Reverse and Frugal (Jugaad) Innovation

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Today

	Topic: Innovation (part 1)	
Time	Topic	Speaker
9.00	Reverse and frugal innovation	Stefano Severi (University of Bologna)
9:30	**Case Study**: start-up companies for accessible healthcare	Caterina Giuliani (Corax), Alan Fabbri (IBD)
10.30	Break	
11.00	Key enabling design and manufacturing technologies for open-source medical devices	Andrés Diaz Lantada (Universidad Politecnica de Madrid)
12:00	Group work	
13:00	Break	
14.00	**Case Study**: AI for Pneumonia detection in LMICs	Katy Stokes (University of Warwick)
15:00	**Case Study**: Medical Device solution for Maternal Health	Gabriella Signorini (Polytechnic of Milan, Italy)
16:00	**Case Study**: Bambi – Ballon against (post-partum) maternal bleeding	Maria Laura Costantino (Polytecnic of Milan, Italy)
17.00	Break	
17.30 and beyond	Group work	-

Introduction

- Focus on "Innovation":

  - What's Innovation? (What's Development?)

  - Is Innovation necessary?

  - Wouldn't it be possible/sufficient to "extend", to share

    solutions/technology?

Introduction

- Most of the modern technology has been developed in 'Western countries', therefore it is not 'sensitive' to other contexts

- Contexts are continuously changing

- Moreover…

Introduction

Global Health calls for Innovation!

However…

- In Italy and US ≈ 0.7 cars per capita
- In the world ≈ 1.2 billion cars
- Hence ≈ 0.15 per capita
- Should we have 0.7 x 8 = 5.6 billion cars?

Introduction

- Not any kind of innovation can contribute to sustainable development.

- Innovation that does not take into account since the beginning its accessibility won't contribute to the human development, as set by the SDGs.
It's not only a matter of time ('*They will simply import what they desire from the rich world, just as soon as they can afford it*')

- Innovation is needed. Innovation can play a pivotal role in addressing the unmet needs of low-resource settings, in which already available solutions cannot be successfully applied because of their cost or other specific constraints. This kind of innovation must comply with all the peculiar resources, limitations, barriers of their context of use.

➔ NEED TO INNOVATE INNOVATION!
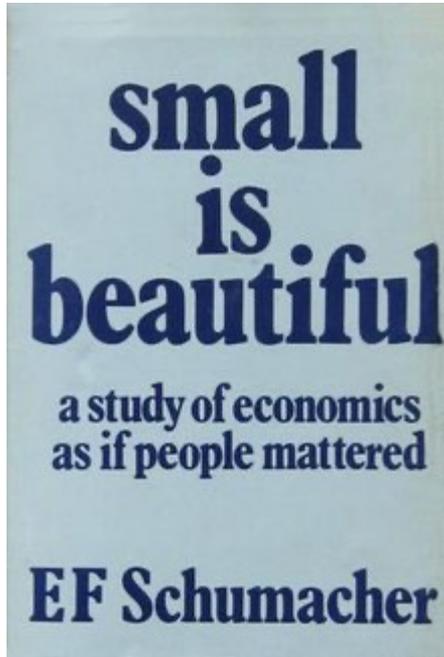
1973
Appropriate Technology
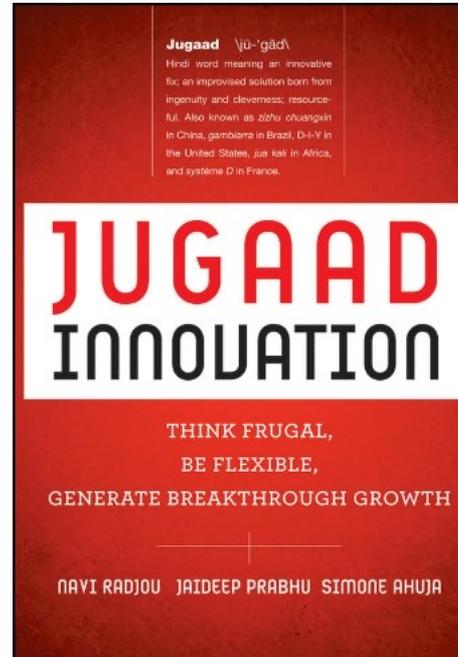
2012
Frugal Innovation
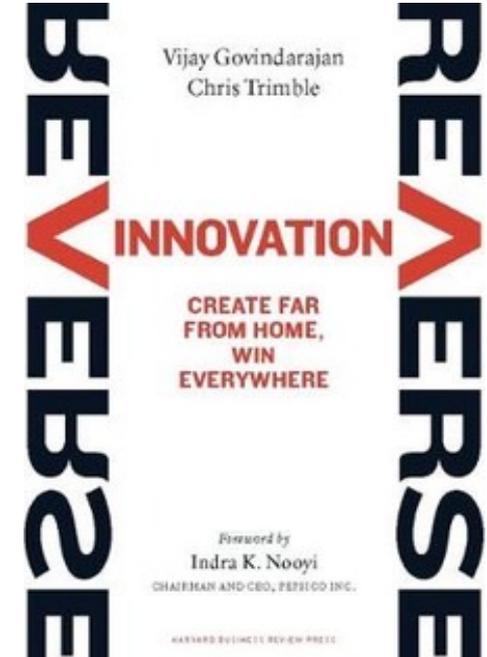
2012
Reverse Innovation

