Promoting climate technology entrepreneurship through incubators and accelerators

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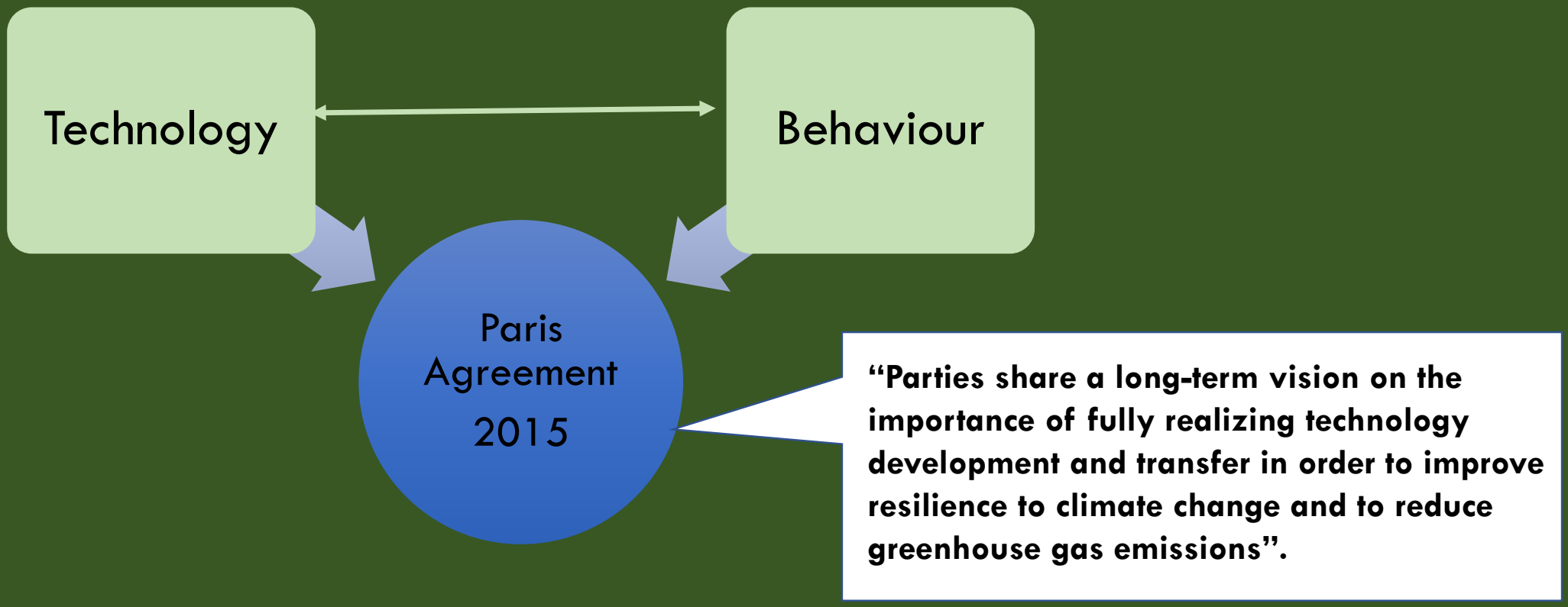
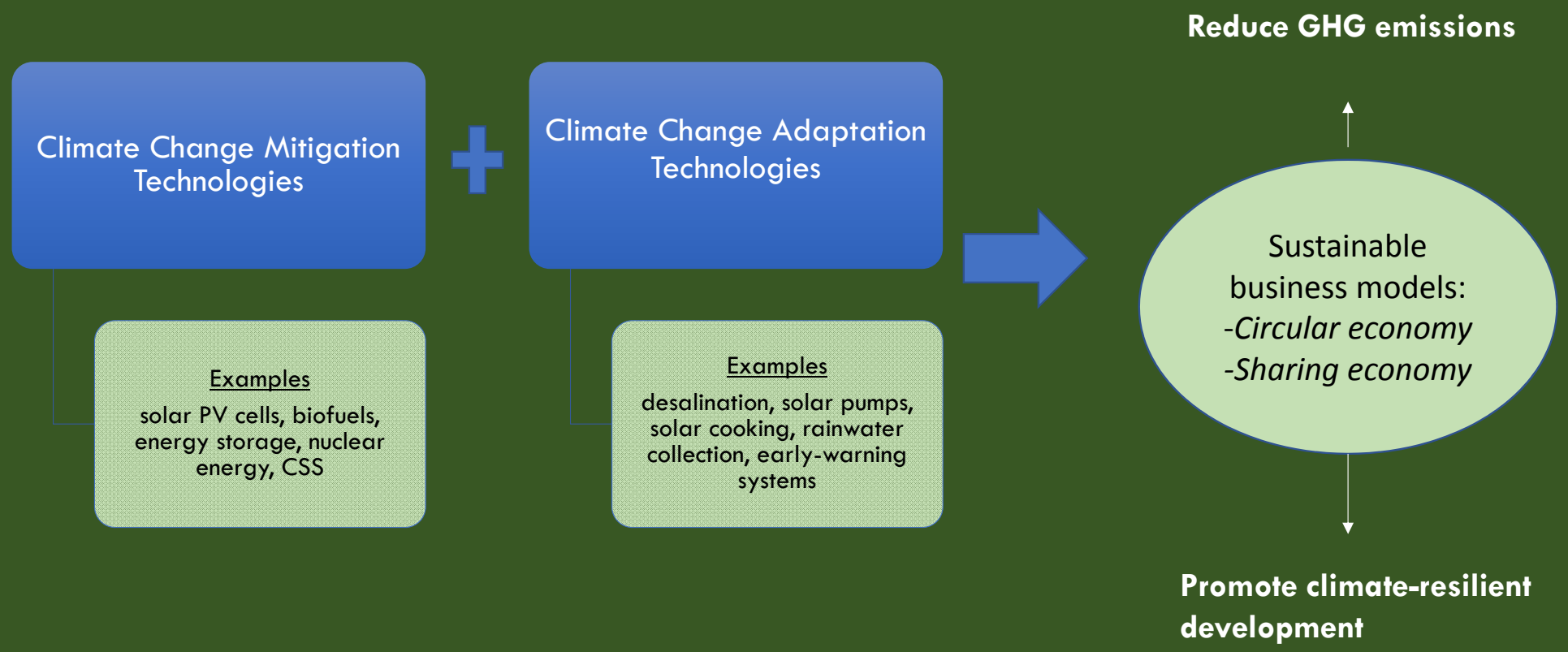
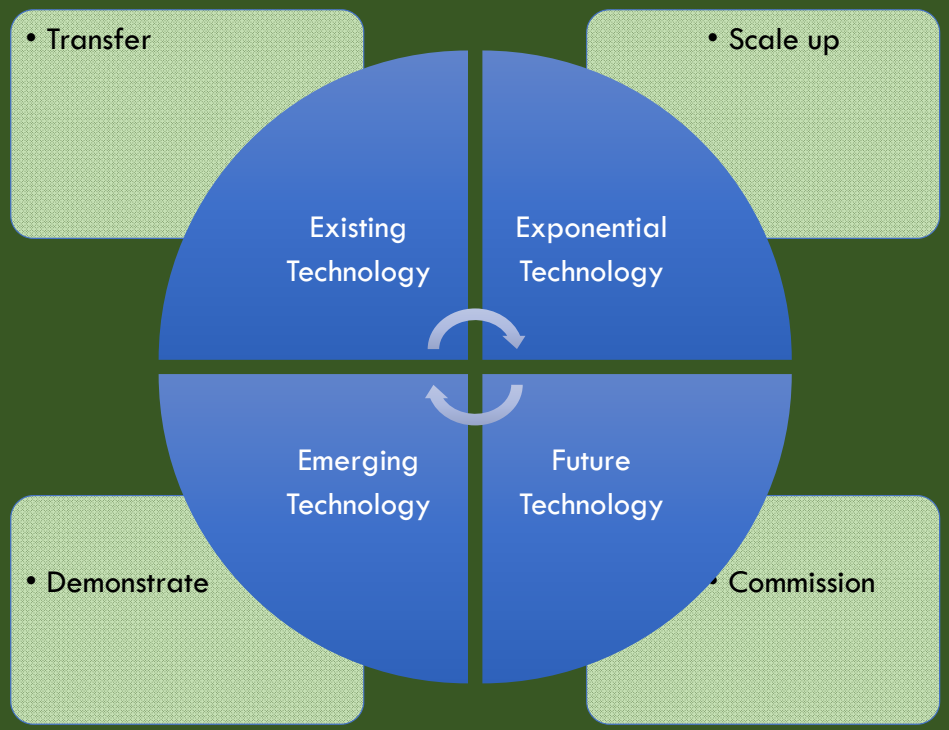
We need technology for combatting climate change



