Strategies to be globally visible and locally engaged

Professor PE Seeram Ramakrishna, FREng
National University of Singapore
Founder, Global Engineering Deans Council (www.gedc.org)
The ASEAN research landscape report, Nov 2015
Singapore Prime Minister Lee advises the local universities on the issue of rankings: That while they want to maintain their standing globally, their KPI should be how well they serve Singapore, not how highly they are ranked. 21 Sep 2015
Higher education: diverse approaches
Japan
Singapore: promoting liberal arts education

Yale-NUS College
BEFORE I DIE

BEFORE I DIE I WANT TO

LIVE THE BEST LIFE I COULD LIVE

BRING DOWN THE RICH

BEFORE I DIE I WANT TO

LEAVE MY LEGACY

NUS U Town
Let's return universities to their philosophical roots

Universities are more professional and glittering than ever, but in some ways there is emptiness deep down. Students are taught how to do things, but many are not forced to reflect on why they should do them or what we are here for. They are given many career options, but they are on their own when it comes to developing criteria to determine which vocation would lead to the fullest life.

University is about exposing students to many things and creating an atmosphere:

1 Reveal moral options
2 Foster transcendent (imagination-altering) experiences
3 Investigate current loves ad teach new things to love
4 Apply the humanities
Sri Sathya Sai University: focus on character building

Average time spent annually by students on each dimension of Sri Sathya Sai system of Values-based Integral Education
Net generation students want to be unicorn!

- entrepreneurship is no longer a bad word for families
- they are exposed to the innovations
- successful examples
Net generation students

- Comes from shrinking nuclear families
  (~ 10 persons now vs over 100 persons in the past!)
- Trusted friends (one to five!)
- Seeks personal fulfillment (vs mere job to take care of family)
- Marries late (~ 30s) & wedding is off beat
- Interested in travel & experience
- Plugged into global digital brain
A university student Alejandro packs laptop, thumb drive, smart phone, lip balm, adopter, charger, etc. instead of texts and note books

Physical library vs digital library
Physical notes vs digital notes
Physical lectures vs digital lectures

http://www.nytimes.com/2015/09/03/business/backpack-makers-rethink-a-student-staple.html?_r=0
Xiaomei, a robot teacher guiding a class at Jiujiang University, China
Their weddings are off-beat!

http://www.shutterbug.com/content/would-you-use-aerial-drone-shoot-wedding-video
Their weddings are off-beat!

7 feet foto-robot at millennials wedding in Seattle

Innovation 3.0

Innovation is critical for sustainability of businesses and countries

In post-globalized world the innovation is globally distributed

The Global Technology Map

China embarks on major changes in S&T, Margaret McCuaig-Johnston and Moxi Zhang, China Institute, University of Alberta, Vol 2, No 2, June 2015

