Unit 1.4 Resources for sustainable development II: How do anthropogenic resources shape the prospects for sustainable development?

The resources directly provided by nature that we discussed in the previous Unit are essential determinants of people's well-being. But through the course of human development, people have used those natural resources to construct additional resources that are now complementary sources of the goods and services used by people to foster well-being. These "anthropogenic" resources have been the focus of much work on the development of economies and are thus often referred to as "assets" or "capital assets." For the purposes of sustainability analysis, they may be conveniently grouped as:

- **Human capital**: people – their health, education, and numbers;
- **Manufactured capital** (also called "produced capital"): human-made systems of roads, buildings, ports, machinery, telecom hardware, pharmaceuticals and personal "stuff";
- **Social capital**: trust, norms, and institutions;
- **Knowledge capital**: understanding of how the world is that is codified in books, journals and patents as well as experiential and indigenous knowledge that is widely shared among people (whether written down or passed on orally).

Each of these anthropogenic resources can contribute directly to society's well-being. They also frequently serve to enhance the benefits that society draws from its stock of natural resources (consider the workings of the plow or the internal combustion engine) and human capital (consider the transportation or information infrastructures that help us get our skills to where they will be most useful). The dynamics and contributions of anthropogenic resources to well-being clearly depend on how they are interconnected with one another. Other things being held constant, investment in many kinds of anthropogenic resources should increase the size of a society's resource base and thus its potential to support increased and inclusive well-being. The challenge for the pursuit of *sustainable* development is that "other things" are not constant. In particular, the creation and use of particular anthropogenic resources, while providing many benefits to society, can be accompanied by damage to the natural resource base and thus may constitute a net loss in the social value of the total bundle of resources available. For example, the environmental services provided by trees are lost when forests are cleared to build factories; people are poisoned by the wastes created in running those factories; synthetic chemicals that are useful to people for one thing also turn out to damage them. Growing the ability of the aggregate resource base to support sustainable development requires awareness and management of such trade-offs.

Preparation for class: In preparation for class, please:

a) **Read**: Matson, P., Clark, W. C., & Andersson, K. (2016). *Pursuing Sustainability: A Guide to the Science and Practice*. Princeton University Press.
   - **Read**: Sections on anthropogenic resources (pp. 37-50,top of page),
   - **Read**: The case study "London: The struggle for sustainable development in an urban environment" (pp. 143-165).

b) **Read** the following brief overviews of the principle anthropogenic resources:
   - **Human capital:** Kurzgesagt – In a Nutshell (Producer). (2016). *Overpopulation – The Human Explosion Explained* [Video recording]. https://www.youtube.com/watch?v=QsBT5EQt348
   - **Manufactured capital**: Krausmann, F., Wiedenhofer, D., Lauk, C., Haas, W., Tanikawa, H., Fishman, T., Miatto, A., Schandl, H., & Haberl, H. (2017). Global socioeconomic material stocks rise 23-fold over the 20th century and require half of annual resource use. *Proceedings of the National Academy of Sciences*, *114*(8), 1880–1885. https://doi.org/10.1073/pnas.1613773114
   - **Social capital**: Ortiz-Ospina, E., Roser, M., & Arriagada, P. (2024). Trust. *Our World in Data*. https://ourworldindata.org/trust

- **Knowledge capital**: Hess, C., & Ostrom, E. (2007). Introduction: An overview of the knowledge commons. In C. Hess & E. Ostrom (Eds.), *Understanding Knowledge as a Commons: From Theory to Practice* (pp. 3–26). MIT Press.

Study Questions to help you get the most out of the readings:

To provide focus, the study questions listed below refer to the London case study assigned in reading 'a'. You can also think about the same questions for any case you know a lot about.

I. **Human capital in London:** What are the trends in each component of human capital in the London case during each phase of London's history? How strongly would you weigh trends in individual dimensions of human capital for your overall assessment of London's inclusive human well-being? In other words, which of the observed trends in population, health, or education of people in London most strongly influenced overall human well-being in each phase of London's development? Were trends in other resources more important?

II. **Manufactured capital in London:** What are the stocks of manufactured capital that are most central to peoples' efforts to improve their well-being in the London case? What are the most important processes through which these stocks of manufactured capital increased or decreased over time? In what ways have efforts to increase the stock of manufactured capital in London damaged or improved the stock of natural capital or human capital there?

III. **Social capital in London:** What are the trends in social capital for the London case? What are the key kinds of social capital created during each phase of history that allowed people to collaborate on a problem that had previously inhibited the pursuit of well-being there? How did these forms of social capital contribute to inclusive well-being and sustainable development? There is much talk of a "dark side" of social capital. This often manifests as a product of inequity—powerful actors have the ability to shape the institutions (rules of the game) to further entrench their own power. What are the most important ways in which an increase in "dark" social capital may have undermined the prospects for sustainable development in the London case? In other cases you are familiar with?

IV. **Knowledge capital in London:** What are the most important trends in knowledge capital for the London case? What are some ways in which London's knowledge stock grew? Declined? Are there key examples of knowledge capital throughout the history of London that significantly contributed to net gains in human well-being in the city? What mechanisms added this valuable knowledge capital to the London system?