What can technology do?

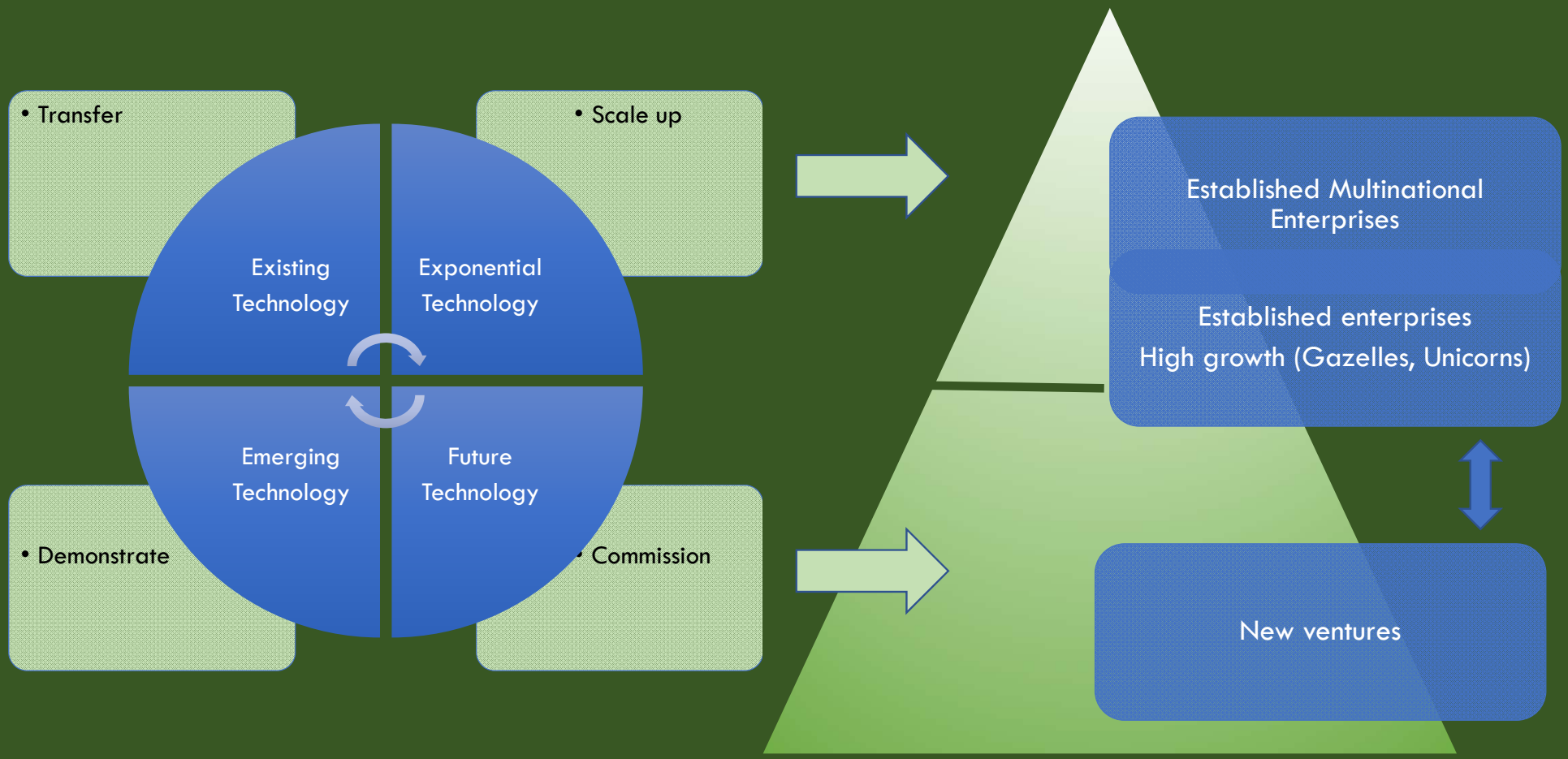


What is the challenge?