<table>
<thead>
<tr>
<th>National innovation index</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Innovation resources</td>
</tr>
<tr>
<td>1. Gross domestic expenditure on R&amp;D as a percentage of GDP</td>
</tr>
<tr>
<td>2. Total R&amp;D personnel per ten thousand population</td>
</tr>
<tr>
<td>3. Tertiary enrollment</td>
</tr>
<tr>
<td>4. Informationization level</td>
</tr>
<tr>
<td>5. R&amp;D expenditure as a percentage of the world’s total</td>
</tr>
<tr>
<td>II. Knowledge creation</td>
</tr>
<tr>
<td>6. Scientific papers citations per one million US dollars of R&amp;D expenditure of academic institutions</td>
</tr>
<tr>
<td>7. Scientific &amp; technical articles per 10,000 scientific researchers</td>
</tr>
<tr>
<td>8. Value added of knowledge-intensive services as a percentage of GDP</td>
</tr>
<tr>
<td>9. Number of invention patent applications per 100 million US dollars of economic output</td>
</tr>
<tr>
<td>10. Number of invention patent grants per 10,000 researchers</td>
</tr>
<tr>
<td>III. Enterprise innovation</td>
</tr>
<tr>
<td>11. Number of triadic patent families as a percentage of the world’s total</td>
</tr>
<tr>
<td>12. R&amp;D expenditure of enterprises as a percentage of industrial value added</td>
</tr>
<tr>
<td>13. Number of patent applications to the PCT per 10,000 business enterprise researchers</td>
</tr>
<tr>
<td>14. Overall technology independency</td>
</tr>
<tr>
<td>15. Business enterprise researchers as a percentage of total R&amp;D personnel</td>
</tr>
<tr>
<td>IV. Innovation performance</td>
</tr>
<tr>
<td>16. Labor productivity</td>
</tr>
<tr>
<td>17. GDP per unit of energy use</td>
</tr>
<tr>
<td>18. Number of patents in force</td>
</tr>
<tr>
<td>19. High-technology exports as a percentage of manufactured exports</td>
</tr>
<tr>
<td>20. Value added of knowledge-intensive industries as a percentage of the world’s total</td>
</tr>
<tr>
<td>V. Innovation environment</td>
</tr>
<tr>
<td>21. Intellectual property protection</td>
</tr>
<tr>
<td>22. Burden of government regulation</td>
</tr>
<tr>
<td>23. Macroeconomic environment</td>
</tr>
<tr>
<td>24. Local availability of research and training services</td>
</tr>
<tr>
<td>25. Effectiveness of anti-monopoly policy</td>
</tr>
<tr>
<td>26. Pay and productivity</td>
</tr>
<tr>
<td>27. Venture capital availability</td>
</tr>
<tr>
<td>28. State of cluster development</td>
</tr>
<tr>
<td>29. University-industry research collaboration</td>
</tr>
<tr>
<td>30. Government procurement of advanced tech products</td>
</tr>
</tbody>
</table>
China embarks on major changes in S&T, Margaret McCuaig-Johnston and Moxi Zhang, China Institute, University of Alberta, Vol 2, No 2, June 2015
ASEAN World Share of Research Papers
Source: Thomson Reuters Web of Science®
Research papers published by ASEAN nations over the last 10 years, 2005-2014.
Source: Thomson Reuters Web of Science®.
Growth in research output by country over the last 10 years, 2005-2014
Source: Thomson Reuters Web of Science®
Percentage share of patents for Asia, North America, Europe, Latin America and ASEAN. Source: Thomson Reuters Derwent World Patents Index®
### Reuters Top 100 Most Innovative Universities (2015)

<table>
<thead>
<tr>
<th>Nation</th>
<th>Number in top 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>50</td>
</tr>
<tr>
<td>Japan</td>
<td>9</td>
</tr>
<tr>
<td>France</td>
<td>8</td>
</tr>
<tr>
<td>South Korea</td>
<td>8</td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
</tr>
<tr>
<td>England</td>
<td>5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3</td>
</tr>
<tr>
<td>Belgium</td>
<td>2</td>
</tr>
<tr>
<td>Canada</td>
<td>2</td>
</tr>
<tr>
<td>Israel</td>
<td>2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
</tr>
<tr>
<td>China</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>1</td>
</tr>
<tr>
<td>Singapore</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Parameters:
- Industrial-co authorship of research papers
- Patents filed/granted
- Publications cited in patents
- Publication downloads by the Industry sector
Why should we pay attention?

- Net generation students have different aspirations
- Governments have no choice but to encourage innovation and entrepreneurship
- A new way for institutions to gain visibility and be relevant
Post-globalized world

- Economy and jobs are influenced by the shift from mass production to mass customization

  - There is a need for universities to be locally engaged while globally visible

What are the strategies?
Strategies to be globally visible and locally engaged?

- Strategy 1 Unbundling Education via Fractal Modules Approach
- Strategy 2 Open-source Collaborative Platforms
- Strategy 3 New Courses
- Strategy 4 Public-University-Private Partnerships
- Strategy 5 Glocal Faculty Members
Education Emphasis with Time

Curricula
- Communication skills
- Multi-cultural skills
- Ethics, social responsibilities
- Interdisciplinary skills

Faculty

Facilities

Credit hours

Quality assurance

(Fundamentals)

Run up to 2000

2000-2015

Future

Innovation
Entreprenuership
Sustainability
Teach ignorance!
Big picture

(Glocal Attributes)
New Format:
each course is broken into short segments of ~ 11 minutes that stretch over seven weeks online learning.

