resources would be like for a community that would like to concurrently study the triple bottom line—associated vulnerabilities. To this effect, perhaps a similar effort by the esteemed authors using GAs could result in some eye-opening observations.

Through this discussion, the discussers aimed to applaud the esteemed authors for their research that helped support and validate the general framework of Eid and El-adaway (2017a), hence crystallizing the true complementary nature of research. To this end, the technical proximity between ABM and GAs provides an excellent opportunity to compare results for cross-validation both at the independent and integrated analysis of the triple-bottom-line components. Thus, the principles of both models as well as prior related research efforts (just some of which were highlighted in the first paragraph) could be merged into a broader framework that fills the gap in all previous efforts so as to achieve more powerful analytical processes that result in more effective and efficient sustainable disaster recovery efforts.

References