- We need to commission future climate technologies.
- We need to demonstrate emerging climate technologies
- We need to transfer existing climate technologies as far as possible.
- We need to scale up firms and generate exponential technologies for fast, high-impact.

What is the role of business?



What is the importance of new start-up ventures?

- Entrepreneurs find and illustrate appropriate technology.
- Often done best through new start-up ventures.
- We need these to
  - disrupt old-economy, carbon-intensive business models.
  - Adapt to the effects of climate change.

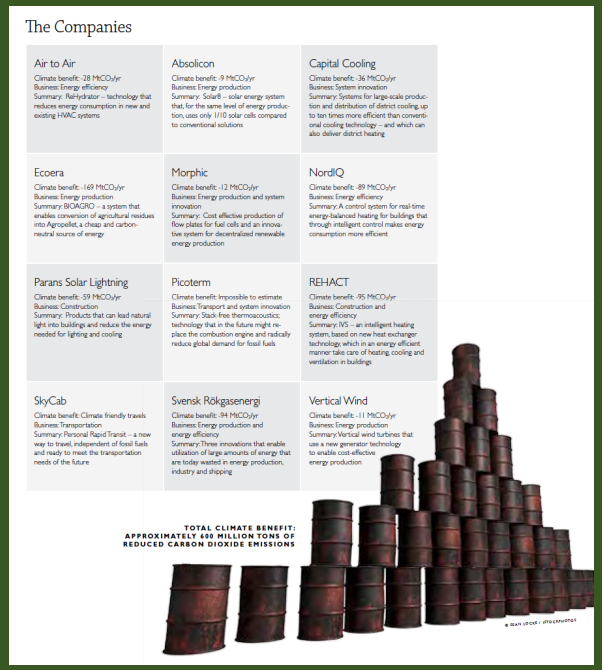
Example of using technology to adapt to climate change :
Zeromass Water is a start-up that has developed and commercialized solar panels that harvests and filters water from the vapour in the air.

What is the importance of new start-up ventures? More examples

Nest Labs [thermostat sensors for households] established 2010, and was bought by Google for US$ 3,2 billion in 2014.

Tesla Motors [electric vehicles] established 2003, went to market in 2010 with a IPO market value of US$ 1,6 billion.

What is the importance of new start-up ventures? More examples



The Companies

Air to Air
Climate benefit: -28 $MtCO_2/yr$
Business: Energy efficiency
Summary: Rel-hydrator – technology that reduces energy consumption in new and existing HVAC systems

Absolicon
Climate benefit: -9 $MtCO_2/yr$
Business: Energy production
Summary: Solar® – solar energy system that, for the same level of energy production, uses only 1/10 solar cells compared to conventional solutions

Capital Cooling
Climate benefit: -36 $MtCO_2/yr$
Business: System innovation
Summary: Systems for large-scale production and distribution of district cooling, up to ten times more efficient than conventional cooling technology – and which can also deliver district heating

Ecoera
Climate benefit: -169 $MtCO_2/yr$
Business: Energy production
Summary: BIOAGRO – a system that enables conversion of agricultural residues into Agropellet, a cheap and carbon-neutral source of energy

Morphic
Climate benefit: -12 $MtCO_2/yr$
Business: Energy production and system innovation
Summary: Cost effective production of flow plates for fuel cells and an innovative system for decentralized renewable energy production

NordIQ
Climate benefit: -89 $MtCO_2/yr$
Business: Energy efficiency
Summary: A control system for real-time energy-balanced heating for buildings that through intelligent control makes energy consumption more efficient

Parans Solar Lightning
Climate benefit: -59 $MtCO_2/yr$
Business: Construction
Summary: Products that can lead natural light into buildings and reduce the energy needed for lighting and cooling

Picoterm
Climate benefit: Impossible to estimate
Business: Transport and system innovation
Summary: Stack-free thermoacoustics; technology that in the future might replace the combustion engine and radically reduce global demand for fossil fuels

REHACT
Climate benefit: -95 $MtCO_2/yr$
Business: Construction and energy efficiency
Summary: IVS – an intelligent heating system, based on new heat exchanger technology, which in an energy efficient manner take care of heating, cooling and ventilation in buildings

SkyCab
Climate benefit: Climate friendly travels
Business: Transportation
Summary: Personal Rapid Transit – a new way to travel, independent of fossil fuels and ready to meet the transportation needs of the future

Svensk Rökgasenergi
Climate benefit: -94 $MtCO_2/yr$
Business: Energy production and energy efficiency
Summary: Three innovations that enable utilization of large amounts of energy that are today wasted in energy production, industry and shipping

Vertical Wind
Climate benefit: -11 $MtCO_2/yr$
Business: Energy production
Summary: Vertical wind turbines that use a new generator technology to enable cost-effective energy production

TOTAL CLIMATE BENEFIT:
APPROXIMATELY 600 MILLION TONS OF
REDUCED CARBON DIOXIDE EMISSIONS

- These 12 climate entrepreneurs' start-ups can reduce GHG by 600 million tons annually:
- ***`equal to the total combined annual emissions of Australia, Argentina and Belgium'*** (p.4).