V. **Interacting resource stocks in London:** How did each of the natural and anthropogenic resource stocks we have studied in this and the previous Unit contribute to London's development pathway? To do this pick a specific time period in London's history you are interested in, then 1) List trends in each of the seven resource stocks in the time period you selected (if there is not enough data about a particular asset stock provided you can either do some research yourself or skip it; 2) Describe the ways in which changes in each of the resource stocks impacted other resource stocks and overall human well-being (those impacts can be both negative and positive).

VI. **Your case:** Think about anthropogenic resources in your own case. First, create a simple table showing the current status (growing, stable, declining) of each anthropogenic resource in your case. Second, identify an anthropogenic resource constraint limiting sustainable development in your case. What makes this resource particularly important? Third, analyze one key interaction between anthropogenic and natural resources in your case - is there a tradeoff where building one type of capital degrades another? Or a synergy where investments in one enhance another?

Digging deeper (optional materials for further exploring the anthropogenic capital that most interests you):

Human capital

c) Lundborg, P., Nordin, M., & Rooth, D. O. (2018). The intergenerational transmission of human capital: The role of skills and health. *Journal of Population Economics*, *31*(4), Article 4. https://doi.org/10.1007/s00148-018-0702-3

Especially important perspective on how what you get from your parents' generation shapes your prospects for well-being.

d) Jumbri, I. A., Ikeda, S., & Managi, S. (2018). Heterogeneous global health stock and growth: Quantitative evidence from 140 countries, 1990–2100. *Archives of Public Health*, *76*(1), 81. https://doi.org/10.1186/s13690-018-0327-8

Manufactured capital

e) Weisz, H., Suh, S., & Graedel, T. E. (2015). Industrial ecology: The role of manufactured capital in sustainability. *Proceedings of the National Academy of Sciences*, *112*(20), 6260–6264. https://doi.org/10.1073/pnas.1506532112 .

A survey of how the physical stuff that society produces does (and does not) affect its prospects for sustainable development

f) Södersten, C.-J., Wood, R., & Wiedmann, T. (2020). The capital load of global material footprints. *Resources, Conservation and Recycling*, *158*, 104811. https://doi.org/10.1016/j.resconrec.2020.104811 .

A valuable effort to link two approaches to accounting for the role of manufactured capital in sustainable development: asset stocks and material footprints.

g) Krausmann, F., Schandl, H., Eisenmenger, N., Giljum, S., & Jackson, T. (2017). Material flow accounting: Measuring global material use for sustainable development. *Annual Review of Environment and Resources*, *42*(1), 647–675. https://doi.org/10.1146/annurev-environ-102016-060726

Social capital

h) Dasgupta, P. (2021). *The economics of biodiversity (The Dasgupta Review)*. HM Treasury. https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review.

Especially relevant is the chapter on "Laws and norms as social institutions" (Ch. 6, pp 167-187).

i) Hamilton, K. E., Helliwell, J. F., & Woolcock, M. (2016). *Social capital, trust, and well-being in the evaluation of wealth* (No. WPS7707; pp. 1–23). The World Bank. http://documents.worldbank.org/curated/en/249031468195550873/Social-capital-trust-and-well-being-in-the-evaluation-of-wealth

A seminal paper on the links among well-being, trust, and social capital

j) Schlager, E., & Ostrom, E. (1992). Property-Rights Regimes and Natural Resources: A Conceptual Analysis. *Land Economics*, *68*(3), Article 3. https://doi.org/10.2307/3146375

This reading is especially interesting in light of our experience playing Fishbanks. It studies in detail different varieties of property rights regimes or design (institutional arrangements) and the impact of different property rights regimes on the sustainability of fisheries management in a lobster fishery in Maine.

k) Edelman. (2024). *Why we study Trust*. Edelman. https://www.edelman.com/trust

Read the current "Trust barometer report" and other links on this page to see how strategies for monitoring and building trust have become a part of good business.

Knowledge capital

l) Conway, G., & Waage, J. (2010). *Science and Innovation for Development*. UK Collaborative on Development Sciences (UKCDS).
This work is dated, but still provides one of the best overall perspectives on the subject.

m) Anadon, L. D., Chan, G., Harley, A. G., Matus, K., Moon, S., Murthy, S. L., & Clark, W. C. (2016). Making technological innovation work for sustainable development. *Proceedings of the National Academy of Sciences*, *113*(35), 9682–9690. https://doi.org/10.1073/pnas.1525004113
Synthesis of a major project digging into the multiple processes from invention to retirement that go into the making of innovations that serve the public good.

n) Roser, M. (2024). *Our world in data*. https://ourworldindata.org/
The amazing *Our World in Data* website has many different datasets that help us understand current trends in knowledge capital. Explore the website "Topics" on "Education and Knowledge" and on "Innovation and Technological Change" to find datasets that address some aspect of knowledge capital you are interested in. Think about whether the data being reported is a stock or a flow measurement for knowledge capital.