Philanthropy University
What is a Nanodegree program? What's the experience like?
A Nanodegree program is a compact online curriculum designed to get you the skills that employers believe are key to get a job in technology. It focuses on learning by doing. It is typically comprised of 5 to 8 projects with relevant courses to support the skills needed to complete those projects.
As soon as you start a Nanodegree program, you join a cohort of students who start the Nanodegree program at the same time and work through the program at about the same pace. You interact with other people in your cohort, as well as members of the Udacity Coach team, in an online community to receive support throughout the program. Udacity Coaches also offer Webcasts and one on one appointments.
To make progress in your Nanodegree program, you need to submit your projects by certain deadlines. When all the projects have met required specifications, you will graduate and earn your Nanodegree program certificate.
https://www.udacity.com/nanodegree
Future of MIT Education taskforce report: unbundling education

<table>
<thead>
<tr>
<th>Traditional Instruction</th>
<th>Hands-on and Experiential</th>
<th>Informal Learning</th>
<th>Residential Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester Course</td>
<td>Module</td>
<td>Field experience</td>
<td>Campus living</td>
</tr>
<tr>
<td></td>
<td>Module</td>
<td>Professor/TA/Student mentoring</td>
<td>Clubs/Teams</td>
</tr>
<tr>
<td></td>
<td>Module</td>
<td>Peer-to-peer learning</td>
<td>Research experience</td>
</tr>
<tr>
<td></td>
<td>Module</td>
<td>Research experience</td>
<td>Serendipitous learning/Magic</td>
</tr>
<tr>
<td></td>
<td>Module</td>
<td>Studio/Performing arts</td>
<td></td>
</tr>
</tbody>
</table>

Examples:

- Labs/Studios
- Projects
- Discussions
- Field experience
- Professor/TA/Student mentoring
- Peer-to-peer learning
- Research experience
- Serendipitous learning/Magic
- Campus living
- Clubs/Teams
- Sports
- Studio/Performing arts
Brain storm solution(s), and not solve problems in a sequential and hierarchical way
Alumni Factor

At institutions with successful alumni role models, one in five students is motivated to try the start-up route.
Examples:
Examples:

NUS: Immerse students in innovation hubs

for graduate researchers who are interested in commercializing technological inventions
Strategies to be globally visible and locally engaged?

Strategy 1 Unbundling Education via Fractal Modules Approach

Strategy 2 Open-source Collaborative Platforms

Strategy 3 New Courses

Strategy 4 Public-University-Private Partnerships

Strategy 5 Glocal Faculty Members
Examples:

Digital platform for global collaborations among diverse students around a single idea

IOTA, an open source hardware

It is a co-creation platform where anyone can propose, collaborate, build and share, a complete ecosystem for creation from concept to product.

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Knowledge

Innovation culture

Entrepreneurship culture

Technical Skills

Communication Skills

Glocal attributes

Reimagined Education
In addition to their technical and analytical expertise, engineering students need to be flexible, resilient, creative, empathetic, and have the ability to recognize and seize opportunities.

All of these skills can and should be taught to engineers as part of their formal education. It is thus the responsibility of engineering educators to instill these qualities in students to enable them to be more innovative and entrepreneurial.

* Byers, et. al; Aligning Engineering Education and Experience to Meet the Needs of Industry and Society, NAE, The Bridge on Undergraduate Engineering Education, Summer 2013
Examples:

Univ of Colorado, Colorado Springs (UCCS): Bachelor of Innovation

- Mathematics (18 Credits)
- Science (11 credits)
- English (3 Credits)
- EE Core (39 credits)
- EE Electives (9 Credits)
- Cross Discipline Core (15 Credits)
- Innovation Core (27 Credits)
Curriculum to teach Ignorance!

When we present knowledge as more certain than it is, we discourage curiosity, further learning and new knowledge.

Stuart J Firestein, Neuroscientist, Colombia University
Marlys H Witte, Surgery Professor, University of Arizona

http://www.nytimes.com/2015/08/24/opinion/the-case-for-teaching-ignorance.html?_r=0
Why didn’t I do this before?

Brain storm solution(s), and not solve problems in a sequential and hierarchical way
Strategies to be globally visible and locally engaged?

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Patterns for Bridging Innovative Technology Seeds and Commercialization (image)

(a) Bridging through “Public Research Institutions”
- Universities/Basic R&D Institutes
- Bridging Public Research Institutes
- Public funding
- R&D assigned by business
- Business
- HR mobility
- Consignment R&D

Public Research institutes conduct R&D utilizing public funding until such research reaches the level where the business sector can make investment decisions. The business sector incorporates the outcomes of R&D to start new businesses through HR mobility and consignment R&D.

