The Natural Step, Natural Capitalism & Conscious Capitalism in the XXIst century

Applying old tools to entirely new circumstances

Terry Thiele
4 December 2014
Corporate Roundtable
provocative
prəˈväkəтив

1. causing annoyance, anger, or another strong reaction, especially deliberately. "a provocative article"

synonyms: annoying, irritating, exasperating, infuriating, maddening, vexing, galling
cur·mudg·eon
kərˈmɛjən/noun

a bad-tempered or surly person.
THESIS:
Sustainability thinking in the XXth Century will have to be “rethought” for the XXIst Century.

EVIDENCE: emergence of TNS, Natural / Conscious Capitalism
Capitalism & the Industrial Revolution

With compliments from the Smoke.

Monte Ahuja College of Business
Center for Sustainable Business Practices
Adam Smith and Life-cycle Assessment

The Industrial Revolution!

Individually made \(\rightarrow\) MASS PRODUCED

Capital

Labor

MASS PRODUCED GOODS
Adam Smith and Life-cycle Assessment

1st Industrial Revolution - early

- Energy: open-flame boilers/coal/steam
- Transportation: horses
- Communication: telegraph

Mass production → numerous industries
Adam Smith and Life-cycle Assessment

1st Industrial Revolution - mature
- Energy: open-flame boilers/coal/steam
- Transportation: horses/railroads
- Communication: telegraph

Towns spread out - industries consolidate

Water refill for steam locomotive
Adam Smith and Life-cycle Assessment

2nd Industrial Revolution

- Energy: internal combustion engine/oil/electricity
- Transportation: automobiles/trucks/airplanes
- Communication: telephone/television
- Urbanization

Global concentration
“In 1882, A.W. Brayton wrote, ‘The Virginia Deer is rarely met with in Ohio at present, except as domesticated in parts.’

“By 1904, White-tailed Deer were extirpated from Ohio....”

http://www.ohiohistorycentral.org/w/White-tailed_Deer?rec=1117
Mass Production and Life-Cycle Assessment

☑ Environmental profile for mass produced goods
Mass Production and Eco-Efficiency
HECKSHER-OHLIN-SAMUELSON 2 SECTOR MODEL OF GENERAL EQUILIBRIUM

- Comparative Advantage
- Opportunity Cost
- Specialization
- Economies of Scale
- Barriers to Entry
- Inventory / Just-in-Time

☐ Economic profile for mass produced goods
The 3rd Industrial Revolution
The 3rd Industrial Revolution

Mass Production and **THE FUTURE**

- Energy:

Stage setting: role played by energy in the progress of civilization
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Vegetation, meat</td>
<td>Muscle</td>
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<tr>
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<td>Fire</td>
<td>Warmth, light, food prep, defense</td>
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**Paleolithic**

- **200,000 BC**
- **12,000 BC**
- **12-10,000 BC**

**Mesolithic**

- **2014**
### Mesolithic

**12-10,000 BC**

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<td>Vegetation, meat</td>
<td>Animals (6 x Muscle)</td>
<td>Hunting, gathering, farming, building, transportation</td>
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Ox ≈ 4 laborers \rightarrow \text{ better harness } \approx 6 \text{ laborers}
## Mesolithic vs. Neolithic

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<td>Organized labor (1000s x Muscle)</td>
<td>“monument building”</td>
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**Timeframe:**
- **Mesolithic:** 10,000 BC - 5,000 BC
- **Neolithic:** 5,000 BC - 1000 BC

**Energy Sources and Uses:**
- **Vegetation, meat:** Hunting, gathering
- **Wood:** Fire, warmth, light, food prep, defense
- **Animals:** Hunting, gathering, farming, building, transportation
- **Wind:** Sail, transportation
- **Organized labor:** “monument building”
Early windmill ≈ 14-140 laborers
### “Classical Era”

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<tr>
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<td>Slave labor (10,000s x muscle)</td>
<td>“Empire building”</td>
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### “Modern Era”

- 2014

**ENERGY SOURCE**
- Wood
- Wind
- Grain, meat
- Slave labor

**CONVERSION**
- Fire
- Sail
- Organized labor

**USE**
- Warmth, light, food prep, defense
- Transportation
- “monument building”
“Classical Era”
5,000 BC
300 AD

“Modern Era”
2014

“Pre-Industrial”
300 AD

“Industrial Revolution”
1750
2014
### “Pre-Industrial”

