Engineering Education’s Contribution to Economic Development

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Royal Society of Canada

Promote - Canadian research & scholarly and artistic accomplishments
Recognize - Academic and artistic excellence
Advise - Governments, NGOs & Can. public on matters of public importance

Canada’s National Academy, established by statute of Parliament of Canada – 1882, senior Canadian collegium of distinguished scholars, artists and scientists

Royal Society of London & Institut de France
RSC – Academies

Typically 6-8 Engineers & Applied Scientists inducted annually
Expert Panels – Recent Reports

The Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments, ‘15


Symposium “Canadian Marine Biodiversity: Indispensable Resources, Unprecedented Opportunities, Unequivocal Responsibilities”
Engineering & Innovation
Every major engineering innovation, from metal-making to electronics, has brought about changes in society.
Engineering Education and Economic Impact
Every IIT-ian created 100 jobs
Every rupee spent on IIT-ian created economic impact of Rs 50 at global level, ½ is India's share

Annual Revenue Responsibility per Alumni
(By geography, for 2007-08)

Impact of IIT Alumni
Economic Impact – India’s IITans

Combined Employment Generated by IIT Alumni

- Industry: 13 million jobs
- Entrepreneurship: 1 million jobs
- Government Roles: 2.5 million jobs
- Research and Education: 0.5 million jobs
- Total: $17 million

Employment Generated per Alumnus (By batches, for over last 50 years)

- Till 1976: 166 jobs per IIT Alumnus
- 1976-1986 Batches: 162 jobs per IIT Alumnus
- 1986-1996 Batches: 123 jobs per IIT Alumnus
- 1996-2001: 92 jobs per IIT Alumnus
- Post 2001: 13 jobs per IIT Alumnus

On average, an IIT Alumnus is associated with creating around 100 jobs.

Impact of IIT Alumni
Many IIT graduates now choosing to stay in India

- Ola cabs
- Taxiforsure
  ⇝ 30M customers India
- Snapdeal
- Flipkart ($1B)

http://topyaps.com/8-indian-companies-started-iit-graduates
## Entrepreneurial Efforts by IIT Engineers

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<th>15 Startups</th>
<th>Founder</th>
<th>IIT</th>
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<td>Bluestone</td>
<td>Gaurav Singh Kushwaha</td>
<td>Delhi</td>
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<tr>
<td>Capillary Technologies</td>
<td>Krishna Mehra, Aneesh Reddy and Ajay Modani</td>
<td>Kharagpur</td>
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<td>Druva</td>
<td>Jaspreet Singh</td>
<td>Guwahati</td>
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<td>Flipkart</td>
<td>Sachin Bansal and Binny Bansal</td>
<td>Delhi</td>
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<td>Housing</td>
<td>Rahul Yadav and 11 others</td>
<td>Bombay</td>
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<td>InMobi</td>
<td>Naveen Tewari, Abhay Singhal and Amit Gupta</td>
<td>Kanpur</td>
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<td>Ixigo</td>
<td>Alok Bajpai and Rajnish Kumar</td>
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<td>Knowlarity</td>
<td>Ambarish Gupta and Pallav Pandey</td>
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<td>Livspace</td>
<td>Ramakant Sharma</td>
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<td>Mettl</td>
<td>Ketan Kapoor and Tonmoy Shingal</td>
<td>Roorkee/Kanpur</td>
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<td>MobiKwik</td>
<td>Bipin Preet Singh</td>
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<td>Ola</td>
<td>Bhavish Aggarwal and Ankit Bhati</td>
<td>Bombay</td>
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<td>Shopclues</td>
<td>Sanjay Sethi</td>
<td>Varanasi</td>
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<td>Snapdeal</td>
<td>Rohit Bansal</td>
<td>Delhi</td>
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<tr>
<td>Zomato</td>
<td>Deepinder Goyal and Pankaj Chaddah</td>
<td>Delhi</td>
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Eng. Educ. - China’s Economic Growth

