

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?*



"industrial revolution"



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[Industrial Revolution - Wikipedia, the free encyclopedia](#)

en.wikipedia.org/wiki/Industrial_Revolution

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 ...](#)

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[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

From the first cotton spinning machine to the steam engine, the Industrial Revolution began in 1733



"industrial revolution"



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...red in the period from

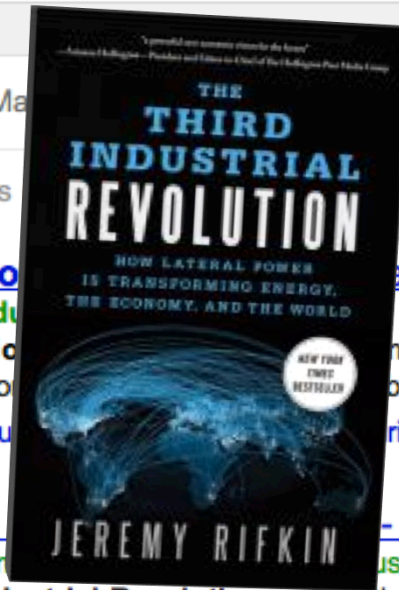
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www.history.com/topics/industrial-revolution

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

Jeremy Rifkin

1st revolution

2nd revolution

3rd revolution

Automatic
printing press

Electrical
communication

Internet

Steam-powered
technology

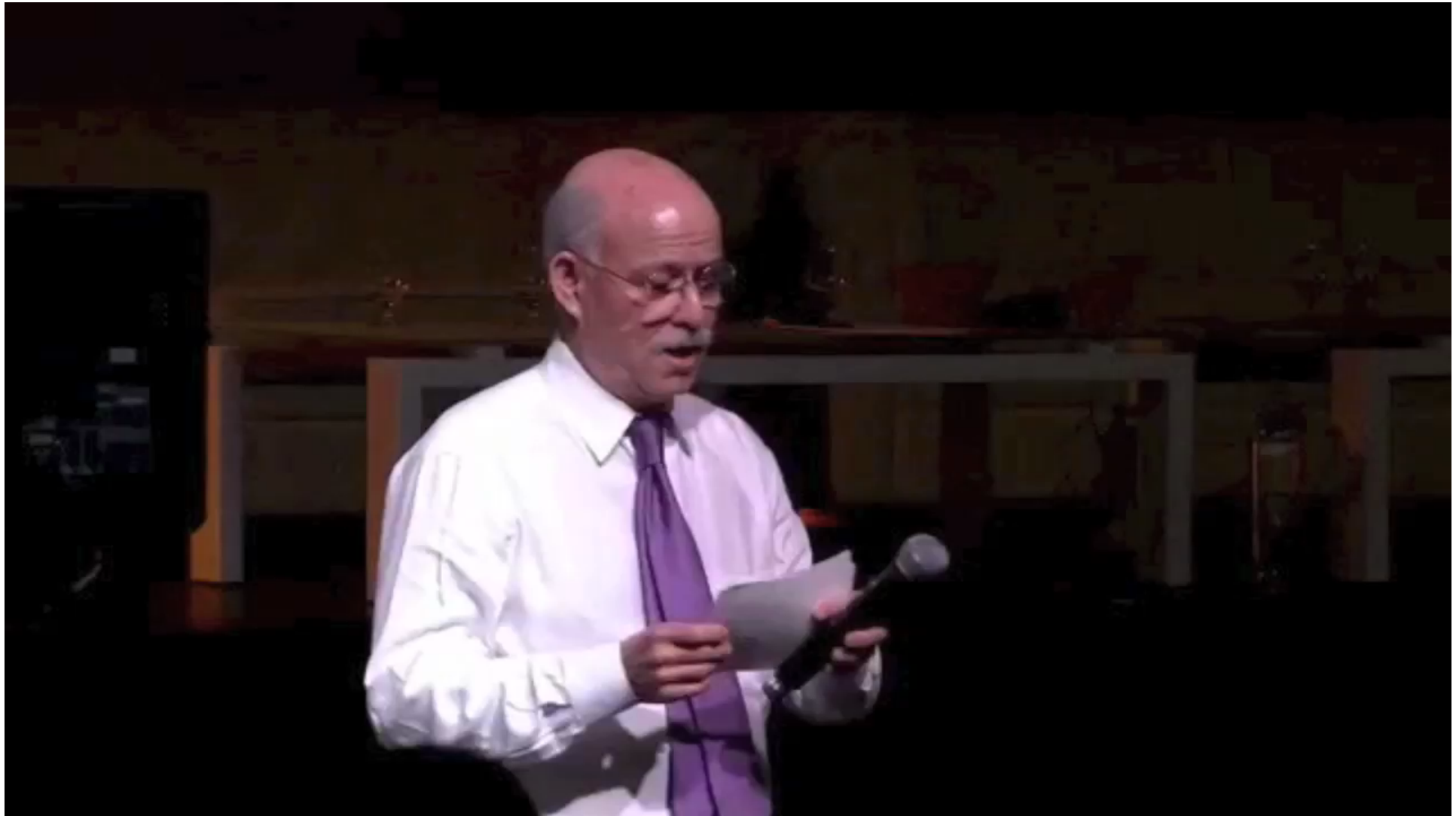
Oil-powered
combustion
engine

Renewable
energy

19th century

20th century

21st century



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.