Appropriate Technology

The Indian leader **Gandhi** is often cited as the "father" of the concept of appropriate technology. In his idea of development, technology must **not create forms of exploitation of human beings**, neither at the international nor at the national level, nor at the local level, between cities, countryside and villages.

Gandhi advocated for **small-scale technologies**, **cooperative systems** and the production of **goods and services that people really need**, to help India's villages become self-reliant.

Appropriate Technology

- The german-English economist Ernest Fritz Schumacher coined the term Appropriate Technology.

- Based the philosophy of appropriate technology on his experiences in developing nations.

- His 1973 publication "*Small Is Beautiful: Economics As If People Mattered*" outlined Appropriate technology concepts.
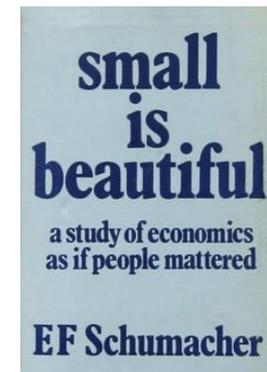
Appropriate Technology

- AT is technology that is designed to be <mark>"appropriate" to the context it is intended for</mark> - including <mark>environmentally, culturally and economically</mark>. (*Appropedia.org*)

- AT is the appropriate selection of a device or solution to a problem <mark>based on the individual needs of an area, or a population</mark>; which <mark>generally utilizes simple and user friendly products</mark> and or systems.

- AT: an approach to address challenges in the developing world through <mark>creative and people focused</mark> product development (Patel et al. *IEEE Technol. Soc. Mag. 2014*)

- AT recognizes that <mark>social, environmental, cultural, political, and economic concerns</mark> are just as important as technical requirements in the design of innovative products and services (P. Dunn, *Appropriate Technology: Technology With a Human Face*. New York: Schocken, 1979)

- A core group of design <mark>tenets that span from the cultural (e.g., compliance with societal norms), to the consumer (e.g., community ownership model), to the technological (e.g., environmental friendliness)</mark>.

Appropriate Technology

The Alma Ata Declaration emerged as a major milestone of the twentieth century in the field of public health, reaffirming "*the attainment of the highest possible level of health as a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector*".

PHC was defined as "*essential health care based on **practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination***"[11].

Appropriate Technology

Which criteria for the appropriateness of medical technologies in low-resource settings?

- Low costs / Affordability
  - operational costs
  - repair and maintenance costs (both monetarily & in labor)
- Can be built locally
- Made with locally available materials
- Easily repaired — By local people with locally available equipment.
- Suitably disposable — Locally and not polluting in it's disposal or recycling
- Renewable Sources of Energy / no need for stable power grid
- Create Job opportunities
- Simple, small scale Appropriate to the community
- Usability (easy to use by the intended users)
- Culturally acceptable
- reduced need for high quality water
- reduced need for disposables
- …

Appropriate Technology

S. Patel et al. Appropriate Technologies in the Globalized World: FAQs. *IEEE TECHNOLOGY AND SOCIETY MAGAZINE* 2014

- Should we Design Technologies for Aid or for Trade?