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<td>“Empire building”</td>
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<tr>
<td>Water</td>
<td>Watermills</td>
<td>Food prep, fiber prep</td>
</tr>
<tr>
<td>Wind</td>
<td>Windmills</td>
<td>Food prep, fiber prep</td>
</tr>
<tr>
<td>Coal</td>
<td>Open Fire</td>
<td>Warmth, light, food prep</td>
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### “Industrial Revolution”

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“Pre-Industrial”

300 AD

2014

“Industrial Revolution”

1750

2014

“Industrial Revolution”
## Industrial Revolution

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<th>CONVERSION</th>
<th>USE</th>
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<tbody>
<tr>
<td>Oil</td>
<td></td>
<td>Transportation</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agriculture</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td>Food preparation</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>Electrical</td>
<td>Climate control</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>Mechanical</td>
<td>Illumination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warfare</td>
<td>20%</td>
</tr>
<tr>
<td>Renewables</td>
<td></td>
<td>Entertainment</td>
<td>9%</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td></td>
<td>8%</td>
</tr>
</tbody>
</table>
1785 Watt/Bolton steam engine ≈ 333 laborers
1901 35 HP Mercedes ≈ 280 laborers (1 HP ≈ 8 laborers)
118 HP ≈ 1,144 laborers (MINI COOPER S)
US individual energy consumption:

\[
18.3 \text{ mil barrels} \times 42 \text{ gal} \approx 2.43 \text{ gal/person/day}
\]

\[
360 \text{ mil people}
\]

\[
136,567 \text{ BTU/gal} \times 2.43 \approx 331,857 \text{ BTU/person/day}
\]

\[
\times 0.0002931 \approx 97.3 \text{ kW} \approx 1,300 \text{ laborers/person/day}
\]

468 billion laborers...
“Energy plays a fundamental role in shaping the human condition. Indeed, it has been argued that energy is the key "to the advance of civilization," that the evolution of human societies is dependent on the conversion of energy for human use. Few people have questioned the long-held assumption that standard of living and quality of civilization are proportional to the quantity of energy a society uses. However imprecise it may be, most people still accept the steadfast formula: energy=progress=civilization.”
“The world has an astonishing chance to take a billion people out of extreme poverty by 2030.” June 2013

“The advanced projects team at Lockheed, known as Skunk Works, has **unveiled a plan to develop a compact, magnetic fusion device** in less than a decade.”
THE FUTURE & Energy

Nonrenewables

Nuclear

Fuel Cells

Renewables

CHEAP OFF-GRID GLOBAL ENERGY
The 3rd Industrial Revolution

Mass Production and **THE FUTURE**

- Energy: CHEAP OFF-GRID ENERGY
- Communication: IoT KNOWLEDGE MANAGEMENT
THE FUTURE & the “Internet of Things”

THE FUTURE & the "Internet of Things"
THE FUTURE & the “Internet of Things”

Digital World

Things Integration

Data Integration

IoT Society

Knowledge Integration

Semantic Integration

Real Physical World

Virtual Cyber World
The 3rd Industrial Revolution

Mass Production and **THE FUTURE**

- Energy: CHEAP OFF-GRID ENERGY
- Communication: IoT KNOWLEDGE MANAGEMENT
- Manufacturing: 3D PRINTING
THE FUTURE & 3D printing

Removing material OUTSIDE → IN

Adding material INSIDE → OUT

http://www.withinlab.com
It can print everyday articles...
It can print something really big...
It can print something really small...
It can print something incredibly sophisticated...

[ kidney being printed ]
GE produces jet engine turbine blades with 3D printing
... saves ≈ $25,000 per engine. The Motley Fool 10/12/12
It can print something at the store around the corner...

“Staples Easy 3D”... upload designs to website... pick up printed objects at local store.  Wired.com 11/29/12
It can print something on your kitchen table...
It can print something impossible...

Shell Tech Centre (Amsterdam)

(internal cooling channels / structures)

“impossible to make with existing machining techniques.”

3ders.org 9/18/12
THE FUTURE & 3D printing

The Economist

Romneyomics explained
The euro crisis: back after its siesta
Argentina’s oil grab
The science of guerrilla warfare
America’s bagel king

The third industrial revolution
A 14-PAGE SPECIAL REPORT
Mass Production and The Future

- Energy: CHEAP OFF-GRID ENERGY
- Communication: IoT KNOWLEDGE MANAGEMENT
- Manufacturing: 3D PRINTING
- Scaling: NANOTECH
A Basic definition:

Nanotechnology is the engineering of functional systems at the molecular scale. This covers both current work and concepts that are more advanced.