- Huawei – 27 yrs, largest telecom & computer network equipment provider, 10% in R&D (~US$5B)
- High Speed Rail Network - 12,000 km of rail lines, 214B passenger*km, > all other countries combined; mobility - labor force, goods & materials
- Steel - 779M tons of crude steel in 2013 (~50% of world production)

Hong Yan “Engineering Education in China“, 2015
Shifting Education Demographics

By 2020, China aims 20% of its population to be tertiary graduates (195 M)

This number is roughly equals to 25-64 year-olds in the United States in 2020.
Engineering for a successful nation

Key findings from Assessing the economic returns of engineering research and postgraduate training in the UK

March 2015

Engineering is pervasive in our modern society, enabling every sector from communication and entertainment to finance and healthcare, as well as its more visible applications in construction, manufacturing and transport.

Engineering contribution to UK gross value added

- Construction: £87 billion
- Medium and low tech manufacturing: £75 billion
- Computing and Telecoms: £60 billion
- High tech manufacturing: £22 billion
- Architectural and engineering activities: £22 billion
- Other sectors (weighted by concentration of engineers with Level 4+ qualifications): £12 billion

Total: £278 billion = 20% of UK GVA

Royal Academy of Engineering “Engineering for a successful nation”, March 2015
Engineering Education for Society
NAE Grand Challenges - Engineering

- Clean water for everyone
- Engineering better medicines
- Cybersecurity
- Health care

Global Grand Challenges Summit. Beijing, 15-16 Sep 2015

- Health care
  - Informatics: Innovation in Health & Healthcare
  - Wearables to Smart Implants
    - Pervasive & Personalized Healthcare
  - Health in Aging World - What action?

- Education - Engineers to tackle global challenges
  - “For Better Future: China’s Engineer & Engineering Education
  - Our Greatest Grand Challenge: Preparing Next Generation for Future
  - Beginnings of Wisdom: Challenges in Engineering Education”

- Innovations in urban infrastructure
- Sustainability
- Energy

http://ggcs2015.cae.cn/program.html
https://www.youtube.com/watch?v=wmHD8yzA63I&feature=youtu.be
Engineering Endeavors - Future

- Materials – revolutionize manufacturing, construction and infrastructures
- Energy – Fuel cells, biomass, bacterial electricity generators, photovoltaic generators & thermal generators
- Information – personal & portable integrated devices (voice, data, imaging, …)
- Systems engineering – address global challenges in healthcare, urbanization, security, climate change – harmonized with social, political & economic systems
Council on Competitiveness

- Innovation-based curricula - reflective of ill-structured, real-world scenarios
- Top leadership qualities word cloud

- Foster creative thinking & innovation - engaging & relevant curricula
- Develop & commercialize tech, increase industrial collaboration ...
Engineering Education and Some Canadian Innovations
Engineering Education for Econ Growth

- Increase practical training
- Interdisciplinary curriculum - broad knowledge for solving complex real-world problems
- Enhance international outlook – exchange programs
- Strengthen collaborations – academia & industry
- Promote culture of critical thinking, discovery & innovation in engineering education
- Encourage entrepreneurship – importance of creating & marketing competitive products - technical and business leadership
Education – Best Practices in Canada!

- Combine theory and practice; Models of 4-16 months coop education or internships
- U Waterloo - Largest engineering coop program in world
- McMaster - Engineering + Society / Business / Practice

- Problem-based learning @ McMaster (initially medical education, now expanded to other disciplines)

- Novel engineering programs
  - Renaissance engineering - Expert & agile in >1 discipline; Consider and communicate how engineering relates to matters of sustainability, health, safety and civil society ….
  - Biomedical (eng + medical), Engineering practice, Entrepreneurship & engineering innovation, Nanotechnology, Mechatronics …
  - Creative IT Engineering - Interdisciplinary-oriented education (S. Korea)
Between alumni, staff, volunteers and chapters members, EWB is a community of more than **30,000 systems change leaders**.