- Should Technology Solutions Leverage Western or Indigenous Knowledge?

- Is a Technology Appropriate if It Violates Cultural Norms?

- Should AT Products be Localized for a Specific Region or Standardized for a Larger Population?

- Should Technologies Rely on Local Materials and Manufacturing Operations?

- Should Technologies be Designed for Individual or Community Ownership?

- Must ATs Always Strive for the Cheapest Solution?

- Is a Technology Appropriate if it Benefits Some People but Hurts Others?

- Should Labor-Intensive Tasks be Replaced with Automated Systems?

- Should Technologies be Deskilled to Allow More People to use Them?

- Should Low Technology Products be Emphasized over High Technology Products?

- Is it More Important for Technologies to Be Affordable or Durable?

- Should We Promote Economically-Beneficial Technologies that Hurt the Environment?

Appropriate Technology

*'…instead of considering AT design tenets as rules for technology development, **they must be considered as a series of tradeoffs** and systemic design decisions that are informed and co-created by the **specific communities and their context**.'*

*Though all aspiring **AT projects have the same overall goal of improving the lives of resource-constrained communities, they operate in different environments to address dissimilar problems**. For instance, a company attempting to provide electricity to rural Indian villages need not adhere to the same tenets as a group helping a community reconstruct a water reservoir in Kenya, or a venture commercializing affordable food dryers in Nicaragua. **We argue against the application of rigid tenets and design principles** and encourage innovators to adopt a **systems approach** when developing new technologies.*

Appropriate Technology

https://www.appropedia.org/

Paul Polak: ***The Death of Appropriate Technology organizations***
The flowering of the Appropriate Technology movement in decades past had no major impact on the poor, and many organizations devoted to appropriate technology have closed or scaled-down.

The production of "appropriate technology" has died as the organizations producing appropriate technology did not apply business models with an emphasis on financial viability.

The appropriate technology movement died because it was led by well-intentioned tinkerers instead of hard-nosed entrepreneurs designing for the market.

His arguments are found at:

• The Death of Appropriate Technology I : If you can't sell it don't do it

• The Death of Appropriate Technology II : How to Design for the Market

He talks about technology for the poor, as distinct from the earlier appropriate technology movement which he argues did not take cost-effectiveness seriously, and therefore failed.

Frugal Innovation
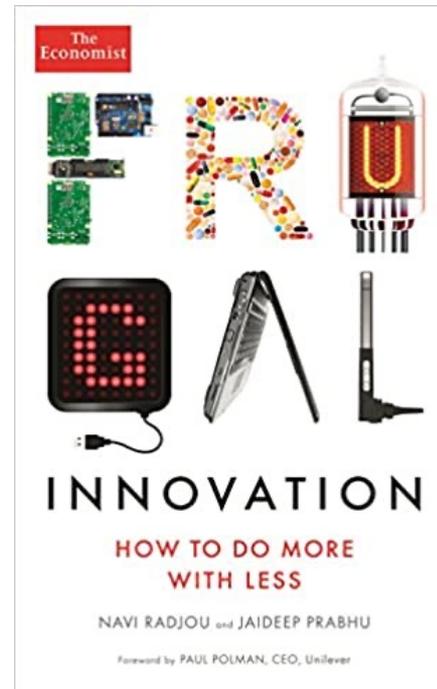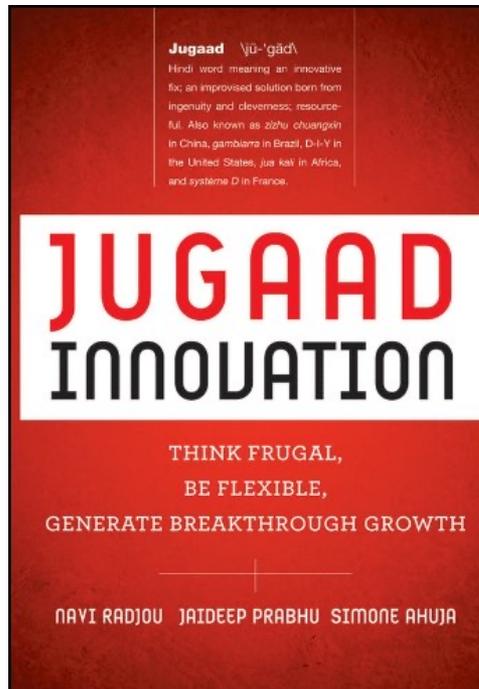
Frugal Innovation

