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THE ENVIRONMENT-VULNERABILITY-DECISION-TECHNOLOGY FRAMEWORK: A PROCESS FOR DEVELOPING MULTI-DISCIPLINARY DECISION SUPPORT SYSTEMS FOR SUSTAINABLE DEVELOPMENT APPLICATIONS

Abstract

The Environment-Vulnerability-Decision-Technology (EVDT) Framework is a process for developing multi-disciplinary, interactive decision support systems (DSS) for a variety of sustainable development applications. This framework seeks to support the use of Earth Observation and socioeconomic data in a format usable by non-experts, while harnessing cloud computing, machine learning, economic analysis, complex systems modeling, and systems engineering. It is characterized by five basic elements: (1) the use of systems architecture stakeholder analysis to identify needs and understand the context; (2) collaborative development of the DSS that continues stakeholder engagement past the initial systems architecting; (3) a concept of the sustainable development application as a complex socio-enviro-technical system, typically involving the Environment, Human Vulnerability and Societal Impact, Human Behavior and Decision-Making, and Technology Design; (4) an interactive decision-support system; and (5) A consideration towards modularity and re-use of DSS components in future applications.

In particular, the EVDT Framework draws from the fields of systems architecture (and other systems engineering techniques), GIS, collaborative planning, and remote observation, each of which have complementary aspects that can be brought to bear on development challenges, particularly those of relatively small spatial scales (municipalities to metropolitan regions) that tend to be underserved by major international development programs. Over the past few years, the EVDT Framework has been used to develop DSSs for mangrove conservation in Brazil, flood resilience in Indonesia, invasive plant species management in Benin, cranberry bog renovation and wetland restoration in Massachusetts, and COVID-19 response in six major metropolitan areas around the world. These projects involved both space and non-space stakeholders including the IPP (Rio de Janeiro's municipal data agency), GGPEN (the Angolan space agency), MICITEC (Chile's science ministry), the Universitas Diponegoro of Indonesia, and the Yurok tribe of modern day California, among others. Through these applications and collaborations, the EVDT framework has developed from a conceptual framing to a concrete process that is shown to be repeatable across geographic contexts.

This paper presents the details of the framework, including (1) a discussion of the motivation for the creation of this framework, including its benefits, limitations, and methodological underpinnings; (2) a step-by-step guide for applying the framework applications, including a discussion of different potential

use-cases; (3) examples of applications (such as those mentioned previously), including lessons learned from each; and (4) areas of ongoing improvement, including improved modularity and re-use.