

On March 15th, 2017, attendees to the forty-fifth monthly meeting of Systems Thinking Ontario enjoyed an in-depth presentation, by Rose Kudlac, on the latest thinking and activity surrounding, *Circular Economies*. She told the story of how one innovative Dutch architect negotiated a deal with Phillips Lighting whereby, instead of providing lighting systems, they provided *Pay per Lux* – lighting as a service. Under this arrangement, Phillips lighting assumed all responsibility for the installed light bulbs and the electrical power consumed, incentivizing them to provide efficient and long-lasting bulbs. And; as system components fail, Phillips profits from repairing and reusing components wherever feasible. Very much the opposite of those incentives built into the current *sale-of-bulbs* model – where higher turnover of bulbs means higher revenues for Phillips Lighting and more wasted material – and; bulb efficiency only need achieve levels acceptable to most consumers, given prevailing rates.

We were introduced to the Ellen MacArthur Foundation, created by Ellen following her solo circumnavigation of the globe. Her long journey taught her the importance of preserving valuable energy, resources and materials – and she became passionate about the incredible opportunity for similar shifts in thinking about the worlds industrial and consumer economies.

Rose communicated a number of important energy-flow and economic concepts underlying the opportunity for Circular Economies - Sankey diagram illustrating relative energy flows of resource extraction, manufacturing and residential service, in Canada – as well as, examples of progressive building construction here in Toronto – and many more insights into emerging trends toward circular economies.

The presentation was followed by lively Q & A, coupled with a variety of suggestions for how to advance these systemic innovations – and discussion of barriers and risks to their increased adoption.

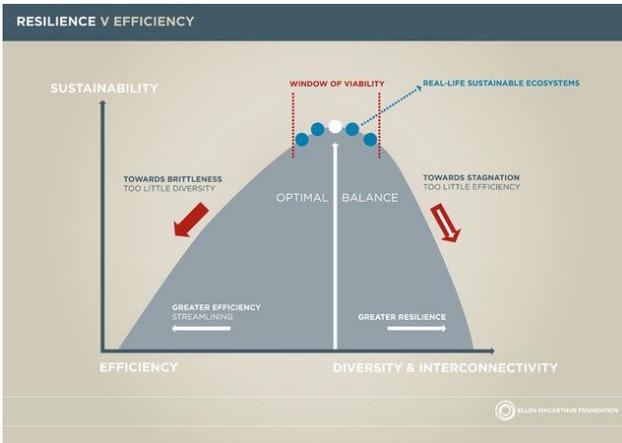
Rose supplied a generous collection of references to various items mentioned during her talk, as well as the following summary notes - inspired by some of the themes and questions raised:

Waste

In biology, waste from one species is often used as food for another species. This does not violate the second law of thermodynamics in that overall, entropy increases.

In the Circular Economies, the ideal is to redesign and repurpose waste as nutrients or feedstocks for other goods and useful or regenerative processes. There are large economic opportunities available to repurpose physical waste in the human economy, again bounded by inviolable physical laws like the second law of thermodynamics, and Carnot efficiencies.

There are generally tradeoffs between efficiency and resilience in systems and subsystems.



<http://thecirculareconomy.wikia.com/wiki/File:Resilience-vs-Efficiency.jpg>

On waste in human work, particularly in information and communication technology, *The Future of the Internet and How to Stop It*, by Jonathan Zittrain, deals with this in detail. The author argues that the price of openness, lack of brittleness, and generativity in the internet (can be extended to technical systems) is that things don't always work smoothly i.e. there will be some waste.

Work

Like our production system, 'work' is also a multi-final system providing workers with economic and other benefits.

Stahel writes about replacing energy with human work, a shift from resource optimization to labour optimization. For example, currently steel beams in buildings have relatively standardized shapes with highest common strength because they require less work during construction, i.e. they are over-specified for many use-cases. They can be made with less material if they are more customized to specific loads in different parts of a building. This requires more work in managing diverse inventory and correct installation.

And generally a shift towards more maintenance, repair, reuse and remanufacturing creates additional work closer to markets.

As we've seen in sectors such as the caring professions, there often isn't a lack of work to do, but the lack of mechanisms to pay for the work.

There is additional work involved in:

- Redesigning everything, including products, new materials and processes for deconstruction and reuse, for resource productivity i.e. re-orienting R+D from planned obsolescence to eco-efficiency, durability, recycle-ability, effectiveness
- Focusing more directly on well-being and finding better ways to distribute benefits

While automation can reduce humans work in some cases, e.g. a bricklaying robot can replace 3 bricklayers – might it also assist with work that we currently don't do at least in the developed world, i.e. building deconstruction for reuse instead of demolition using a wrecking ball because of high labour costs?

The Performance Economy is one way to address how to incentivize and pay for this additional work.

Wealth

Prosperity comprises physical resources, logistical and cultural distribution of benefits. Coert Zaccharias, of Delta Development Group, notes that 'Rethinking Buildings as Material Banks' has resulted in lower cost of tenancy i.e. better material efficiency in buildings. It's not clear how much is due to sourcing lower-cost used materials or from the leased materials arrangement itself – he seems to infer the latter. Whether and to what degree this lower cost gets passed along to tenants is a business and social issue.