(b) Bridging through “Venture Business”
- Universities/Basic R&D Institutes
- Start-ups
- Buyouts
- Business

Incorporating new technologies/ideas for new business through buyout of venture business (Acquisition & Research & Development).

(c) Bridging through “Joint Industry-University R&D”
- Universities/Basic R&D Institutes
- Joint Industry-University R&D
- National Projects
- Individual projects between companies & universities, etc.
- Business

Utilizing the outcome of joint R&D for developing new products/businesses.

Funding Agencies

@Yuko Yasunaga, AIST
Singapore's research & development (R&D) efforts have paid off with startups more than doubling in the last decade from 24,000 in 2005 to 55,000 last year, Prime Minister Lee Hsien Loong said on Monday (Oct 19).
Solar Chilli Dryer: Winner of the Humanism Award at TECO Green Technology Competition (Taiwan)
Sustainable living in urban cities via integrating innovations
"Creatives show the vitality of entrepreneurship and innovation among the people, and such creativity will serve as a lasting engine of China's economic growth," Premier Li Keqiang said in January. "I will stoke the fire of innovation with more wood."

Asia, the new hotbed for start-up companies

<table>
<thead>
<tr>
<th>Country</th>
<th>INCORPORATION COSTS</th>
<th>VISAS AND HIRING FOREIGNERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPAN</td>
<td>1 yen (S$0.01) of capital five million yen to apply for an &quot;investor/business manager&quot; visa 150,000 yen to 240,000 yen in fees (S$1,659.61 to S$2,655.61)</td>
<td>Foreigners can set up a company in Japan without permanent residence through an investor visa or consultant visa. Foreigners without permanent residential status can work in only a limited number of job categories. Visa applicants must first secure office space and have at least five million yen (S$55,320.34) to invest, or have hired at least two full-time workers.</td>
</tr>
<tr>
<td>CHINA</td>
<td>Setting up a start-up takes six weeks and costs US$10,000 (S$13,700). However, this can be circumvented by registering a partnership with a local company, which takes three weeks and costs US$9,000.</td>
<td>100,000 yuan (S$22,000) provides visas for five to six foreign employees, on the condition that companies bring in one million yuan of foreign capital within the next 20 years. Foreigners do not require a visa to set up a business and can later obtain a work visa through their own company.</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>Start-ups have to pay a registration fee of S$300 to the Singapore Registrar of Companies. The minimum paid-up capital for registration is S$1. The paid-up capital can be increased after incorporation. Foreigners who do not live in Singapore need to appoint a local resident director.</td>
<td>An EntrePass one-year visa can be sought by eligible foreign entrepreneurs with US$50,000 in paid-up capital in a local bank and at least 30 per cent of company shares. There is a quota for hiring foreign talent, which differs by industry. Firms must pay a foreign worker levy for every such employee. (Only pay for costs of visa and levy)</td>
</tr>
<tr>
<td>TAIWAN</td>
<td>Start-ups need to pay a registration fee of NT$450 (S$19.70), plus 0.025 per cent of the company’s authorised capital, subject to a minimum of NT$1,000 (S$43.6343). There is no minimum capital requirement for foreign start-ups. However, entrepreneurs need to invest NT$3 million (S$130,915.38) annually for a work permit and alien registration card</td>
<td>Requires “foreign investment approval (FIA)” from the Investment Commission. Foreign professionals with at least a bachelor's degree do not need work experience to join qualifying start-ups. Requirements for a company to apply for a work permit:</td>
</tr>
<tr>
<td></td>
<td>1. 5,000,000 TWD (S$218,205.62) capital required for the first year after set up; 2. From the second year, the expected sales revenue has to exceed 10,000,000 TWD (S$436,360.20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NT$2,200 (S$96) for a single entry; NT$3,000 (S$131) for multiple entries. For US citizens, visa application fee is NT$3,600 (S$157).</td>
<td></td>
</tr>
<tr>
<td>THAILAND</td>
<td>Start-ups have to pay a fee of 0.55 per cent of their capital in the case of private limited companies.</td>
<td>Start-ups have to hire one Thai employee for every foreign one. Thailand permits start-ups to hire one foreigner for every two million baht (S$79,000) of fully paid-up registered capital, in the case of up to 10 foreigners. Permits are issued for specific hours and types of work and must be renewed annually.</td>
</tr>
<tr>
<td>HONG KONG</td>
<td>The incorporation cost of a start-up is about US$1,200. Start-ups must have at least one director, one local corporate secretary and a physical location in Hong Kong. No share capital is required. Forming a local company via partnership costs US$200 to US$300.</td>
<td>Hong Kong grants employment visas for skilled professionals such as software engineers, doctors and research and development specialists. Under a supplementary labour scheme, semi-skilled professionals such as technicians can be hired. (Only pay for costs of visa and NO levy, Each of these passes is considered on a case-by-case basis, with no additional requirements for specific sectors).</td>
</tr>
<tr>
<td>INDONESIA</td>
<td>Start-ups are required to invest US$1 million over three years, with 25 per cent in paid-up capital.</td>
<td>Only foreigners deemed “experts” in their field can work in Indonesia. Companies employing foreigners must pay US$100 per month to the Manpower Ministry. To apply for visas, start-ups need a physical office and proof of investment, and must submit investment reports every three months until they receive an &quot;IUT&quot; permanent business licence.</td>
</tr>
</tbody>
</table>
Strategies to be globally visible and locally engaged?

- **Strategy 1** Unbundling Education via Fractal Modules Approach
- **Strategy 2** Open-source Collaborative Platforms
- **Strategy 3** New Courses
- **Strategy 4** Public-University-Private Partnerships
- **Strategy 5** Glocal Faculty Members
Research collaboration between ASEAN nations and global community
<table>
<thead>
<tr>
<th>Country</th>
<th>% Documents in Top 10%</th>
<th>Web of Science Documents</th>
<th>Highly Cited Papers</th>
<th>% International Collaborations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>16.55</td>
<td>56,710</td>
<td>1,361</td>
<td>57.85</td>
</tr>
<tr>
<td>Cambodia</td>
<td>14.44</td>
<td>956</td>
<td>23</td>
<td>93.1</td>
</tr>
<tr>
<td>Philippines</td>
<td>10.16</td>
<td>5,531</td>
<td>95</td>
<td>65.94</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>9.58</td>
<td>689</td>
<td>6</td>
<td>96.23</td>
</tr>
<tr>
<td>Indonesia</td>
<td>8.89</td>
<td>7,427</td>
<td>79</td>
<td>83.03</td>
</tr>
<tr>
<td>Vietnam</td>
<td>8.59</td>
<td>9,523</td>
<td>100</td>
<td>77.34</td>
</tr>
<tr>
<td>Thailand</td>
<td>7.73</td>
<td>32,112</td>
<td>275</td>
<td>49.92</td>
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<tr>
<td>Malaysia</td>
<td>7.45</td>
<td>44,811</td>
<td>362</td>
<td>46.52</td>
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<tr>
<td>Myanmar</td>
<td>6.01</td>
<td>316</td>
<td>3</td>
<td>92.09</td>
</tr>
<tr>
<td>Brunei</td>
<td>5.57</td>
<td>449</td>
<td>-</td>
<td>69.71</td>
</tr>
</tbody>
</table>

Output and impact of ASEAN countries’ research papers. Source: Thomson Reuters Web of Science® and InCites.
NATURE SAVES LIVES

51% of cancer-fighting drugs are derived from nature, such as coral reefs.

We are working with community leaders in more than 75 countries to make sure coral reefs have a fighting chance to survive and thrive into the future.

Learn how you can help us heal nature by visiting nature.org.

The Nature Conservancy
Protecting nature. Preserving life.
About half the products in your supermarket contain palm oil. From lipstick to laundry soap, chocolate to crisps. And more and more of this versatile oil is being grown at the expense of tropical forests effecting both communities and wildlife.

Make sure what you buy contains palm oil that is grown sustainably. If it doesn’t, then ask for it.
Are Products Socially Responsible?

~ 10 million tons of plastic end in ocean per year

Total greenhouse gas emissions: 110 kg CO₂ e

Nano-composites: Eco Smart Homes

Stronger and lighter concrete; steel-less concrete; less carbon foot print

Improved thermal and sound management

Smart windows for light control; energy efficiency; energy generation

Self-cleaning and durable coatings
Nano-composites: Eco Smart Homes

3D Printed Home
Healthy to 100 plus, How?