BMC Medicine

COMMENTARY   **Open Access**

CrossMark

Frugal innovation in medicine for low resource settings

Viet-Thi Tran[1,2,3*] and Philippe Ravaud[2,3,4,5]

Journal of Frugal Innovation

RESEARCH   **Open Access**

CrossMark

What is frugal innovation? Three defining criteria

Timo Weyrauch[*] and Cornelius Herstatt

Frugal Innovation

Frugal Innovation is the ability to 'do more with less': resource constraints as an innovation/business opportunity, not a liability

Frugal Innovation

- Frugal innovation is a broad term encompassing heterogeneous activities providing effective functional solutions to common problems encountered by "the many", with a minimal use of resources

- we define three criteria for frugal innovation:

  1. **substantial cost reduction**,

  2. **concentration on core functionalities** (…not only a way to reduce costs, itcan also have the purpose of

     - making a product or service easy to use

     - saving resources

     - having a lower impact on the environment

     - meeting a specific lifestyle or consumer behaviour

  3. **optimised performance level** (frugal innovations must meet the performance level that is needed for its de facto purpose and the local conditions, compared to current solutions available in the market)

Frugal Innovation

Two forces drive frugal innovation:

- One is from companies or is supported by organizations

such as the WHO [1] or PATH [2], the leader in global health innovation, to provide accessible technologies by simplifying existing high-tech tools.

- The other is from low-cost homegrown "fixes", using low-tech (or even "no-tech") solutions to solve unmet needs.

[1] World Health Organization. Compendium of innovative health technologies for low ressources settings. Geneva: WHO; 2015 / 2022
[2] Elias C. Essay can we ensure health is within reach for everyone? Lancet. 2006;368:S40–1.
PATH (Program for Appropriate Technology in Health): an international non-profit organisation www.path.org

Frugal Innovation

four subtypes of frugal innovation in medicine:

Lean tools and techniques Simplification of existing techniques or technologies	Opportunistic solutions Use of modern technologies to tackle "old" problems	Contextualized adaptations Diversion of existing tools for completely different purposes	Bottom-up innovations Use of low tech approaches to solve local unmet needs	
• General Electric's low cost ECG machine • General Electric's lullaby warmer • Fonastra & PATH's milk pasteurization monitor • Foldscope: an origami paper based microscope	• SMS to improve adherence to antiretroviral therapy • SMS to fight counterfeit drugs • 3D printed prosthetic hands	• Urinary reagent strips for evaluation of cerebrospinal or synovial fluid • Paper clips in surgery • Sunscreen from almond oil and white beeswax • Plastic bottles as asthma spacers	• The stethoscope • Solar disinfection of water • Sari cloth filtration to reduce cholera • Odon's device for vaginal deliveries • Kangaroo care for preterm infants	Homegrown

Fig. 1 Examples of frugal innovations in healthcare. More examples and references are available on our website (http://frugal-innovation-medicine.com/)

- http://frugal-innovation-medicine.com/

Reverse Innovation

Reverse Innovation

Reverse Innovation is the strategy of innovating in emerging (or developing) markets and then distributing/marketing these innovations in developed markets. E.g.: many companies are developing products in emerging countries like China and India and then distributing them globally.

The term was coined and the concept was introduced by Vijay Govindarajan. He is the Earl C. Daum 1924 Professor of International Business at the Tuck School of Business and founding director of Tuck's Center for Global Leadership.


Harvard Business Review
www.hbr.org

For decades, GE has sold modified Western products to emerging markets. Now, to preempt the emerging giants, it's trying the reverse.

