



## **Engineering paradigms and anthropogenic global change**

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This essay discusses 'paradigms' as means to conceive anthropogenic global change. Humankind alters earth-systems because of the number of people, the patterns of consumption of resources, and the alterations of environments. This process of anthropogenic global change is a composite consisting of societal (in the 'noosphere') and natural (in the 'bio-geosphere') features. Engineering intercedes these features; e.g. observing stratospheric ozone depletion has led to understanding it as a collateral artefact of a particular set of engineering choices.

Beyond any specific use-case, engineering works have a common function; e.g. civil-engineering intersects economic activity and geosphere. People conceive their actions in the noosphere including giving purpose to their engineering. The 'noosphere' is the ensemble of social, cultural or political concepts ('shared subjective mental insights') of people. Among people's concepts are the paradigms how to shape environments, production systems and consumption patterns given their societal preferences. In that context, engineering is a means to implement a given development path. Four paradigms currently are distinguishable how to make anthropogenic global change happening.

Among the 'engineering paradigms' for anthropogenic global change, 'adaptation' is a paradigm for a business-as-usual scenario and steady development paths of societies. Applying this paradigm implies to forecast the change to come, to appropriately design engineering works, and to maintain as far as possible the current production and consumption patterns. An alternative would be to adjust incrementally development paths of societies, namely to 'dovetail' anthropogenic and natural fluxes of matter and energy. To apply that paradigm research has to identify 'natural boundaries', how to modify production and consumption patterns, and how to tackle process in the noosphere to render alterations of common development paths acceptable. A further alternative, the paradigm of 'ecomodernism' implies to accentuate some of the current development paths of societies with the goal to 'decouple' anthropogenic and natural fluxes of matter and energy. Applying the paradigm 'geoengineering', engineering works shall 'modulate' natural fluxes of matter to counter the effect of anthropogenic fluxes of matter instead to alter the development paths of societies.

Thus, anthropogenic global change is a composite process in which engineering intercedes the 'noosphere' and in the 'bio-geosphere'. Paradigms 'how to engineering earth systems' reflect different concepts ('shared subjective insights') how to combine knowledge with use, function and purpose. Currently, four paradigms are distinguishable how to engineer anthropogenic global change. They convene recipes human activity and bio-geosphere should intersect.