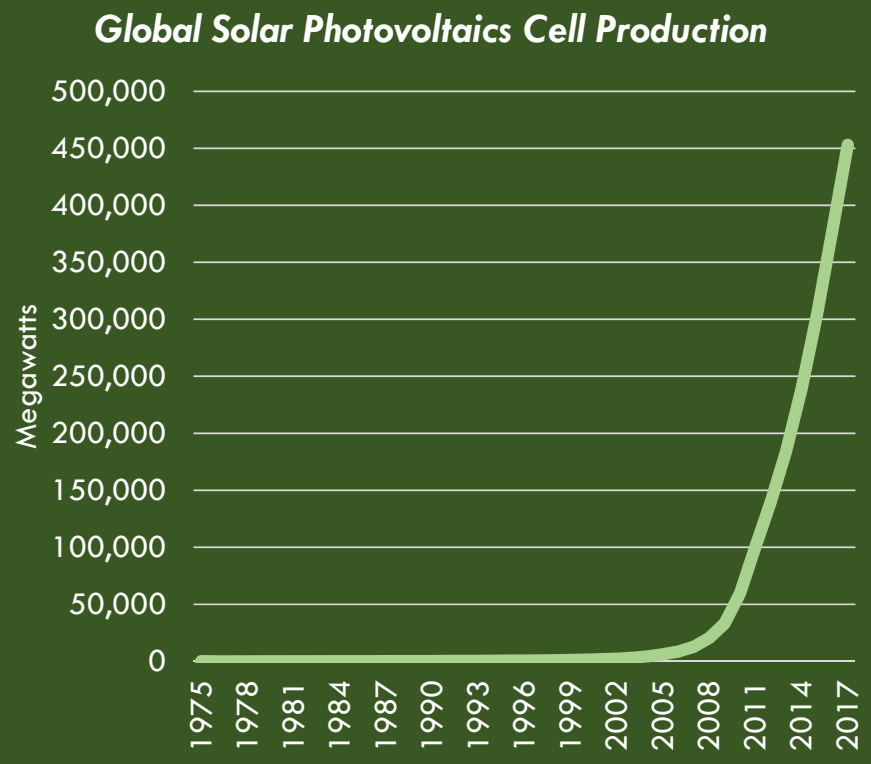
How big is the entrepreneurial opportunity?

- Global market for clean energy : US$ 325 billion
- Market for biotechnology : US$ 80 billion
- Market for mitigation and adaptation in developing countries: US$ 23 trillion
- Market for `green' infrastructure: US$5,7 trillion
- Huge opportunity for Africa:
  - `Africa has nine times the solar potential of Europe and an annual equivalent to one hundred million tons of oil' (Diamandis and Kotler, 2012:157)

Huge opportunity in Africa? Drones can help in adaptation through for instance in raising agricultural productivity, remote sensing, improving healthcare services, and transportation.

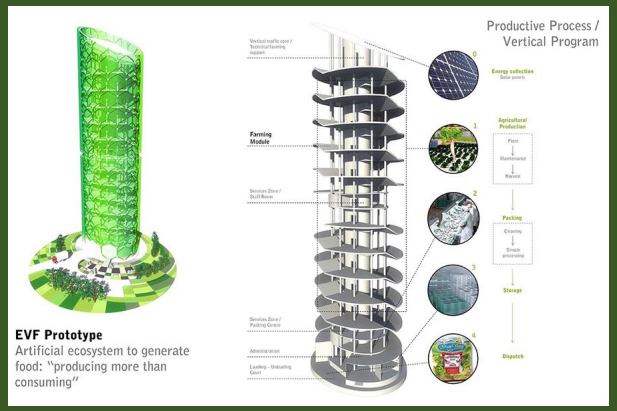
What is the importance of scaling up?

- Most start-ups fail
- There are many technological dead-ends
- 1/1000 may however result in an exponential technology: scalable, with significant impact over a short time.
- For example: Solar PV as exponential technology. Its adoption is driving by economics, not political and other sentiments.
- This is what is needed in combatting climate change.



Potential exponential technologies for use in adaptation to climate change (examples)

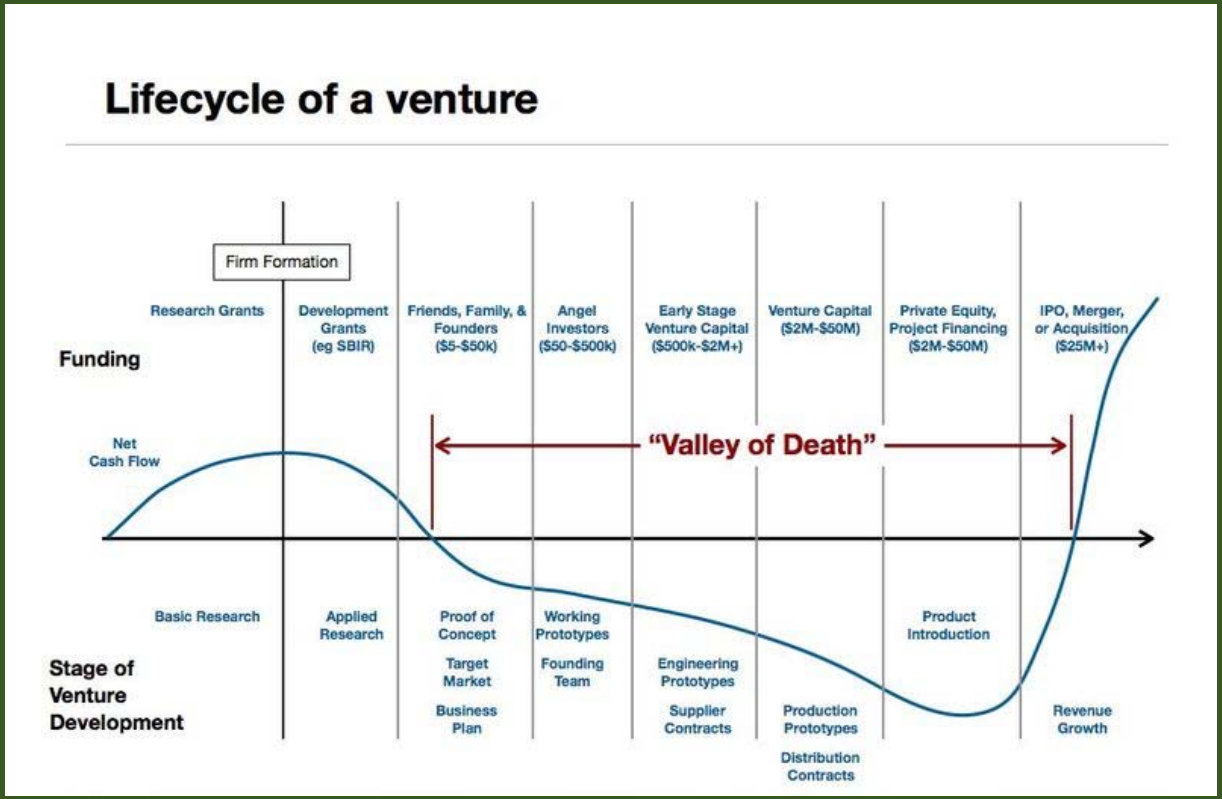
Potential exponential technology	Examples for climate change adaptation in developing countries
Artificial intelligence and big data based on energy-efficient neural networks	Smart farming e.g. crop monitoring and automatic crop disease detection. Vertical agriculture: computerized factories for food production. Automation and acceleration of threat detection and analysis. Voice recognition for secure and targeted social protection.
Robotics	Unmanned aerial vehicles (drones) for remote sensing, advanced warning systems, livestock monitoring, aid and distribution and emergency assistance.
Biotechnology	Molecular crop breeding for better drought, salinity and pest resistance.
FinTech / ICT	Insurance and social protection against climate change induced damages. Blockchain for land registries and land improvement. Submarine telecommunication cables for weather and tsunami warnings. eHealth
Renewable energy	Creating water out of thin air.