How GE Is Disrupting Itself

by Jeffrey R. Immelt, Vijay Govindarajan, and Chris Trimble

2009

REVERSE INNOVATION
CREATE FAR FROM HOME, WIN EVERYWHERE
Vijay Govindarajan
Chris Trimble
Foreword by Indra K. Nooyi
CHAIRMAN AND CEO, PEPSICO INC.

2012
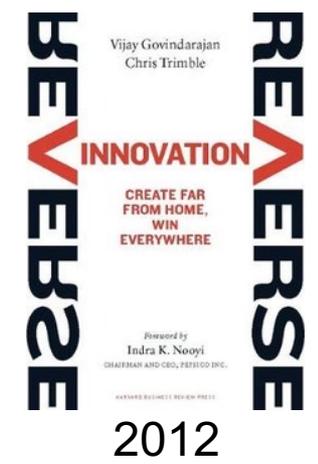
Reverse Innovation

What is Reverse Innovation?

Traditional Path

Development country innovation

Developing country innovation

New Path
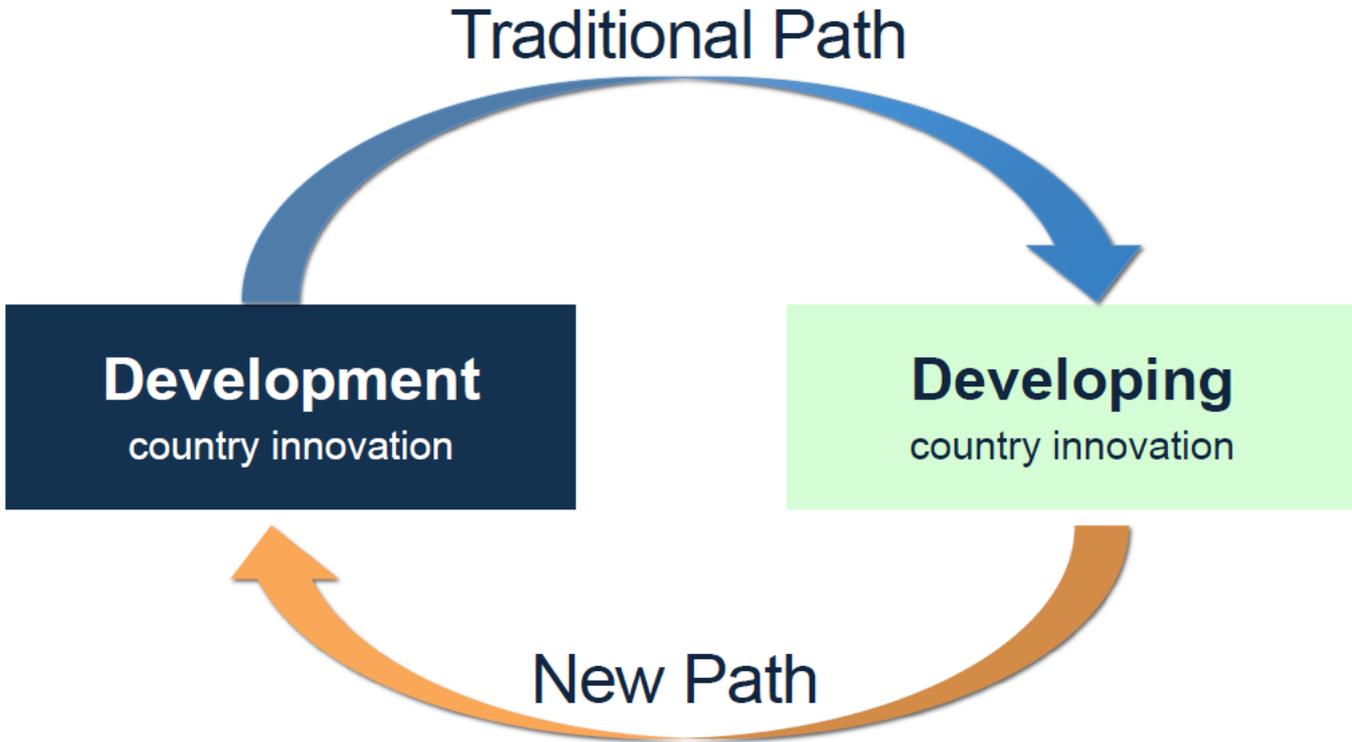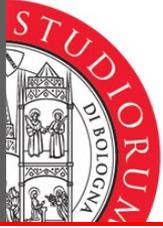
Reverse Innovation