In its original sense, 'nanotechnology' refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products.
The growth of nanotechnology

Social and Environmental Impacts

Nano-factories
Nano-devices
Nano-materials

2000-2005
2005-2010?
???

http://www.futuretimeline.net/subject/nanotechnology.htm
The 3rd Industrial Revolution

Mass Production and \textit{The Future}

- Energy: CHEAP OFF-GRID ENERGY
- Communication: IoT KNOWLEDGE MANAGEMENT
- Manufacturing: 3D PRINTING
- Scaling: NANOTECH
- Automation: ROBOTICS
Automation is Voldemort: the terrifying force nobody is willing to name.

— JERRY MICHALSKI, FOUNDER OF REX, THE RELATIONSHIP ECONOMY EXPEDITION
The 3rd Industrial Revolution

Mass Production and THE FUTURE

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- New Materials: ???

http://engineering.unt.edu/materials/research
THE FUTURE & New Materials

9 Materials That Will Change the Future of Manufacturing

Researchers are developing cutting-edge foams, coatings, metals and other substances to make our homes, vehicles and gadgets more energy efficient and environmentally friendly.
THE FUTURE & New Materials

SCIENTIFIC AMERICAN

FUNGAL FOAM: Initially conceived as a cost-effective, environmentally friendly and high-performance alternative to Styrofoam, Ecovative Design makes its Mushroom Packaging from agricultural crop waste—plant stalks and rice and wheat husks—bonded together with mushroom roots (called mycelium). [... More]
The 3rd Industrial Revolution

Mass Production and **THE FUTURE**

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What does this all mean?
Sustainability and **THE FUTURE**

- The Natural Step
- Natural Capitalism
- Conscious Capitalism
Karl-Henrik Robert & the 3rd Industrial Revolution

The Natural Step (TNS)

- Non profit
- Science based model to integrate environmental, social, and economic considerations into business decisionmaking.
- Founded in 1989 by Dr. Karl-Henrik Robèrt in Sweden.
- Offices in 11 countries and a list of partners that includes some of the world’s leading brands.

http://www.thenaturalstep.org/en
Karl-Henrik Robert & the 3rd Industrial Revolution

TNS Rationale

The Funnel

Water  Biodiversity  Forests  Soil  Life-support resources  declining

Global Trade  Population  Affluence  Technology  demand for life-support resources  rising

Sustainability
TNS and Life-Cycle Assessment

#1. Substances from the earth’s crust must not systematically increase in the biosphere.

#2. Substances produced by society must not systematically increase in the biosphere.

#3. Natural functions and diversity must not be systematically impoverished by displacement, overharvesting or other manipulation.

#4. Resources must be used fairly and efficiently to meet basic human needs globally.

TNS establishes LCA interpretation objectives.
Natural Capitalism

- Future economic development needs “natural capital” (“macro” life-supporting services that currently have no “micro” market value).
- Badly designed business systems + population growth + wasteful consumption $\rightarrow$ increasing loss of natural capital.
- Need market-based system where human, manufactured, financial, and natural capital are fully valued.
- Economic/environmental sustainability depends on redressing global inequities of income and material well-being.

Natural Capitalism $\approx$ The Circular Economy

http://en.wikipedia.org/wiki/Natural_Capitalism
Amory Lovins (and Paul Hawken) & the 3rd Industrial Revolution

Natural Capitalism and Eco-Efficiency

Social Justice

Human Capital

Natural Capital

Environmental Circular Economy

Capital

Labor

MASS PRODUCED GOODS

Natural Capitalism expands traditional H-O-S definition of capital (money/goods) to include NATURAL and HUMAN capital
**Conscious Capitalism**

- **Liberating the Heroic Spirit of Business**
- “People are most fulfilled and happiest when their work is aligned with their own inner passions. Personal passion, corporate purpose, and business performance all go together.”
- “Conscious businesses think caringly, creatively, and strategically about the environment. They consider it one of the company’s key stakeholders and treat it with the same respect and attention they give to the others.”
- “Purpose-driven motivation is intrinsic motivation and is far more effective and powerful than extrinsic financial incentives.”
Conscious Capitalism expands objective of Capitalism beyond merely delivering a return on shareholder capital investment.
Why B Corps Matter

“B Corps might turn out to be like civil rights for blacks or voting rights for women - eccentric, unpopular ideas that took hold and changed the world.”

Exquisite Magazine

Certified B Corporations are leading a global movement to redefine success in business.