Ellen MacArthur Foundation: Towards the Circular Economy Vol 1

- We used our circularity model to study products belonging to the 'sweet-spot' segment—the segment with the highest circular economy potential—namely, complex medium-lived products
- High-end washing machines would be accessible for most households if they were leased instead of sold—customers would save roughly a third per wash cycle, and the manufacturer would earn roughly a third more in profits. Over a 20-year period, replacing the purchase of five 2,000-cycle machines with leases to one 10,000-cycle machine would also yield almost 180 kg of steel savings and more than 2.5 tonnes of CO2e savings.
- Governments and companies have started looking at the circular model not only as a hedge against resource scarcity but as an engine for innovation and growth.
- it is the reuse of vast amounts of material reclaimed from end-of-life products, rather than the extraction of resources, that is the foundation of economic growth.

Rent seeking on assets is currently a factor in driving socio-economic inequality, a major contributor to poverty:

- While in 1980 wages in the financial sector were basically on par with wages in the rest of the economy, by 2006 the average wage in finance was 72 percent higher than the average non-financial wage. These wages can't be explained solely by skills; research argues that rents account for 30–50 percent of these higher wages, especially since the late 1990s.
- Indeed, a key source of growth comes from asset management activities, which include both the management of 401(k)s and mutual funds, as well as alternative investment vehicles like private equity and hedge funds. The growth in asset management income accounts for roughly 35 percent of the growth of the financial sector as a percent of

GDP, driven by the opaque fee structures, especially when it comes to alternative investment vehicles. 36

- There is little evidence of any advantages, for instance in better long-run performance, when it comes to higher management fees.
- Joseph Stiglitz, et al “Rewriting the Rules” <http://rooseveltinstitute.org/rewriting-rules-report/>

Walter R. Stahel writes about the “Loop” economy and the “Lake” economy i.e. asset management of Product-Service Systems. It’s not clear that PSS in itself will increase the social tendency towards wealth concentration, but the latter needs to be countered by the usual methods of anti-monopoly regulation, redistributive measures-- see for example, Thomas Picketty’s Capital in the Twenty First Century on inequality-- and measures against excessive financialization for example, like the use of public money creation by the Bank of Canada during the period 1935-1975. (<http://positivemoney.org/2015/11/can-public-money-creation-work-some-answers-from-canadian-history/>) The latter is currently opposed and effectively stopped by the banking cartel, The Bank of International Settlement.

In many cases, like selling uptime for jet engines, the performance economy address a new value space, which Stahel sees as internalizing product liability and product waste cost – important for sustainability-- but may extend also to other kinds of value created by information. Economics journalist, Paul Mason writes:

The great technological advance of the early 21st century consists not only of new objects and processes, but of old ones made intelligent. The knowledge content of products is becoming more valuable than the physical things that are used to produce them. But it is a value measured as usefulness, not exchange or asset value. In the 1990s economists and technologists began to have the same thought at once: that this new role for information was creating a new, “third” kind of capitalism – as different from industrial capitalism as industrial capitalism was to the merchant and slave capitalism of the 17th and 18th centuries. But they have struggled to describe the dynamics of the new “cognitive” capitalism. And for a reason. Its dynamics are profoundly non-capitalist.

<https://www.theguardian.com/books/2015/jul/17/postcapitalism-end-of-capitalism-begun>

With respect to ‘growth’ on a physically finite planet, though it may seem obvious it’s worth recalling that even with so-called cognitive capitalism, information and knowledge have physical components and are thus bounded by laws of physics. And knowledge itself can help us access resources and avoid waste and can only partially transcend matter: a map or a recipe does not replace food.

References

The Performance Economy, Walter R. Stahel, 2010, <http://www.palgrave.com/us/book/9780230584662>

Sustainable Materials With Both Eyes Open, Julian M. Allwood, Jonathan M. Cullen, UIT Cambridge, <http://www.withbotheyesopen.com/>

