

Final Progress Report
Sustainability Science Program
Term: September 1, 2014 – July 31, 2015

Name: Ross Collins

Your fields:

engineering management, system dynamics, sustainable development, economics

Your degree program, institution and graduation date:

PhD, Massachusetts Institute of Technology, 2015

Faculty host at Harvard:

William C. Clark, Kennedy School of Government

Description of SSP-related research activity:

Evaluating infrastructure policy for sustainable development: How will interventions impact the development trajectory of countries over time?

Abstract: This research seeks to evaluate infrastructure systems¹ – specifically their technology and policy interventions – by their effect on the sustainability of a nation's development. The research framework consists of three parts. First, to operationalize sustainability in the context of national infrastructure systems, this research leverages the welfare economic theory of the wealth/capitals framework, where development is deemed sustainable provided that the value-sum of a nation's capital asset stocks do not decline. Second, in order to project the development outcomes of different infrastructure interventions over time, the research uses systems modeling and simulation that captures relevant interactions between economic and physical processes. Third, interventions are evaluated using scenario-based, cost-benefit-analysis to inform practical policy decisions. The above framework is applied in a case study of electricity infrastructure planning in the Kingdom of Saudi Arabia and other oil-exporting countries. In addition to developing case-specific policy insights, this research will provide a new perspective on national infrastructure planning. Additionally, this research will advance the state of the art in policy evaluation for sustainable development by making the first attempt at prospective policy evaluation using the wealth-capitals framework.

Identification of the problem you address:

Methodologically, how to use inclusive wealth theory in a prospective framework that allows evaluation of national (infrastructure) policies; practically, uncovering (infrastructure) policies in Saudi Arabia that facilitate sustainable development trajectories and elucidating key tradeoffs

Key question asked about the problem:

How to use inclusive wealth theory in a prospective framework that allows evaluation of national (infrastructure) policies? How will (infrastructure) policy interventions impact the development trajectory of Saudi Arabia over time?

The methods by which you answered that question:

quantitative and qualitative data collection and analysis; systems modeling and simulation

Principle literature upon which the research drew:

welfare economics; electric power systems and planning; system dynamics; cost-benefit and decision analysis

¹ "The term 'infrastructure systems' is used in its broadest sense, encompassing both built infrastructure (buildings, roads, bridges, pipe networks, treatment facilities, etc.) and infrastructure services that rely on integrated built and natural systems to provide fundamental needs of society." This definition comes from the website of the Sustainable and Resilient Infrastructure Systems (SRIS) Program in the Civil and Environmental Engineering department at the University of Illinois (<http://cee.illinois.edu/SRIS>).

Empirical data acquisition description:

data collection from Saudi sources (e.g. Saudi Electricity Company, Saline Water Conversion Corporation, etc.) and international organizations (e.g. UN, World Bank, etc.) for other oil-exporting countries

Geographical region studied:

Kingdom of Saudi Arabia (and the UAE and Kuwait for comparative purposes)

Recommendations that might be relevant for your problem:

Making economic and policy decisions should be guided based on anticipated impacts to capital *stocks* over time, not impacts to *flows* like GDP

A description of the final product you have/are aiming to produce:

A paper submitted to the journal *Ecological Economics* (currently being written)

Description of major other intellectual or professional advancement activity(ies) over the past academic year:

Development and leadership of the MIT-Harvard joint working group on Evaluating Technology and Policy for Sustainable Development (SUST-EVAL for short); preparation of teaching material for Prof. Clark's sustainability class based on fellowship work; accepted job at PA Consulting in their Business Dynamics practice

Please list citations for reports, papers, publications and presentations that built on your fellowship research:

Collins, R., Sakhrani, V., Selin, N., Alsaati, A., & Strzepek, K. (2014). Using inclusive wealth for policy evaluation: the case of infrastructure capital. In *Inclusive Wealth Report 2014: Measuring Progress toward Sustainability*. Cambridge, UK: Cambridge University Press. Retrieval at: <http://mgiep.unesco.org/wp-content/uploads/2014/12/IWR2014-WEB.pdf>

Please describe any collaborative activities with other SSP Fellows that you are involved with.

MIT/Harvard Working Group on Evaluating Technology and Policy for Sustainable Development

Principal collaborators outside Harvard:

Olivier de Weck, MIT; Noelle Selin, MIT; Stephen Connors, MIT; Kenneth Strzepek, MIT; Adnan Al-Saati, King Abdulaziz City for Science and Technology

List any awards or grants that you have received this year for the current or coming year:

Martin Family Society of Fellows for Sustainability, spring (2015) semester's worth of tuition and stipend at MIT, received award in spring 2014 from MIT

If you are moving to a new position, please list your contact information there:

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