GENERAL ELECTRIC:

- a $1,000 handheld electrocardiogram device

- a portable, PC-based ultrasound machine that sells for as little as $15,000

…are revolutionary, and not just because of their small size and low price. They're also extraordinary because they originally were developed for markets in emerging economies (the ECG device for rural India and the ultrasound machine for rural China) and are now being sold in the United States, where they're pioneering new uses for such machines.

(How GE is disrupting itself)

Reverse Innovation

o *once we approached overseas markets in the conventional way: we exported! Sometimes with small modifications for local markets, but basically global products, mainly lower-end models with fewer features*

o *but the assumptions are misguided. In emerging markets customers needs are starkly different. Megamarkets with microcounsumer: one person with ten dollars to spend has a completely different set of wants and needs than ten people each with one dollar to spend!*

o *Reverse innovation begins not with inventing, but with forgetting! Then you must start with humility and curiosity. It's best to assume that you've just landed to Mars*

o *need to combine global vision and mission with focus on local needs*

o *why would a rich man ever want a poor man's product? …under certain circumstances, it offers new, unexpected, or long-overlooked value*
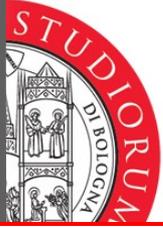
Reverse Innovation

The concept of Reverse Innovation also imply the idea that 'developed' countries can learn and benefit from innovation coming from 'underdeveloped' countries!

Harris *et al. Globalization and Health* (2015) 11:45
DOI 10.1186/s12992-015-0130-z

GLOBALIZATION AND HEALTH

RESEARCH   **Open Access**

CrossMark

'They hear "Africa" and they think that there can't be any good services' – perceived context in cross-national learning: a qualitative study of the barriers to Reverse Innovation

Reverse Innovation

The concept of Reverse Innovation also imply the idea that 'developed' countries can learn and benefit from innovation coming from 'underdeveloped' countries! It implies 'turning the world upside down'!
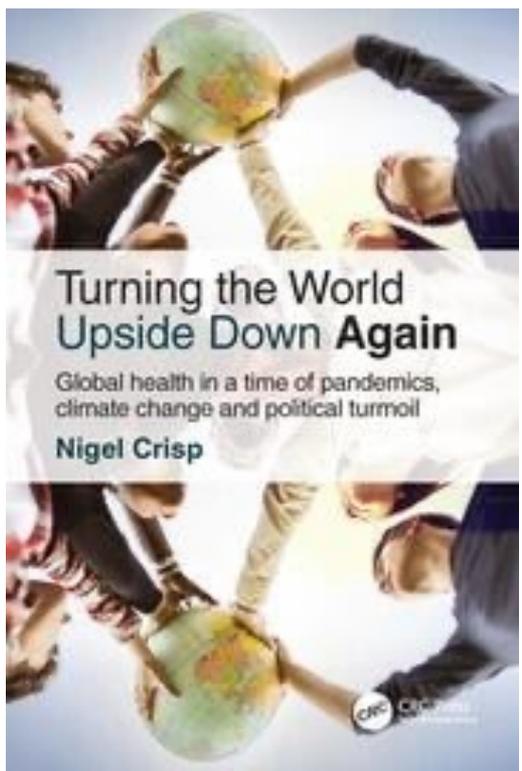
Turning the World Upside Down **Again**
Global health in a time of pandemics, climate change and political turmoil
Nigel Crisp

Harris *et al. Globalization and Health* (2015) 11:45
DOI 10.1186/s12992-015-0130-z

GLOBALIZATION AND HEALTH

RESEARCH   **Open Access**

'They hear "Africa" and they think that there can't be any good services' – perceived context in cross-national learning: a qualitative study of the barriers to Reverse Innovation

And now… from the real world: