Smart management of emergencies in the agricultural, forestry, and animal production domain: tackling evolving risks in the climate change era

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The agricultural, forestry, and animal production domain (AFA domain) plays an essential role in meeting global needs and supporting livelihoods while facing escalating challenges from climate change-induced impacts and extreme natural events. This perspective advocates for urgent strategies to enhance resilience through effective emergency management and prevention measures tailored to this critical domain. Through a conceptual model that integrates both restoration and prevention measures, this analysis evaluates three Italian case studies across the AFA domain (the 2023 rainstorms in Emilia-Romagna, the 2018 Vaia storm, and the 2017 wildfires). Each case study, described by location, timing, nature, and consequences, critically evaluates the implemented risk prevention measures, details the emergency and recovery actions, and highlights shortcomings in response efforts. The analysis, incorporating a retrospective comparative component based on the proposed conceptual model, highlights the importance of identifying lessons learned and potential future applications. It emphasizes the urgent need for a well-structured emergency management strategy that integrates risk mapping and advanced technology to ensure timely and effective responses. The active engagement of domain professionals (agronomists, foresters, animal production doctors) and scholars of AFA domain sciences, as either farm owners or technical advisors, is crucial to optimize intervention strategies. This engagement is especially important for enhancing resilience during recovery phases, aligning with the best international practices such as making use of local knowledge and citizen engagement strategies. A key innovation presented is the *Emergency Causes X Domain of Interest* matrix, which delineates the roles and responsibilities of various professionals within the AFA domain. This framework promotes a systematic understanding of interdependencies and supports coordinated responses to emergencies, enhancing overall resilience. Furthermore, applying lessons learned from other domains where emergency management systems are operational provides valuable insights for planning and implementation in the AFA context. Collaboration among professionals, academia, public institutions, and stakeholders is emphasized as essential for addressing these challenges comprehensively. Raising awareness about the distinction between *Civil Protection* and *Production Protection* and fostering their close interconnection are strategic measures for enhancing resilience, particularly in rural and forestry

areas. The study also advocates for capacity building through innovative training initiatives such as micro-credentials, e-learning platforms, and generative AI tools for learning assistance. These approaches aim to increase the knowledge, skills, and competencies of professionals, creating new profiles and specializations tailored to the evolving needs of the domain. Additionally, focused research efforts are crucial for developing new insights and strategies to address the unique challenges of the AFA sector effectively. Ultimately, the findings emphasize the need for a paradigm shift toward an integrated approach that values collaboration, local knowledge, and interdisciplinary synergies. This evolution does not imply a return to traditional practices but rather the adoption of modern, coordinated frameworks that align with international best practices. By integrating these strategies, the AFA domain can better withstand the impacts of climate change and extreme events, safeguarding livelihoods and supporting global needs while fostering a more resilient and sustainable future.

Reference.

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