

Evolution of societal value on water for economic development and environmental sustainability in Australia during 1843-2011

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The stress on freshwater resources around the world cast by the human activities now as well as in future requires a radical paradigm shift in approaches to water resources management. Changes in values are seen as leading to changes in decisions and thus to changes in behaviour. However, societal value has not been addressed adequately in current water management studies.

This paper aims to understand the evolution of societal value on water resources for economic development and environmental sustainability in Australia. The Sydney Morning Herald was used as the data sources to track the changes of societal values on water resource between 1843 and 2011. Specifically, this paper will address the following three research questions:

- 1) How did the societal value on water for economic development verse environmental sustainability in Australia evolve over timescale of 169 years?
- 2) What was the transition pattern of the societal value?
- 3) In what context such transition occurs, and what factors possibly trigger such transition?

Three methods were used in this study include: 1) describing evolution of the societal value on water for economic development and environmental sustainability in Australia with the content analysis of newspaper; 2) determining the pattern of evolution of the societal value with both regression analysis and transition theory; 3) understanding the pattern of evolution of the societal value with co-evolutionary framework.

Overall, the importance of economic development has been declining with the arising attention given to environment. The vision for environmental sustainability were kept at a minimal level at the beginning, and stayed as a relatively low voice in the society until it took off at around 1960s and overweigh the voice of economic development in the last decade. The fitted sigmoid curve for societal value on economic development and societal value on environmental sustainability were regressed. According to the derivatives of these two equations, three stages were identified. The predevelopment stage of societal value on environmental sustainability when changes occurred only marginally was identified as the period during 1843-1961. The take-off stage was considered between 1962-1980. The take-off point was when the rate of change speed is maximized. The acceleration stage was identified during 1981-2011. It is a period of the absolute value of societal value is still increasing, the acceleration rate is negative and the rate of change is decreasing. Around 2000 a new process of the acceleration rate increase started. The stabilization stage did not appear because the rate of change of societal value has not come to zero.

The societal value on water resources in Australia has co-evolved with the variability of rainfall, and management policies and practice reforms. The co-evolutionary processes are explained according to the stages of societal value transition identified above. They include the predevelopment (1900s-1960s)- societal value on water resources was dominated by economic development; take-off (1962-1980), societal value on water resources reflected increasing awareness of the environment due to outbreak of pollution events; 1980-2011: environment oriented societal value on water resources and the Millennium Drought triggered a package of policy initiatives and management practice towards sustainable water resource use.

This study developed a new method in combination of qualitative and quantitative approach to measure the change of societal value on water, a "less tangible" variable, and its transition pattern with time. Our study provided an understanding of the dynamical mechanism of transitions

which can assist policy makers to identify management practices that require improvement by understanding how today's conditions and problems were created in the past.

Keywords: Societal value change, Water resources managmeent, Content analysis of news paper, Social-hydrology, Social-ecological co-evolution