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2nd revolution

Electrical
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Oil-powered
combustion
engine

20th century

3rd revolution

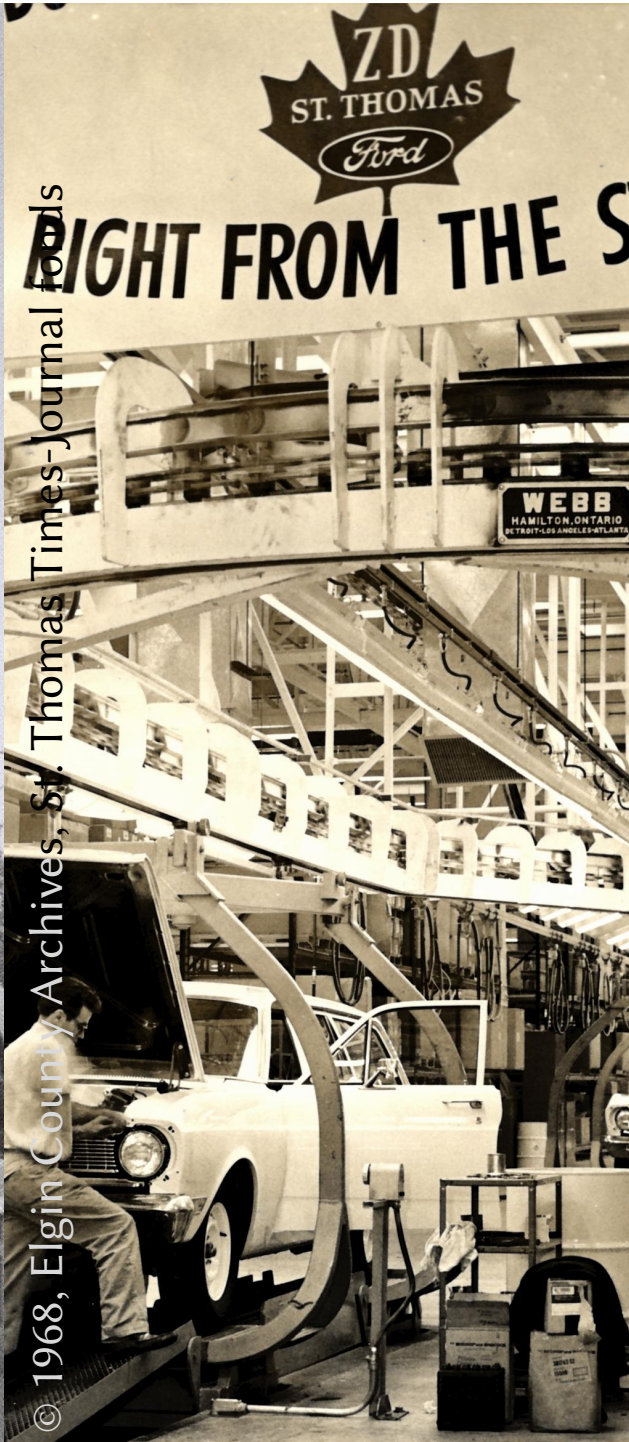
Internet

Renewable
energy

21st century



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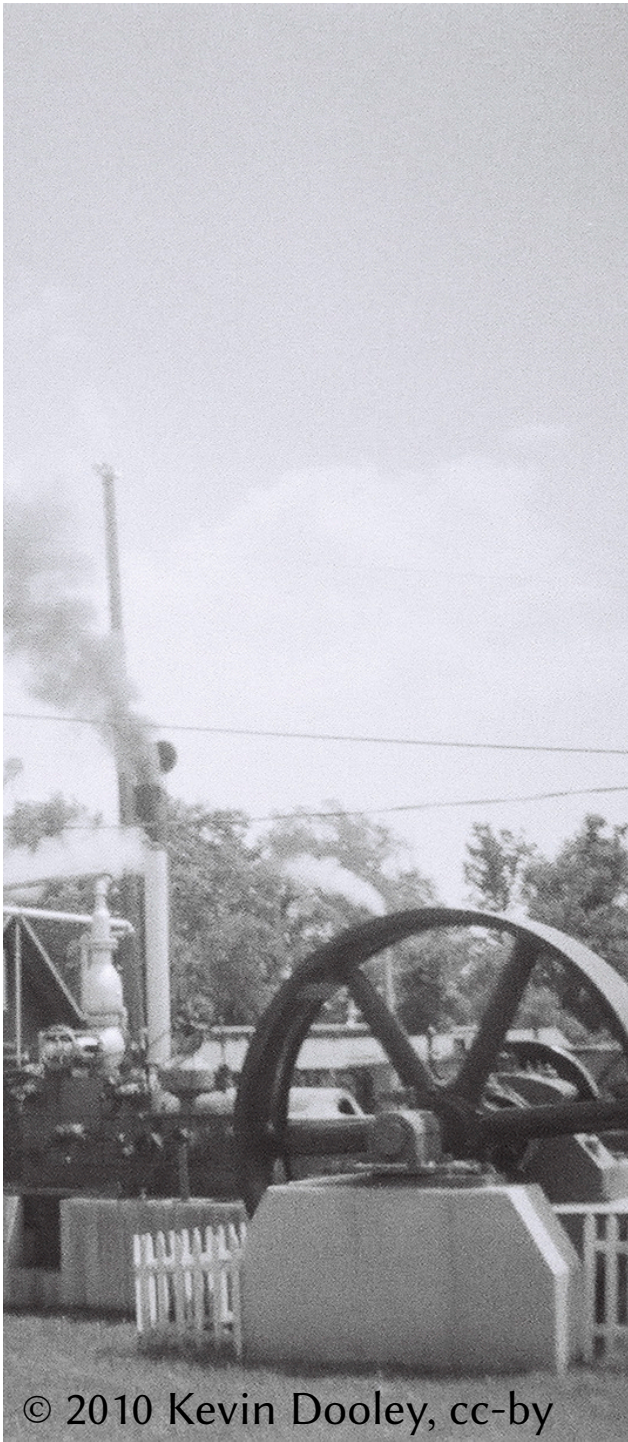
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3rd revolution

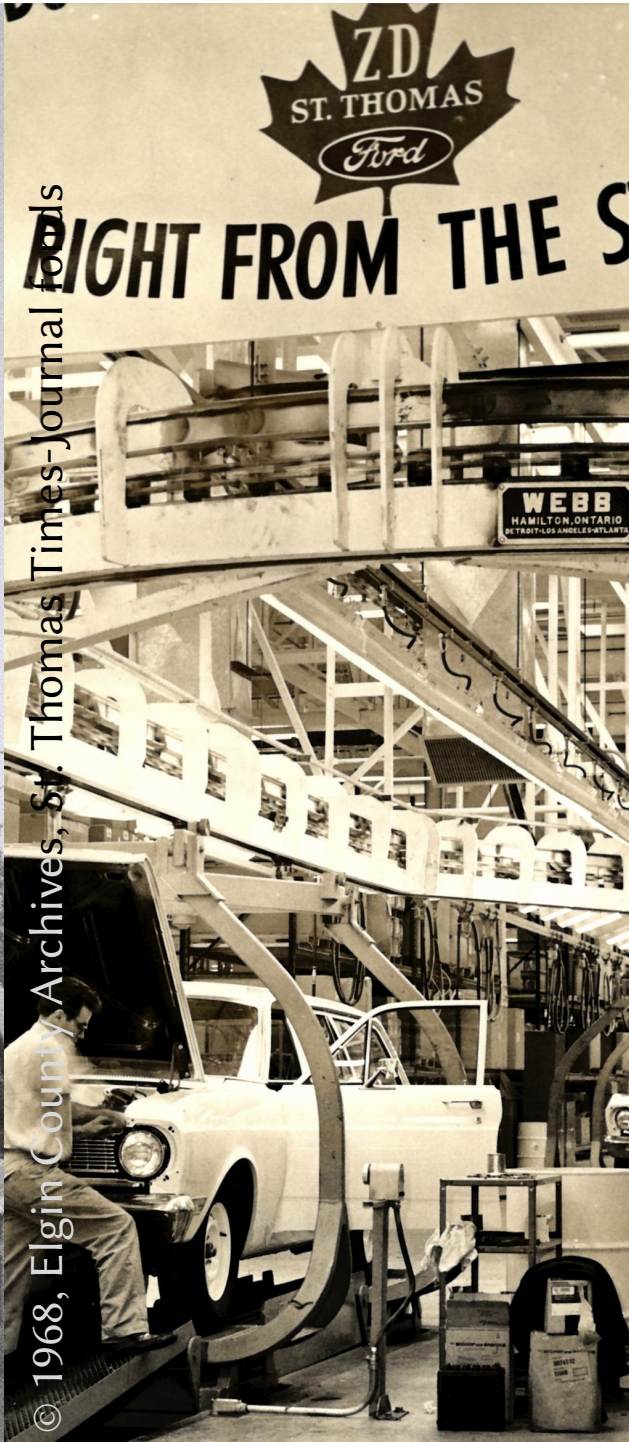
Internet

Renewable
energy

21st century



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E. W. KING,
Capitalist, Bozeman.

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- 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

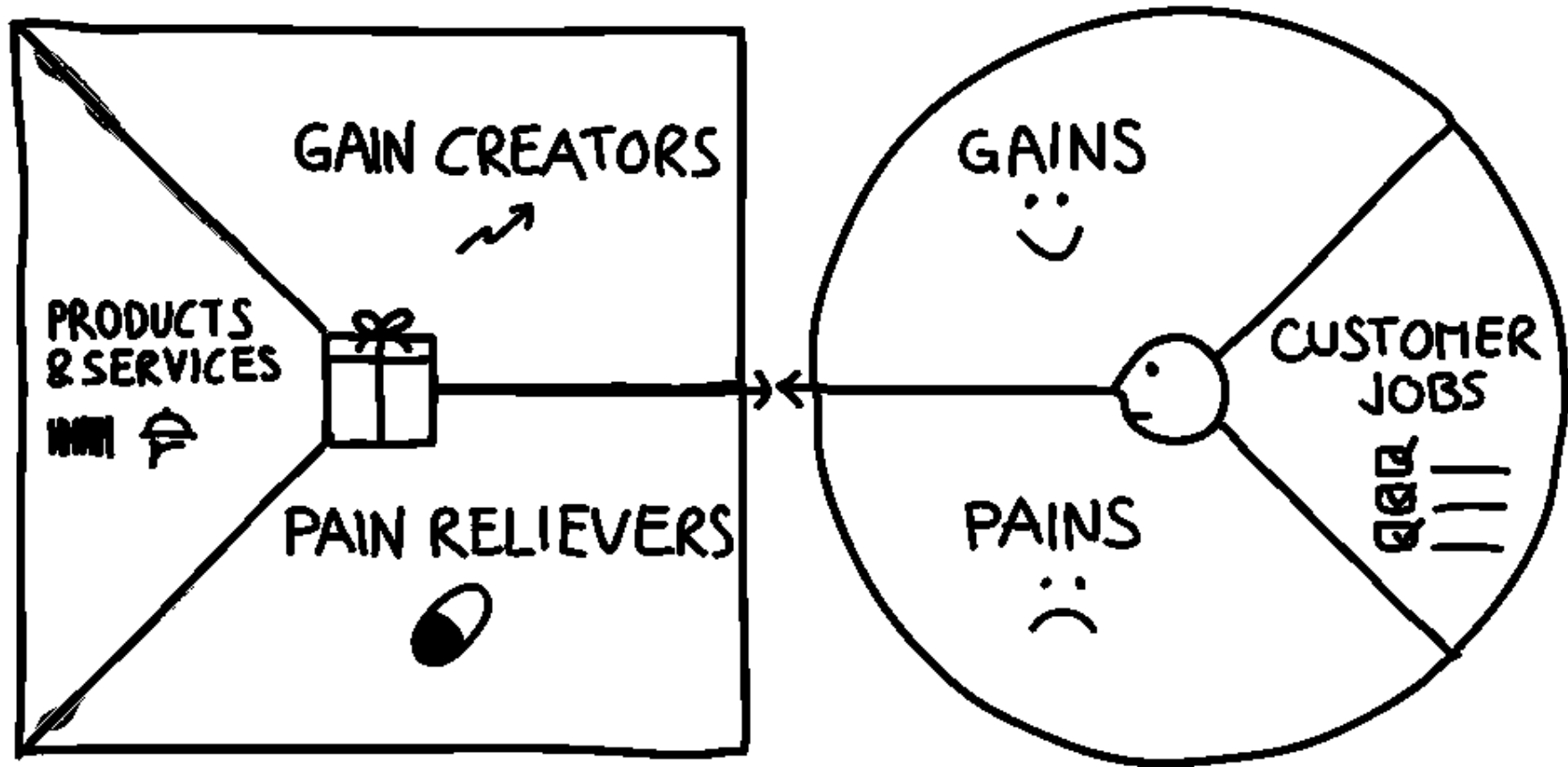
- creates specific gain
- relieves specific pain

Customer: Value

- Activities
- Don't Do It Yourself

- receives specific gain
- reduces specific pain

Value Proposition

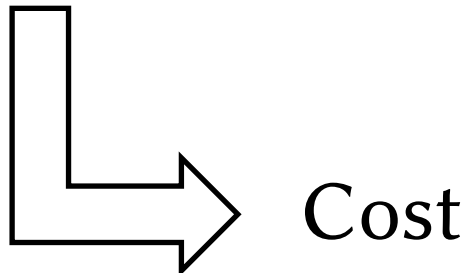


Value Proposition

Supplier: Proposition

- Product
- Service

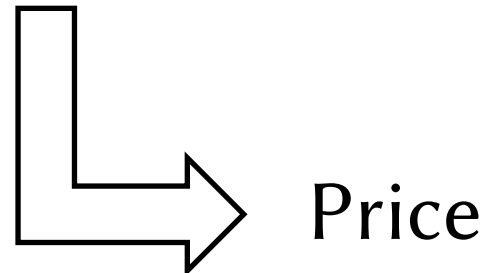
- creates specific gain
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Customer: Value

- Activities
- Don't Do It Yourself

- receives specific gain
- reduces specific pain



Fab Lab Business Models

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

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

Resource	Financially	
Machines	Investment	fixed / step
–	Leasing	fixed
Depreciation	Cost (direct / indirect)	fixed
Rent	Cost (indirect)	fixed / step
Insurance etc.	Cost (indirect)	fixed
Staffing	Cost (direct / indirect)	fixed / step
Consumables	Cost (direct / indirect)	variable
Material	Cost (direct)	variable








The Business Model Canvas

Designed for:

Designed by:

Date:

Iteration:

<h3>Key Partners</h3>  <p>Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>	<h3>Key Activities</h3>  <p>What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>	<h3>Value Propositions</h3>  <p>What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>	<h3>Customer Relationships</h3>  <p>What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our business model? How costly are they?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>	<h3>Customer Segments</h3>  <p>For whom are we creating value? Who are our most important customers?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>
<h3>Cost Structure</h3>  <p>What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>	<h3>Revenue Streams</h3>  <p>For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues?</p> <p>Business model canvas Business model generation Business model innovation Business model design Business model development Business model implementation</p>			

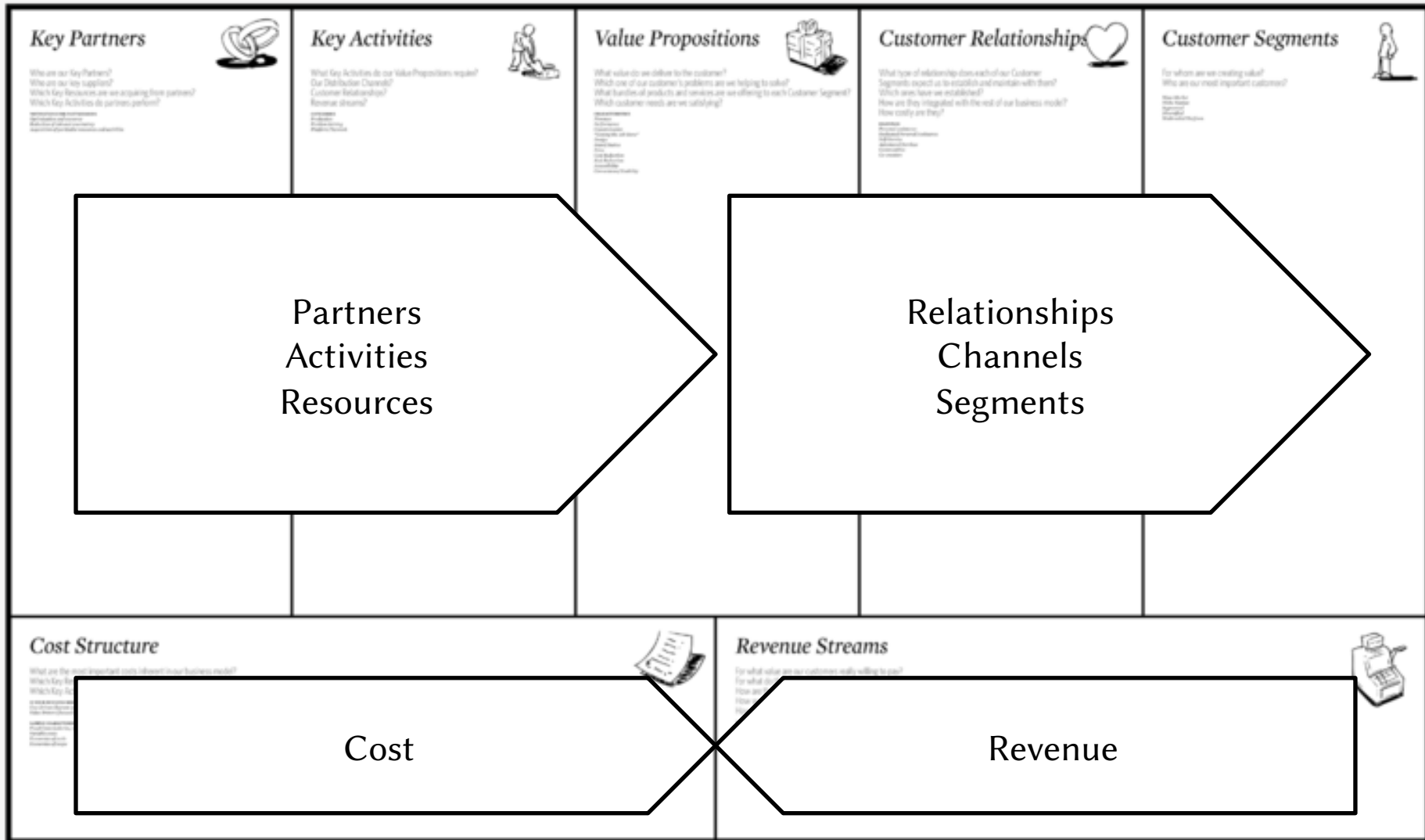
The Business Model Canvas

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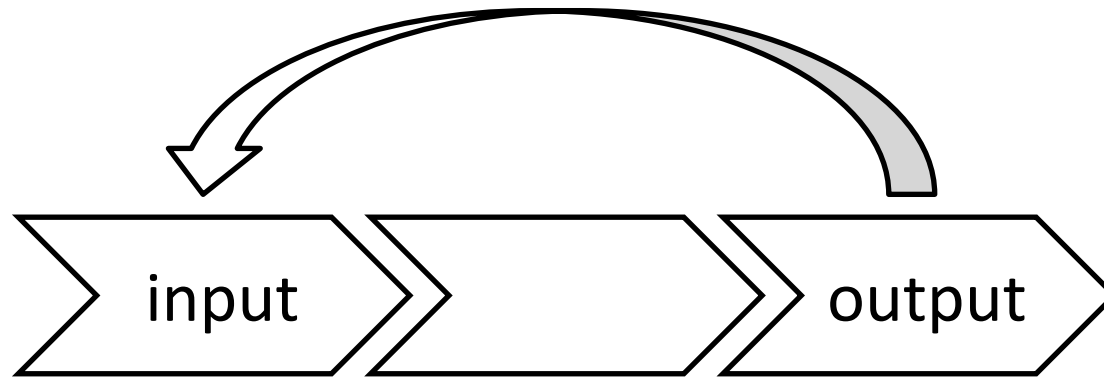


CASH FLOW

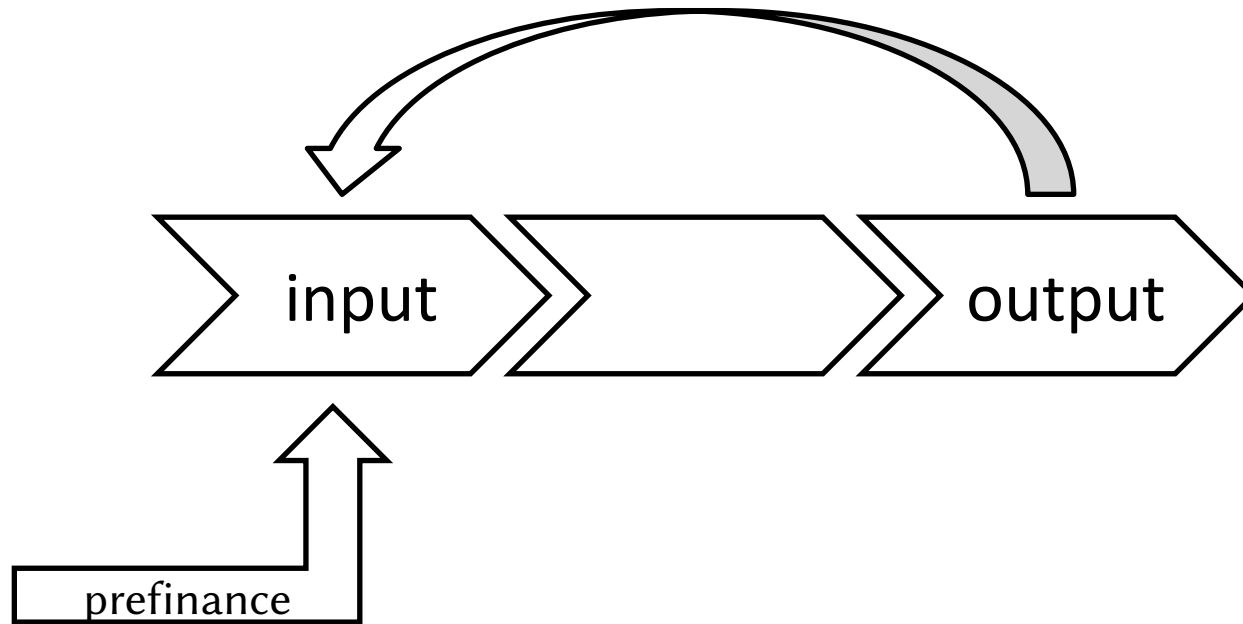
Principal Resources

Resource	Type	Cash Flow
Machines	Investment	Investing
–	Leasing	Operation
Depreciation	Cost (direct / indirect)	Operation
Rent	Cost (indirect)	Operation
Insurance etc.	Cost (indirect)	Operation
Staffing	Cost (direct / indirect)	Operation
Consumables	Cost (direct / indirect)	Operation
Material	Cost (direct)	Operation

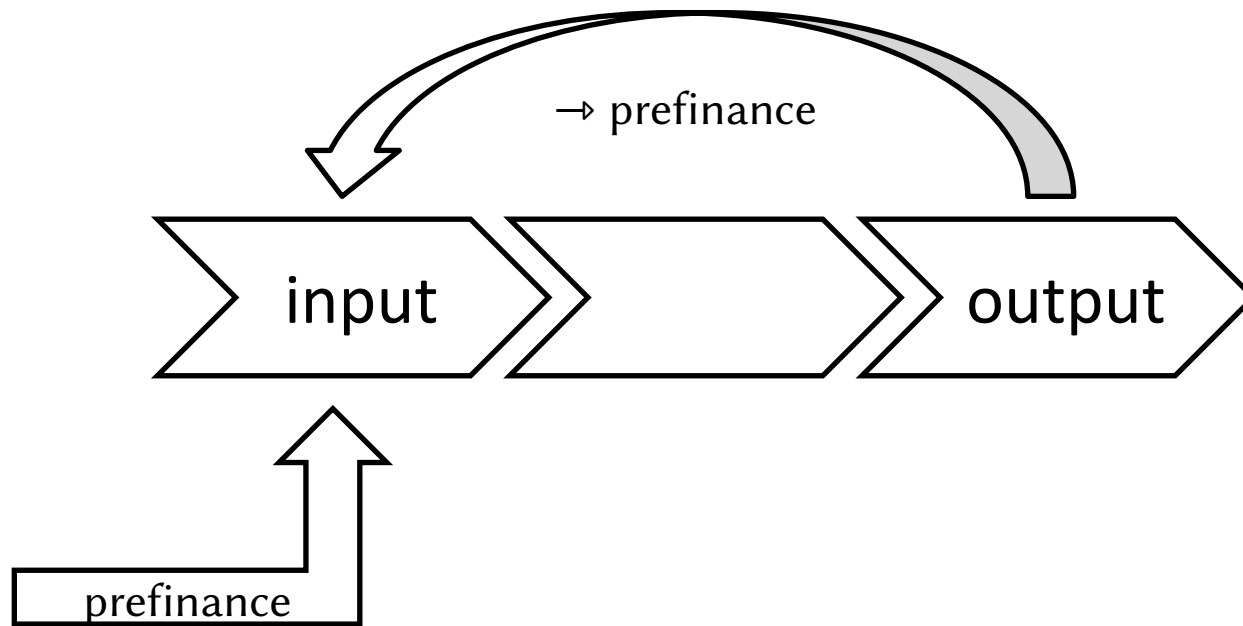
Cash Flow



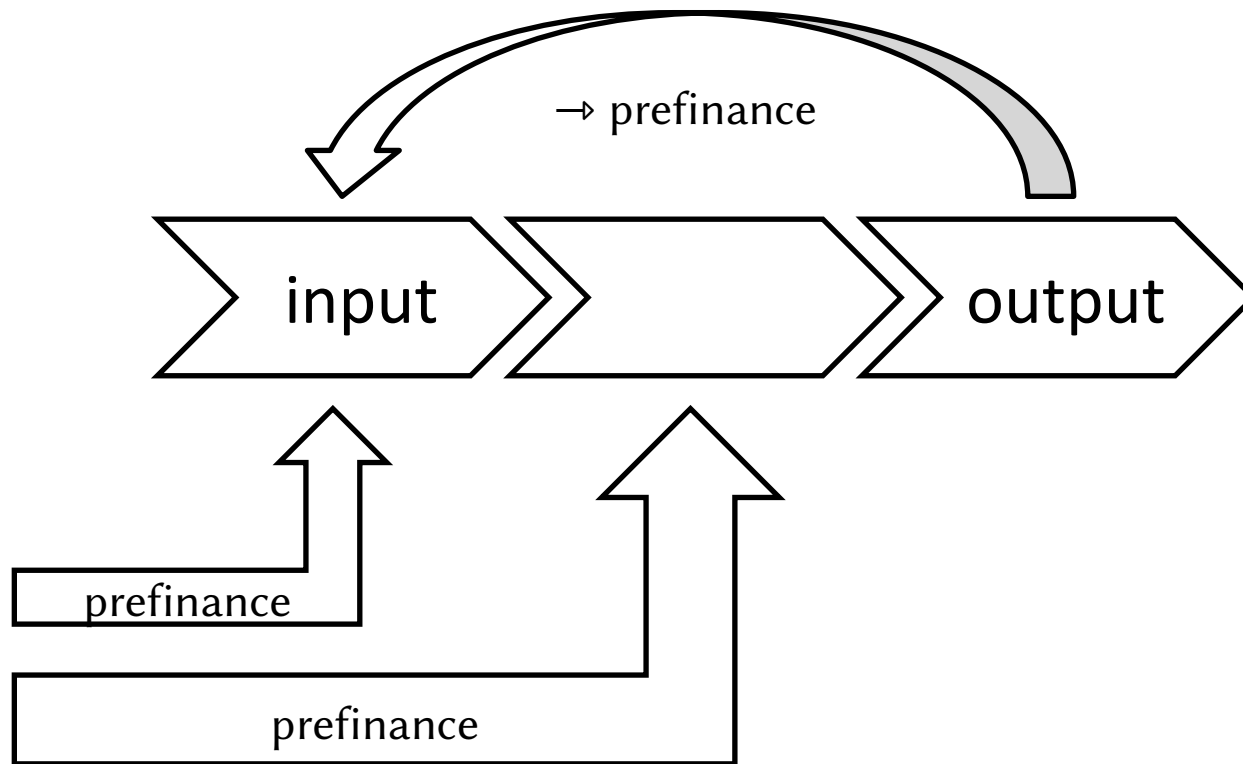
Cash Flow



Cash Flow



Cash Flow



EXTENDING THE BUSINESS MODEL








The Business Model Canvas

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Date:

Iteration:

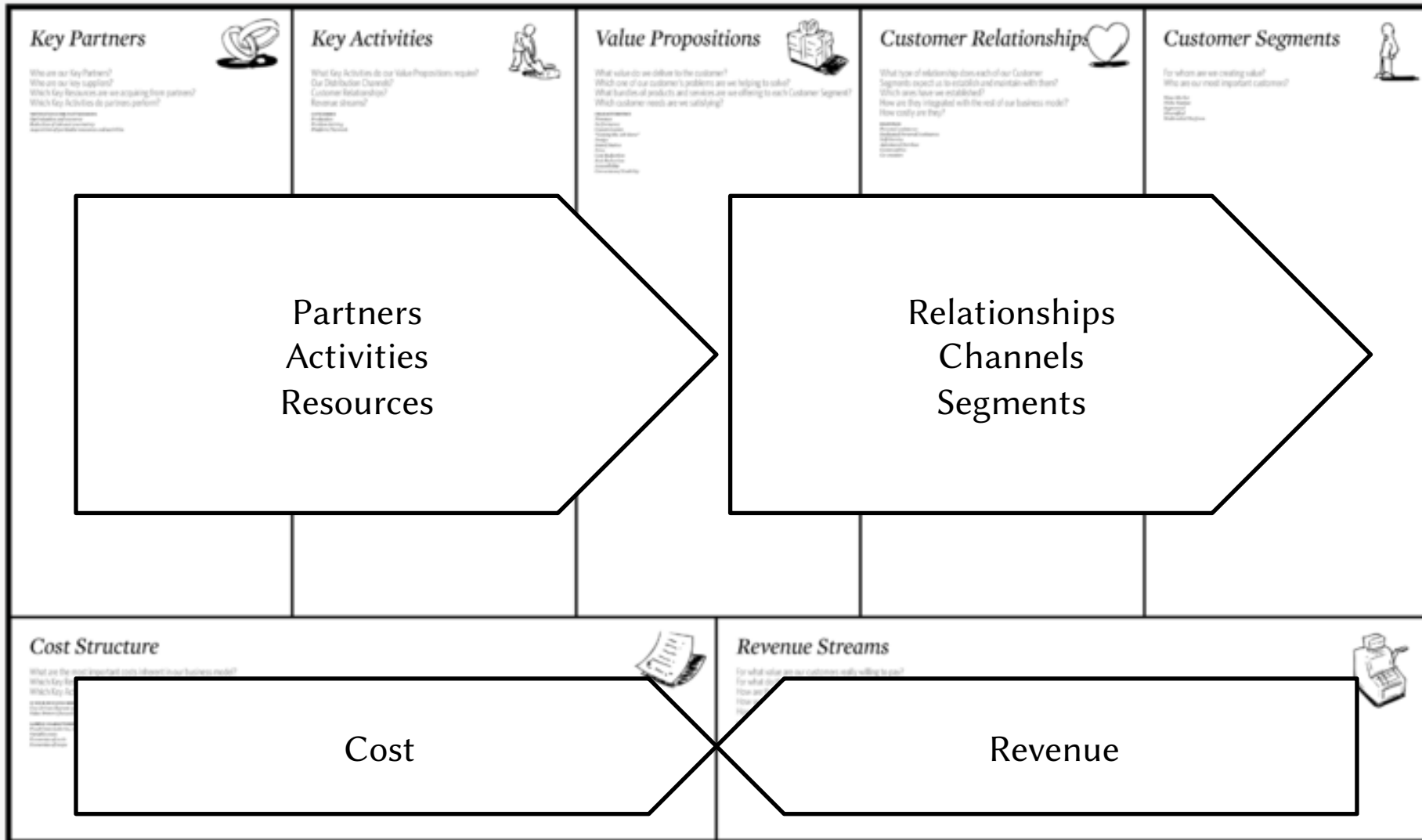
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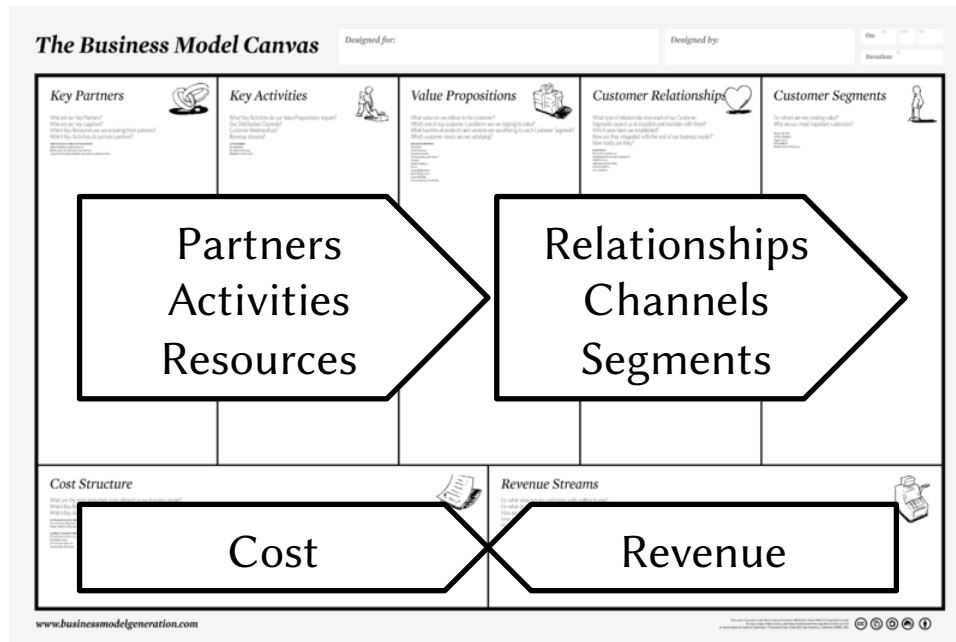
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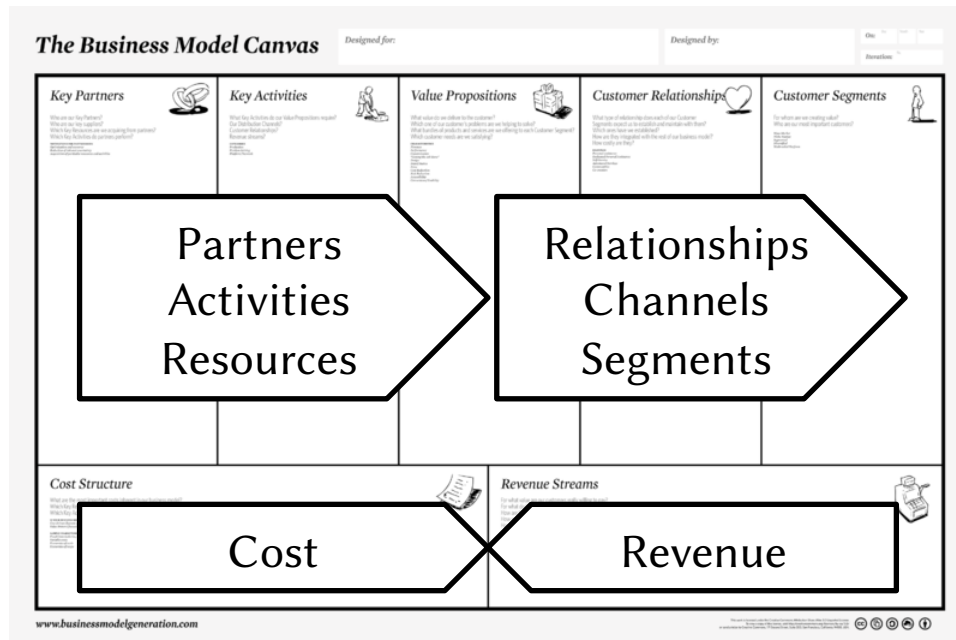
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conventional goods and services





societal and private values

- literacy
- peace
- equality
- ...

conventional goods and services

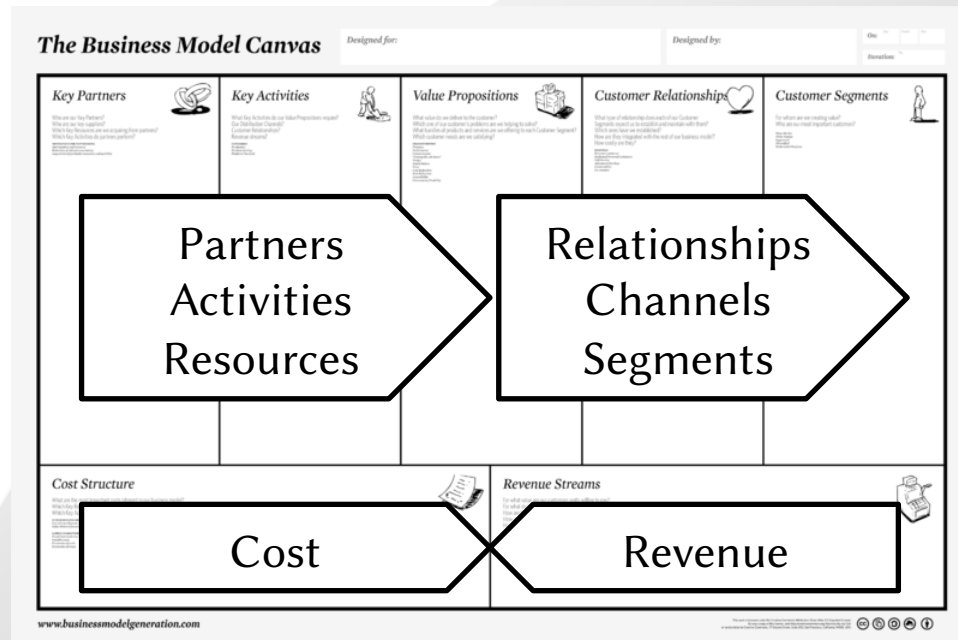


non-monetary

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