1. “Livermore California’s Centennial Light” www.centennialbulb.org
2. Consumption cartoon <http://mik.aidt.co/wp-content/uploads/2013/03/tillvaekst-cartoonUK.jpg>
3. Ontario Bill 151: Strategy for a Waste Free Ontario: Building the Circular Economy
4. Toronto’s Long Term Waste Strategy: “The final Waste Strategy recommends the inclusion of a new aspirational goal to work towards a circular economy and zero waste future, which will be measured by a new key performance indicator: waste generation rate per capita. A circular economy shifts the way waste management is viewed and approached, looking to prevent waste generation and maximize resource recovery.”
<http://www.toronto.ca/legdocs/mmis/2016/pw/bgrd/backgroundfile-94037.pdf>
5. Dame Ellen MacArthur, “The Surprising Thing I Learned Sailing Solo Around the World”, TED talk http://www.ted.com/talks/dame_ellen_macarthur_the_surprising_thing_i_learned_sailing_solo_around_the_world
6. Sankey Diagram, https://en.wikipedia.org/wiki/Sankey_diagram
7. The Ellen MacArthur Foundation, <https://www.ellenmacarthurfoundation.org/>
8. “Roughly three quarters of all industrial energy consumption is associated with the extraction or production of basic materials like steel and cement, while only about one quarter is used in the transformation of raw material into finished goods such as machines and buildings. The converse is true of labour, about three times as much being used in the conversion of materials to finished products as is required in the production of material” (Stahel and Reday-Mulvey, 1976/81). See also Julian Allwood, Jonathan M. Cullen, *Sustainable Materials With Both Eyes Open*
9. Prof. Tyler Cowan, Aug 10, 2011: blog post “Is there a Productivity Crisis in Canada?”, <http://marginalrevolution.com/marginalrevolution/2011/08/is-there-a-productivity-crisis-in-canada.html>
10. “Canada’s Lagging Productivity” ,The Agenda with Steve Paikin, aired Oct 15, 2015, See comment by Andrew Baldwin <http://tvo.org/video/programs/the-agenda-with-steve-paikin/canadas-lagging-productivity>
11. “Toronto is a global mining hub, with the TSX accounting for 57% of the world’s publicly traded mining companies, and the city is home to 400 mining and exploration companies offices and several hundred suppliers”, The World Won’t Wait: Why Canada needs to Rethink its International Policies, Ed Roland Paris and Taylor Owen p51
12. Mark Cutifani, CEO of Anglo-American mining giant (2013 speech to World Mining Congress in Montreal) “mining and petroleum, including payments to their service providers and spin-off benefits to other industries...contribute more than 45 percent of global GDP making the sector the most important industrial activity on the face of the planet”. “The multifactor productivity metric for mining in Australia –the only area for which I have recent data – has decreased by 40

per cent over the past 10 years. That is, it now takes 40 per cent more inputs to generate a single unit of mineral product.” “Can we see the crisis we are lurching towards or do we simply not understand our role in society?” <http://www.angloamerican.com/~media/Files/A/Anglo-American-PLC-V2/presentations/2013pres/mark-cutifani-speech-at-WMC.pdf>. See also “To the Ends of the Earth” **Documentary** about extreme energy extraction in Canada <http://tvo.org/video/documentaries/to-the-ends-of-the-earth>

13. Component Lifespans diagram, Stewart Brand, *How Buildings Learn: What Happens After They're Built*, Viking Press, 1994
14. “Netherlands gets first Nationwide Internet of Things” <http://phys.org/news/2016-06-netherlands-nationwide-internet.html#nRlv>
15. **Documentary**: “The End of Ownership”, VPRO, Thomas Rau, Turn-too, <https://www.youtube.com/watch?v=oOO-pYUI9-w>
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17. Frank Tieze, Eric G. Hansen, “To Own or To Use: How Product-Service Systems Facilitate Eco-Innovation Behavior”,
18. “Pay-as-you-go Lighting Arrives at Amsterdam’s Schiphol Airport” <http://luxreview.com/article/2015/04/pay-as-you-go-lighting-arrives-at-amsterdam-s-schiphol-airport>
19. James McKinnon, “The LED Quandary: Why there’s no such thing as built to last” , <http://www.newyorker.com/business/currency/the-l-e-d-quandary-why-theres-no-such-thing-as-built-to-last>
20. “Viva Las Vegas: LED’s and the Energy Efficiency Paradox”, photo <http://www.lowtechmagazine.com/2008/10/led-light-cfl-b.html>
21. Alliance for Sustainable Building Products :”The Benefits of Designing for Deconstruction and Reuse”, <http://asbp.org.uk/presentations/various-speakers-presentations-the-benefits-of-designing-for-deconstruction-resource-march-2016>
22. OEM Product Services Institute www.oemservices.org (from Stahel, 2010)
23. Queen Richmond West Centre, Allied REIT <http://qrcwest.com/>

All links accessed 2016, March 2017, unless otherwise noted

Further Reading/ Viewing

“Pyramids of Waste” (“The lightbulb conspiracy”), **Documentary**

“Waste = Food” **Documentary** about Cradle to Cradle, <http://topdocumentaryfilms.com/waste-food/>

“Welcome To 2030: I Own Nothing, Have No Privacy, and Life Has Never Been Better” Ida Auken, Forbes, <https://www.forbes.com/sites/worldeconomicforum/2016/11/10/shopping-i-cant-really-remember->

[what-that-is-or-how-differently-well-live-in-2030/#2a314b011735](#) (note: the writer is likely too young to recall the 1970's when nuclear power was 'too cheap to meter')

"Waste Land", **Documentary** about pickers of recyclable materials in Rio De Janeiro, at Jardim Gramacho, the world's largest landfill (since closed) <http://www.imdb.com/title/tt1268204/>

"Trashed" Documentary with Jeremy Irons, about pollution associated with waste
<https://www.youtube.com/watch?v=7UM73CEvwMY> [https://en.wikipedia.org/wiki/Trashed_\(film\)](https://en.wikipedia.org/wiki/Trashed_(film))

Andrew Russel, "Hail the Maintainers", <https://aeon.co/essays/innovation-is-overvalued-maintenance-often-matters-more>