Business Models for Open Fabrication and 3D Printing

Peter Troxler, Research Professor
Atoms are the New Bits
Chris Anderson, Wired, 2010

Factory@home
Hod Lipson, Melba Kurman, 2010

Kitchentable Industrialist
Anand Giridharadas, NY Times Magazine, 2011

Makers: The New Industrial Revolution
Chris Anderson, 2012
“Industrial Revolution”

There are a few problems with that term

• industrial revolutions
  – stable economies
    certainly 19th century, see Polany, The Great Transformation, 1944

• revolution
  – but not 100 % displacement
    or was that really a characteristic of political revolutions?
About 12,800,000 results (0.45 seconds)

**Industrial Revolution - Wikipedia, the free encyclopedia**

The **Industrial Revolution** was the transition to new manufacturing processes that occurred in the period from about 1760 to some time between 1820 and 1840.

Second Industrial Revolution - Life in Great Britain during the ...

**Child Labour & The Industrial Revolution - Nettlesworth Primary**

www.nettlesworth.durham.sch.uk/time/victorian/vindust.html

During the 1800s the **Industrial Revolution** spread throughout Britain. The use of steam-powered machines, led to a massive increase in the number of factories ...

**Images for "industrial revolution" - Report images**

**Industrial Revolution – Britannica Online Encyclopedia**

www.britannica.com/EBchecked/topic/287086/Industrial-Revolution

In modern history, the process of change from an agrarian, handicraft economy to one dominated by industry and machine manufacture. This process began in ...

**Industrial Revolution — History.com Articles, Video, Pictures and Fa...**

www.history.com/topics/industrial-revolution

End of the First Industrial Revolution in Britain in 1830.
12,800,000

1,820,000 blogs
17,300,000 videos
519,000 discussions
3,070,000 books

Industrial Revolution – Britannica Online Encyclopedia
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In modern history, the process of change from an agrarian, handicraft economy dominated by industry and machine manufacture. This process began in...
Industrial Revolution

• Neil Gershenfeld, 2005:
  Fab. The Coming Revolution on Your Desktop
• Jeremy Rifkin, 2011:
  The Third Industrial Revolution. How Lateral Power is
  Transforming Energy, the Economy, and the World.
• Chris Anderson, 2012:
  Makers: The New Industrial Revolution
• Peter Marsh, 2012:
  The New Industrial Revolution: Consumers,
  Globalization and the End of Mass Production
<table>
<thead>
<tr>
<th>Jeremy Rifkin</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; revolution</th>
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Video clip URL: https://vimeo.com/75203727 - Jeremy Rifkin: “This is power to the people ...”
source: http://ec.europa.eu/avservices/video/player.cfm?sitelang=en&ref=85716
Jeremy Rifkin

[T]he conventional top-down organization of society that characterized much of the economic, social, and political life of the fossil-fuel based industrial revolutions is giving way to distributed and collaborative relationships in the emerging green industrial era.

We are in the midst of a profound shift in the very way society is structured, away from hierarchical power and toward lateral power.

*Rifkin 2011, p. 36f.*
<table>
<thead>
<tr>
<th>1\textsuperscript{st} revolution</th>
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Automatic printing press
Steam-powered technology
19th century

2nd revolution
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<td>2nd revolution</td>
<td>3rd revolution</td>
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<tr>
<td>© 1907 E.A. Thomson</td>
<td>Butte-Silver Bow Public Library</td>
</tr>
</tbody>
</table>
3rd revolution

Internet

Renewable energy

21st century
• Icon
  steam engine > conveyor belt > 3D printer
• Actor
  capitalist > management consultant > maker
• Structure
  patriarchal > hierarchical > lateral
• Supply Chain
  colonial > global > continental / regional
• Transport
  railway > automobile & air travel > ???
• Cities
  crowded inner cities > suburbia > ???
• Social
  working class > middle class > ???
• Consumption
  consume > mass consumption > prosumer
• Media
  newspaper > radio > social media, UGC?