By voluntarily meeting higher standards of transparency, accountability, and performance, Certified B Corps are distinguishing themselves in a cluttered marketplace by offering a positive vision of a better way to do business.

We hope that you are inspired, not just by our vision, but by the movement’s ability to translate ideas into action.

B Corps create higher quality jobs and improve the quality of life in our communities. And, as the movement grows, it has become an increasingly powerful agent of change. We are passing laws. We are driving capital.
What is going on here? Why now?
“The view that greater economic activity inevitably hurts the environment is based on **static assumptions** about technology, tastes and environmental investments ...” [emphasis added]

“... as incomes rise, the demand for improvements in environmental quality will increase, as will the resources available for investment.”
Figure 1
Environmental Kuznets Curve: Different Scenarios

Sustainability, the 3rd Industrial Revolution and the Kuznets Curve

Sustainability, the 3rd Industrial Revolution and the Kuznets Curve

You are HERE!
Hans Rosling and the Kuznets Curve

GLOBAL TRENDS
Wealth & Health of Nations

This graph shows how long people live and how much money they earn. Click the play button to see how countries have developed since 1800.

Explore more of Gapminder World:
- Browse example graphs
- Learn to select indicators and more
- Download PDF Guide

Latest News:
- “Finding data in Gapminder World just got easier”
- “Updated data page – quicky search and visualize indicators”

See also:
- 200 years that changed the world
- Stop calling them “developing countries”
What is going on here?

http://www.impactlab.net/2013/06/05/how-did-the-work-life-balance-get-so-awful-in-america/
Sustainability and THE FUTURE

http://www.impactlab.net/2013/06/05/how-did-the-work-life-balance-get-so-awful-in-america/
Sustainability and THE FUTURE

Karl-Henrik Robert, Amory Lovins, Raj Sisodia & the 3rd Industrial Revolution

http://www.telegraph.co.uk/finance/personalfinance/comment/iancowie/6274049/Would-you-put-your-pension-on-a-politicians-promise.html
WHAT WILL YOU DO WITH YOURSELF WHEN YOU AREN’T WORKING TO PUT FOOD ON THE TABLE?
Sustainability and **THE FUTURE**

Viktor Frankl & the 3rd Industrial Revolution

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Monte Ahuja College of Business
Center for Sustainable Business Practices
Sustainability & the 3rd Industrial Revolution
Mass Production and The Future

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- New Materials: ???

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The 3rd Industrial Revolution

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*We really are facing a “meta” revolution*
Mass Production to MASS CUSTOMIZATION

Individually made → MASS PRODUCED → Individually made

Adam Smith & the 3rd Industrial Revolution
“Manufacturers should start by assessing the vulnerability of their output to substitution by the home craftsman. Analyzing the nature of the items that were made in large enterprises before the Industrial Revolution will suggest what types of product line are most defensible. Relevant independent variables might include bulk, product complexity, the ability to personalize design or features, and the potential for display. Strategies for the most vulnerable products might need a complete rethink.”
The exact definition of “makers” is a bit imprecise, but you can think of them as the web generation creating physical things rather than just pixels on screens. To use the terminology of the MIT Media Lab, they’re treating atoms like bits—using the powerful tools of the software and information industries to revolutionize the way we make tangible objects. There are three underlying forces at work in this transformation of tinkering.

1. The first is the emergence of digital tools for design and manufacturing...
2. The second factor is the digital means of collaboration...
3. The third element is the rise of the factory for hire...
Adam Smith & the 3rd Industrial Revolution

Mass Customization and Life-Cycle Assessment

Environmental profiles for custom made-to-order goods???
John Maynard Keynes & the 3rd Industrial Revolution

Mass Customization and Eco-Efficiency

Heckscher-Ohlin-Samuelson 2 Sector Model of General Equilibrium

- Comparative Advantage
- Opportunity Cost
- Specialization
- Economies of Scale
- Barriers to Entry
- Inventory / Just-in-Time

Economic profiles for custom made-to-order goods???
Mass Customization is the Future

Sustainability tools will have to be re-engineered
Sustainability & the 3rd Industrial Revolution

Mass Customization is the future

IoT

New Materials

Natural Capital

Labor

Human Capital

Capital

3D Printing

Energy

Nano tech

Robotics

Getting to the Circular Economy is going to be exciting!
Mass Customization IS THE FUTURE

The rate of change is accelerating!
What the 3rd Industrial Revolution might look like

PUBLISHED IN 1995...

THE DIAMOND AGE

by

Neal Stephenson

A YOUNG LADY'S ILLUSTRATED PRIMER
Thank you.