- Self-sufficiency
- Medical intervention
  - Regenerative Medicine
  - Organ transplantation
  - Medical devices
  - Medicines

- Epigenetics account for 75% variation in life span
- Genetics account for 25% variation in life span

- Lifestyle
- Living Conditions

https://www.youtube.com/watch?v=-h_F3Nx4ebA
One million medical devices to replace every part of human body!

Argus II becomes first "bionic eye" to gain approval for sale in U.S. - Second Sight

Wide range of hearing aids from "Behind-the-Ear" to "Invisible-in-Canal" - Florida Medical Hearing Centers

FDA-Approved Artificial Heart Valve Helps Patients Avoid Major Open Surgery - Medtronic

Total Artificial Heart - Papworth Hospital

Gastric Electrical Stimulation for Gastroparesis - Lourdes Hospital

The second generation pacing system FDA-approved for use in the MRI environment and clinically proven to reduce the progression to permanent AF. - Medtronic

New Prosthetic Fingers Technology To Be Released. - Touch Bionics

Functional Arm Prosthesis - OrtoProfil

Total Hip Arthroplasty - American Academy of Orthopaedic Surgeons

Knee Joint Replacement - DePuy Orthopaedics

Robotic advances promise artificial legs that emulate healthy limbs - Medical Xpress

https://www.youtube.com/watch?v=oo7WYqP7Cjs
3D Printed Body Parts

Human Skull University Medical Centre Utrecht
http://www.wired.co.uk/news/archive/2014-03/26/3d-printed-skull

3D Printed titanium vertebrae
http://www.businessinsider.sg/3d-printing-can-create-replacement-bones-2014-8/#.VNV_2_mUdps
Innovation Frontiers

21 Century
20 Century
20 Century
20 Century
20 Century
20 Century
20 Century
20 Century

Nanotechnology
Internet
Computer
Biotechnology
Aircraft
Chemical synthesis

Strategies to Erase the Nanotechnology Divide:
Lower the barriers for innovation

18 Century
18 Century
~500 BC
~3,000 BC
~4,000 BC
~7,000 BC
~8,000 BC
~9,000 BC

Steam engine
Printing
Gears and pulleys
Writing
Wheel
Smelting of ore
Domestication of animals
Domestication of plants
Summary

In a post-globalized competitive world there is a need for the universities to be locally engaged while globally visible.

Strategy 1 Unbundling Education via Fractal Modules Approach
Strategy 2 Open-source Collaborative Platforms
Strategy 3 New Courses
Strategy 4 Public-University-Private Partnerships
Strategy 5 Glocal Faculty Members
Professor PE Seeram Ramakrishna, FREng

seeram.rk@gmail.com

seeram@nus.edu.sg

➢ 2015 IFEES President’s Global Visionary Award recipient (http://www.ifees.net/awards/presidents-award/2015-ifees-presidents-award-recipients/seeram-ramakrishna/). Founder of Global Engineering Deans Council (www.gedc.org)

➢ Served as the Dean of Faculty of Engineering and Vice-President Research at the National University of Singapore (NUS)

➢ He is among the World’s Most Influential Scientific Minds (Thomson Reuters). Highly cited researcher in Materials Science (highlycited.com). ~ 700 journal papers, ~50,000 citations, and ~100 H-index. Successfully transferred innovations into products.

➢ PhD, University of Cambridge; The General Management Program, Harvard University

➢ Fellow, professional societies & academies of Singapore, UK, India, ASEAN & USA
Life at the click of a button
Earnings of Alumni 10 years after the university education

○ The earnings of many graduates are bleak especially from the lesser known universities

○ Innovation and entrepreneurship are seen as solutions

Source:
US Department of Education
China embarks on major changes in S&T, Margaret McCuaig-Johnston and Moxi Zhang, China Institute, University of Alberta, Vol 2, No 2, June 2015
Research to viable products

R&D: $$ \rightarrow \text{Knowledge} \rightarrow \text{Products} \rightarrow $$

USA: with 181 universities represent nearly a quarter (24.1%) of all universities

China: with 57 universities (8% of all universities)

UK: with 55 universities (~7%)

Germany: with 50 universities (~7%)

Gross expenditures on R&D (GERD) in China (1991-2013), NBS of China

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Volume of patent applications in Malaysia
Source: Derwent World Patents Index