What are the obstacles?

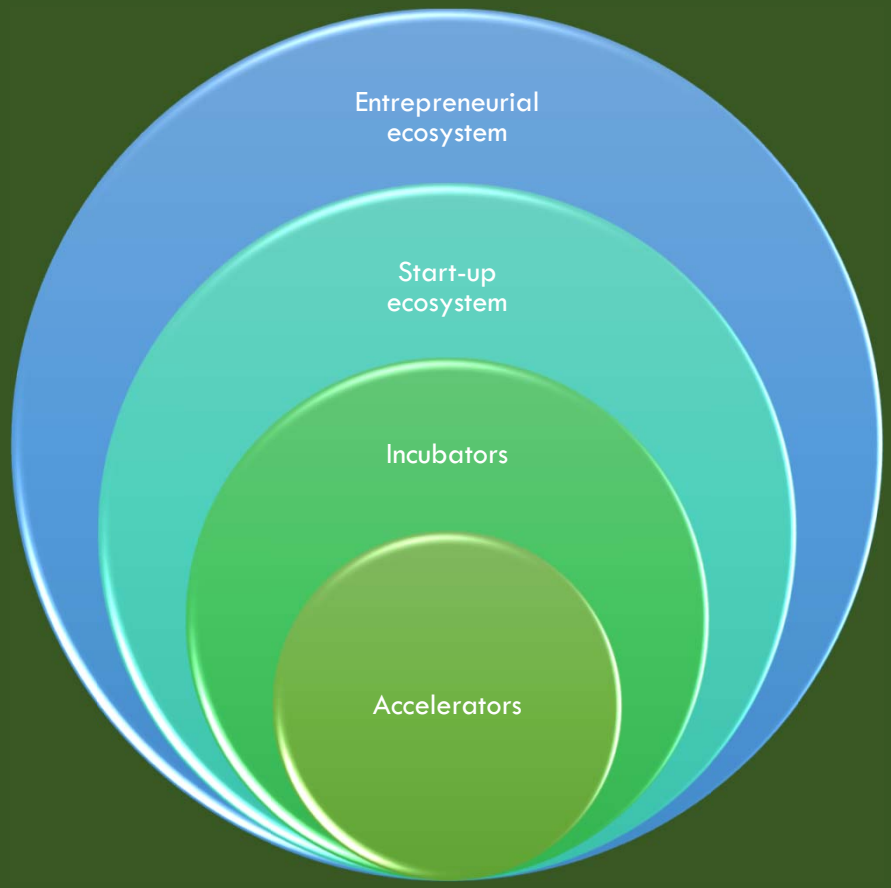
"only around 1 to 2 percent of inventions are generally reckoned to reach the market and generate commercial benefits" (Braunerhjelm et al., 2010:107).

- **High fixed costs in the RD&D phase**
- **High risks in the commercialization phase**
- **Failures in the markets for environment and technology = Double externality**
- **Asymmetric information**
- **Most start-ups and firms eventually just fail !**



Start-up Ecosystems strive to get new start-ups through the "Valley of Death"

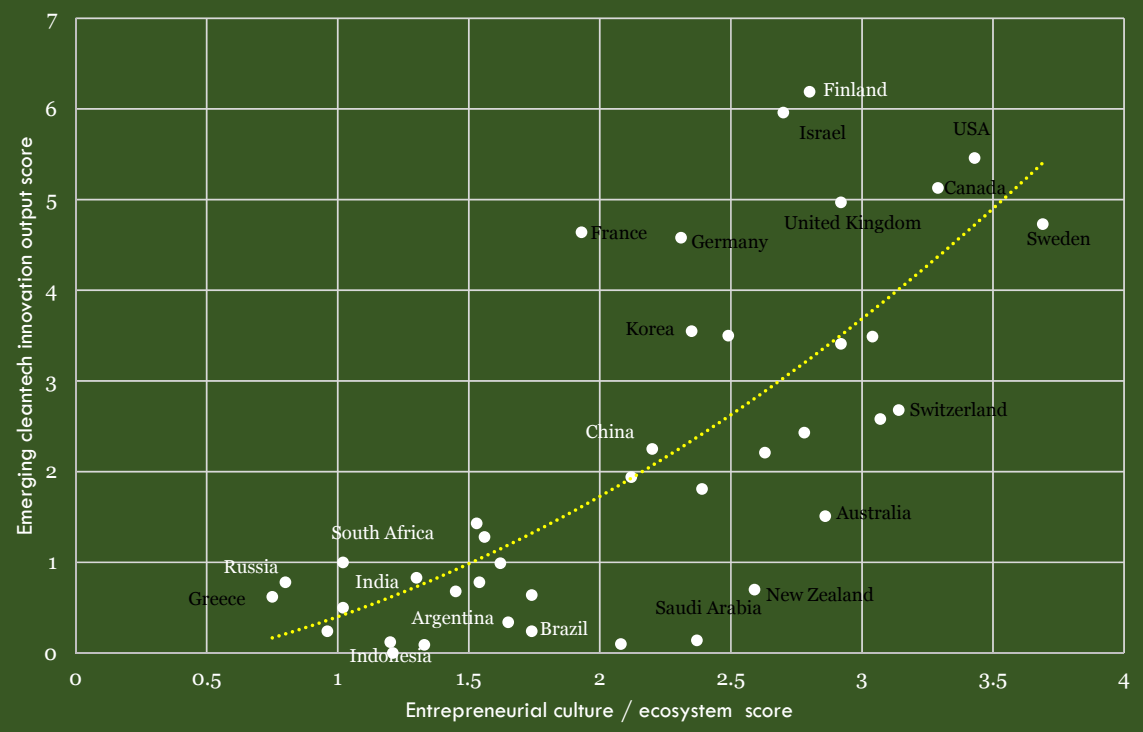
How can climate entrepreneurship best be supported?



Entrepreneurial ability

Entrepreneurial equity finance

Entrepreneurial ecosystems and climate entrepreneurship



Countries with a better entrepreneurial ecosystem also tend to generate more cleantech entrepreneurship

The Entrepreneurial Ecosystem

Objectives

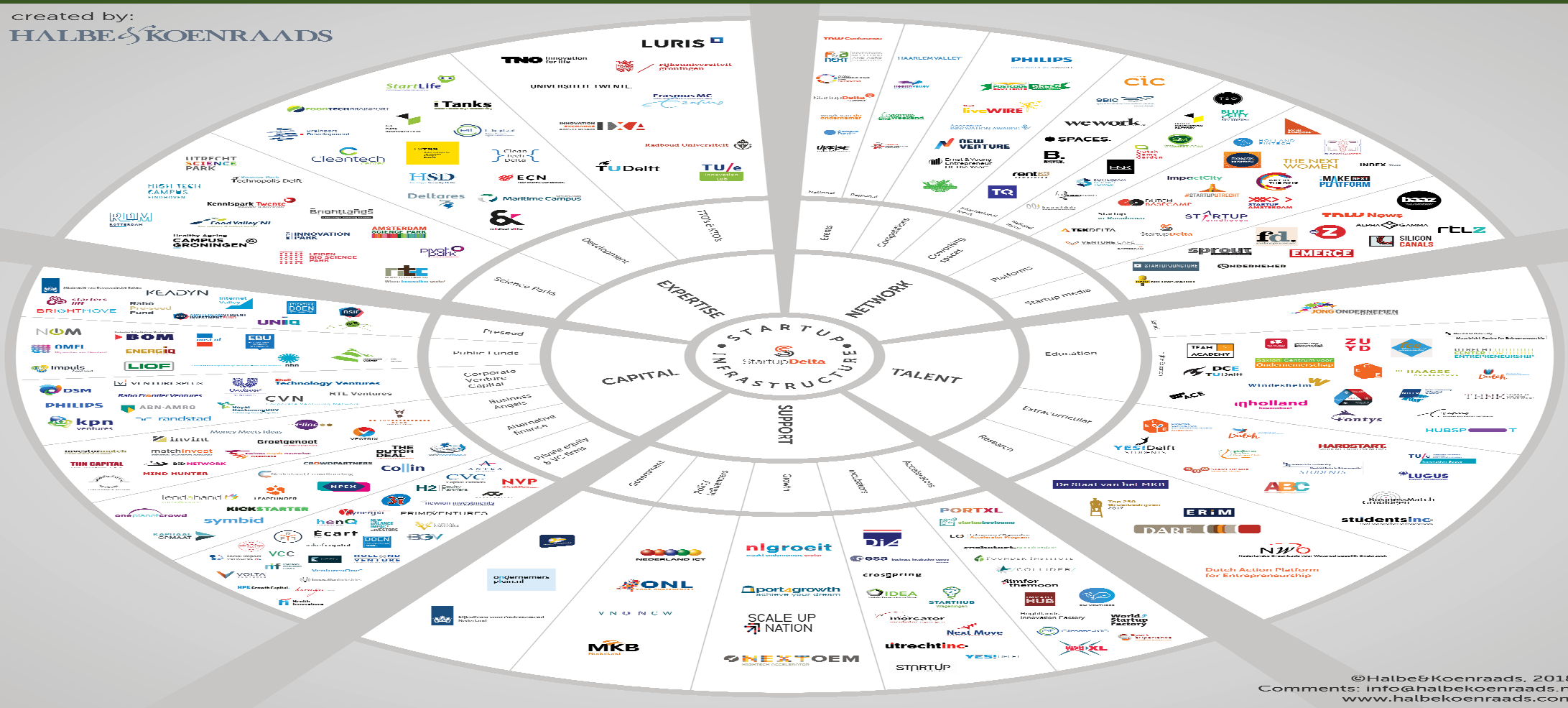
1. Technological development and transfer facilitate
2. Improve position of entrepreneur in broader innovation system (*to raise the demand for venture capital*)
3. Raise the *supply of venture capital*
4. Rules, Regulations (governance)
5. Ethical norms and conduct (governance)
6. Global coordination of rules and regulations (governance)
7. Optimize place-specific assets
8. Generate more start-ups! (start-up ecosystem)

`sets of actors, institutions, social networks, and cultural values that produce and sustain entrepreneurial activity' (Roundy et al., 2018:1).

"innovation doesn't come just from giving people incentives; it comes from creating environments where their ideas can connect" -Steven Johnson, *2010. Where Good Ideas Come From: A Natural History of Innovation*

The Start-up Ecosystem - example

created by:
HALBE&KOENRAADS



Comments: info@halbekoenraads.nl
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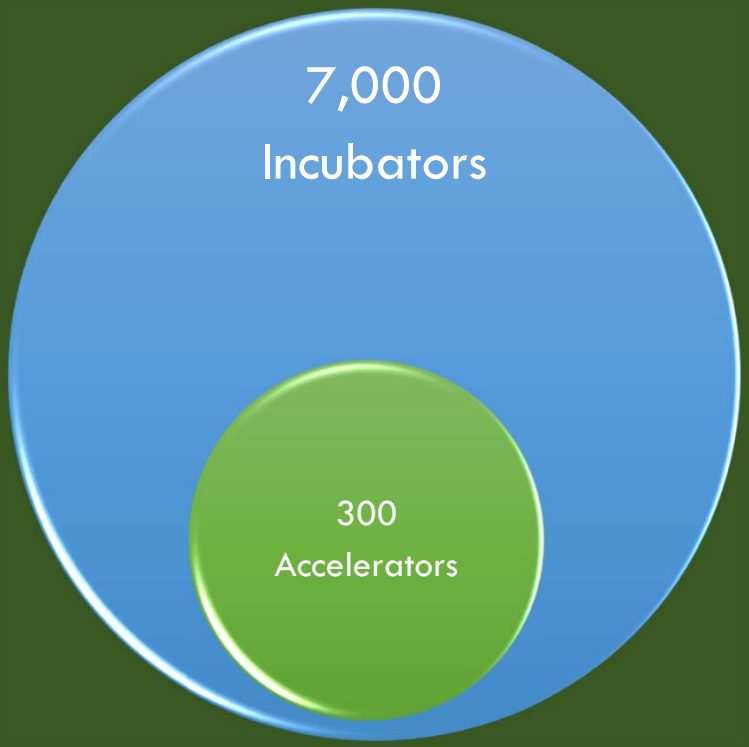
Visualization of the Dutch Start-up Ecosystem

What are incubators and accelerators?



Incubating new firms

Shared office space	Support services (marketing, finance, technical)	**R&D support (innovation hub)**
Diverse sectors	Longer term duration (3-5 yrs)	Networking
Access to financiers / [larger amounts]	Rental fees and subsidies (non-profit)	Corporate incubators
Process oriented (strong selection)	Mentoring	Team participation
High-tech / digital specialized sectors	Short-term duration (3 - 6 months): rapid exit or failure the goal.	Networking
Access to financiers / [small amounts]	Take an equity stake (for profit)	Corporate accelerators

Incubators and accelerators compared -1

1. Incubators are a tried and tested model of start-up support that has been around for more than 50 years.
2. There are over 7,000 incubators in the world, in virtually every country.
3. Incubators tend not to be as sharply focused.
4. Incubators do not request or commission future tech.
5. Incubators may be better suited for very early-stage start-ups that need nurturing of the idea.
6. Incubators generate their revenue from rentals, services, and from government subsidies.

Incubators and accelerators compared -2

Start-up accelerators originated in Silicon Valley in 2005 to match high volumes of Venture Capital with opportunities in the digital economy, where technology cycles are short and scale-up opportunities huge.

The first accelerator, Y-Combinator, generated Unicorns such as AirBnB, Dropbox, Reddit, etc.

1. Accelerators are a new model of start-up support that is still evolving and being adapted.
2. There are around 300 accelerators in the world, and relatively fewer in developing countries.
3. Accelerators have a strong focus on high-tech and many are specialized in a industry.
4. Some accelerators make a “Request for startups” identifying needs, i.e. commissioning future tech.
5. Accelerators generate their revenue from equity stakes and private sector support rather than government, or rental income.

Incubators and accelerators compared -3

1. Incubators provide 3-5 years support to start-ups.
2. Incubators do not rigorously select entrepreneurs.
3. Incubators do not spend much focus on the ability of the entrepreneur, more on the product design.
4. Incubators are criticized for keeping zombie firms alive too long.
5. Incubators tend to be burdened by political considerations and interference.
6. Quality and impact of incubators vary significantly.
7. Incubators may be more sustainable, but less effective.
8. Incubators tend to compete with one another.

There is a lack of research and impact assessments of incubators and accelerators. This is bedeviled by heterogeneity in governance and objectives, in lack of (comparable) data, the relevant novelty of accelerators, and in the complexity of the topic under scrutiny.

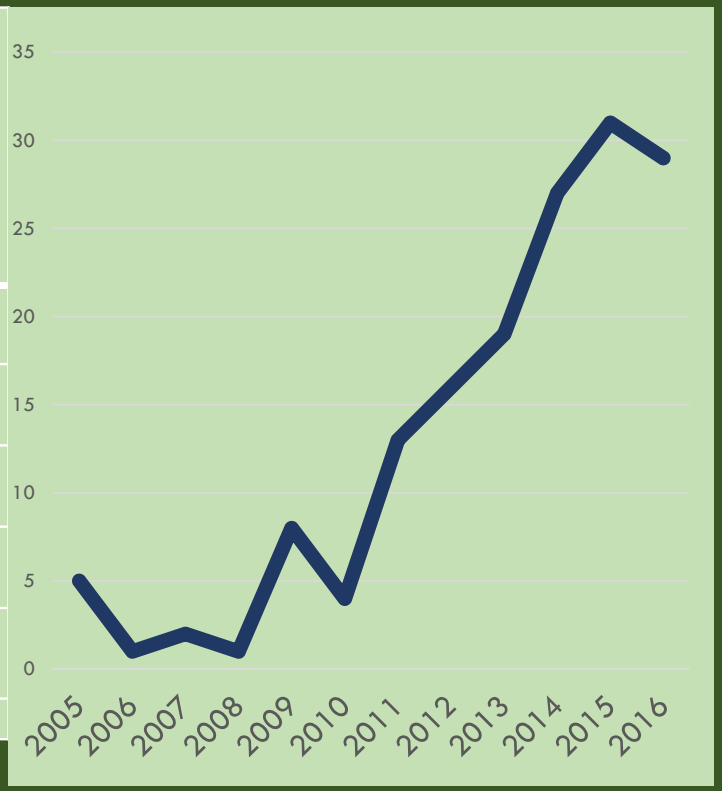
Incubators and accelerators compared -2

1. Accelerators provide 3-6 months of support.
2. Accelerators apply rigorous selection criteria.
3. Accelerators spend most focus on mentoring.
4. Accelerators aim to kill off unprofitable ideas fast.
5. Accelerators face less political interference, but risk of exploitation due to little regulation.
6. Accelerators have little influence on policy / entrepreneurial ecosystem
7. Quality and impact of accelerators vary significantly.
8. Sustainability of many accelerators can be questioned.

an innovation strategy is even more uncertain than playing a lottery, because it is a game of chance in which neither the probability nor the prize can be known for sure in advance' - Coad and Rao, 2008:646

Accelerators: growing (too) fast

	(1) No. of accelerators in 2017	(2) No. of accelerators	(3) No. Start-ups accelerated (2016)	(4) Investment raised, US$ million (2016)
Europe and Central Asia	23	43	3,701	107
North America	41	114	3,269	50
Latin America and Caribbean	35	2	1,795	24
Asia & Oceania	46	14	1,368	17
Middle East & Africa	19	12	1,172	7
TOTAL	164	185	11,305	205



Annual growth in accelerators worldwide

Climate technology accelerators & incubators

	No. Climate Tech Incubators & Accelerators
Europe and Central Asia	20
North America	24
Latin America and Caribbean	2
Asia & Oceania	12
Middle East & Africa	11
TOTAL	69

- GALI's *Global Accelerator Survey 2016* : 86 *"Impact accelerators" in the world*
- *New Energy Nexus* : 69 climate tech incubators and accelerators
- Some examples

Infodev's CIC: in eight developing countri
since 2010

New developments in acceleration and high-tech finance

- Impact investing.
- Crowdfunding.
- corporate VC and corporate accelerators.
- Private sector collaboration e.g. The Breakthrough Energy Coalition.
- Mission Innovation – more R&D.
- Infodev / CIC : including advocacy role.
- Climate accelerators that `invest in capital-light, quick-to-scale, software-based, energy demand-side and Internet-of-Things types of technology'.
- Public Accelerator Incubator (PAI).

The Problem of Entrepreneurial Equity Finance

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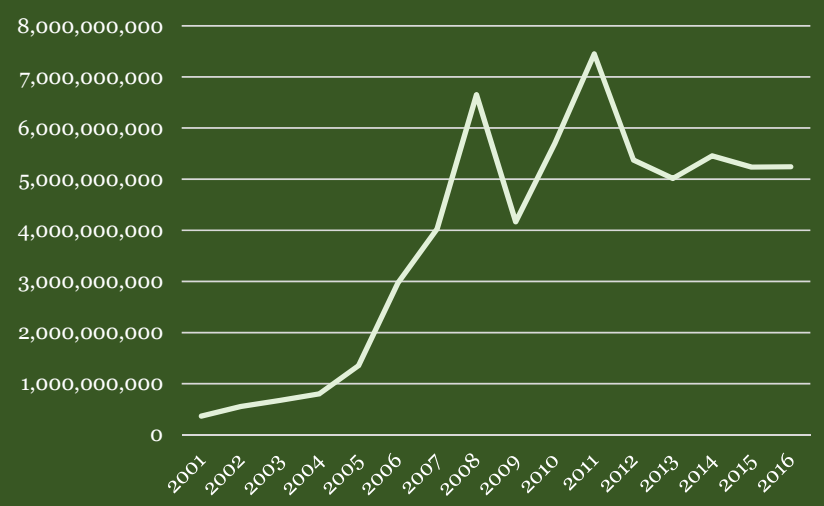
Entrepreneurial ability



Entrepreneurial equity finance

1. Long development time lines.
2. Relative high capital intensity
3. Lower relative returns to e.g. MedTech or software.
4. High fixed costs.
5. Risks – e.g. scalability and policy consistency.
6. Not enough good ideas?
7. Opportunity cost of sunk investment.

Where the gaps are

- Entrepreneurial ability : incubators tend to prolong the life of zombie firms, while accelerators cannot attract enough good entrepreneurial teams.

- Entrepreneurial finance: financing early-stage climate entrepreneurship : there is `no shortage of private funding for investments in *mature* technologies' (FS-UNEP, 2017:1). "Patient" capital is needed.

- Technology Transfer: the rate of innovation and the rate at which technology is absorbed, is declining. This depends on managerial and organisational processes, collaboration, licenses, insurance, and other `social technologies'.

Entrepreneurial Ecosystem building

Where climate-tech is concerned, vital elements are the:

(i) openness to dataflow (ICT connectivity).

(ii) openness to trade and investment (logistical connectivity).

(iii) Risk-diversification (incl. Social protection).

(iv) Demand side growth (incl. environmental regulation and taxes).

(v) Governance and funding of incubators and accelerators.

(vi) Tech-focus: adaption or mitigation? Development or transfer? Demonstration or scale-up? Local or exponential?

(vii) STEAM skills: business schools / Institutes of Technology – for learning, and innovation and processes and organizations (adaptation tech).

Ideas are like frog eggs: you've got to lay a thousand to hatch one. – Peter Drucker

Conclusions

- Start-up ventures can play a potentially important role in mitigation of and adaptation to climate change.
- Incubators and accelerators have a role to play, but neither are without shortcomings.
- Multiplying accelerators (in present form) across developing countries are probably not the recommended model forward for developing countries needing climate change adaptation technologies asap, and where longer incubation periods, with patient capital are required.
- Local solutions to adaptation challenges carry political weight, but may miss the need for globally scalable technologies, including 'social' and 'organizational' tech, to make a large impact over a short time (exponential).
- The UNFCCC system should primarily focus on the latter.