• Encyclopedia
  Diderot > Britannica > Wikipedia

• Software
  electromechanical (?) > proprietary > open source?

• Design
  craft > design > open design
BUSINESS MODELS
Value Proposition

Supplier: Proposition
- Product
- Service
- creates specific gain
- relieves specific pain

Customer: Value
- Activities
- Don't Do It Yourself
- receives specific gain
- reduces specific pain
Value Proposition

GAIN CREATORS

PRODUCTS & SERVICES

PAIN RELIEVERS

GAINS

CUSTOMER JOBS

PAINS

image © 2012 by Alex Osterwalder
Value Proposition

Supplier: Proposition
- Product
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Cost → Price
# Fab Lab Business Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Core Source of Funding</th>
<th>Value Proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidized</td>
<td>Funding Programme</td>
<td>Contribution to Funder's Objectives</td>
</tr>
<tr>
<td>Institutional</td>
<td>Institutional Budget</td>
<td>Contribution to Institution's Objectives</td>
</tr>
<tr>
<td>Prototyping</td>
<td>Companies</td>
<td>Specialist Facility and Expertise</td>
</tr>
<tr>
<td>Education</td>
<td>Educational Institutions, Individuals</td>
<td>Specific Types of (Technical) Education</td>
</tr>
<tr>
<td>Social</td>
<td>Social Institutions, Government</td>
<td>Interventions: (Re-) Qualification, -Integration</td>
</tr>
<tr>
<td>Incubator</td>
<td>Companies, Government</td>
<td>Specialist Facility and Community</td>
</tr>
<tr>
<td>Platform</td>
<td>Companies</td>
<td>Specialist Facility (and Possibly Market)</td>
</tr>
</tbody>
</table>
Pricing

• cost-based
  – machine cost 20,000; 10 years @ 400h
    = 5/h + consumables + repair
  – hourly salary

• target price
  – student course for an Arduino, 1 hour @ x
  – what would students do otherwise? drink beer.
    average expenditure per hour drinking beer? 20
  – x = 20
# Principal Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Financially</th>
<th>Financialally</th>
</tr>
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<tbody>
<tr>
<td>Machines</td>
<td>Investment</td>
<td>fixed / step</td>
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<tr>
<td>–</td>
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<td>fixed</td>
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<td>Cost (direct / indirect)</td>
<td>fixed</td>
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<td>Cost (indirect)</td>
<td>fixed / step</td>
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<tr>
<td>Insurance etc.</td>
<td>Cost (indirect)</td>
<td>fixed</td>
</tr>
<tr>
<td>Staffing</td>
<td>Cost (direct / indirect)</td>
<td>fixed / step</td>
</tr>
<tr>
<td>Consumables</td>
<td>Cost (direct / indirect)</td>
<td>variable</td>
</tr>
<tr>
<td>Material</td>
<td>Cost (direct)</td>
<td>variable</td>
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</table>
CASH FLOW
## Principal Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Type</th>
<th>Cash Flow</th>
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<td>Machines</td>
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Cash Flow
Cash Flow

input

output

prefinance
Cash Flow

input  →  prefinance  →  output

prefinance
Cash Flow

input → prefinance

output

prefinance

prefinance

prefinance
EXTENDING THE BUSINESS MODEL
The Business Model Canvas

- Partners
- Activities
- Resources
- Relationships
- Channels
- Segments
- Cost
- Revenue

conventional goods and services
societal and private values
• literacy
• peace
• equality
• …

conventional goods and services
non-monetary

societal and private values
- literacy
- peace
- equality
- ...

conventional goods and services

non-monetary
3D PRINTING
3D Printing

• manufacturing
• service (specialized 3D print shops)
• ...as part of a Fab Lab... (facility, see above)
• tools for manufacturing (e.g. molds)
• integration into delivery chain
• software
• materials