

Transformational Technologies Of The Next Decade & Implications

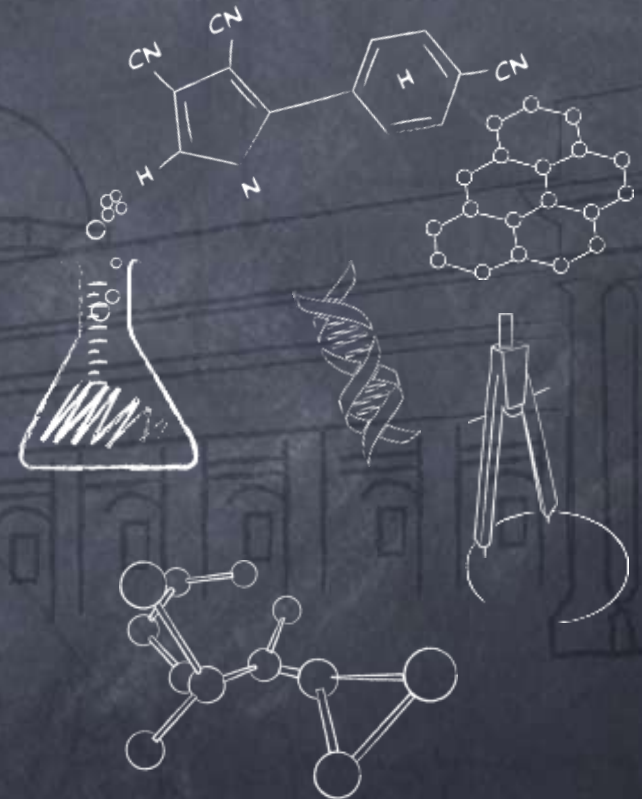
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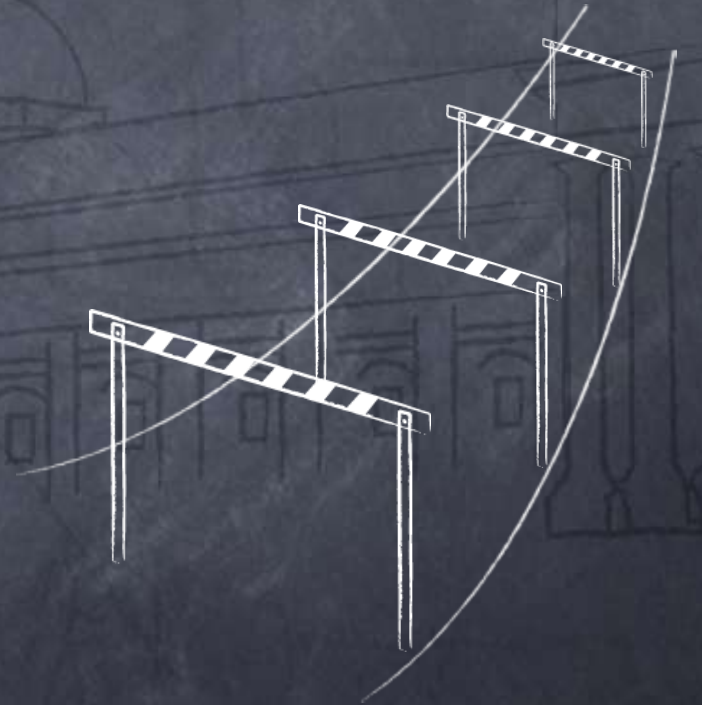
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Contents ...

- Some challenges of the world in 2020 and beyond
- A few transformational changes and technologies
- Implications
- Suggestions for upcoming engineers and other professionals



Challenges Facing Our World In 2020 & Beyond

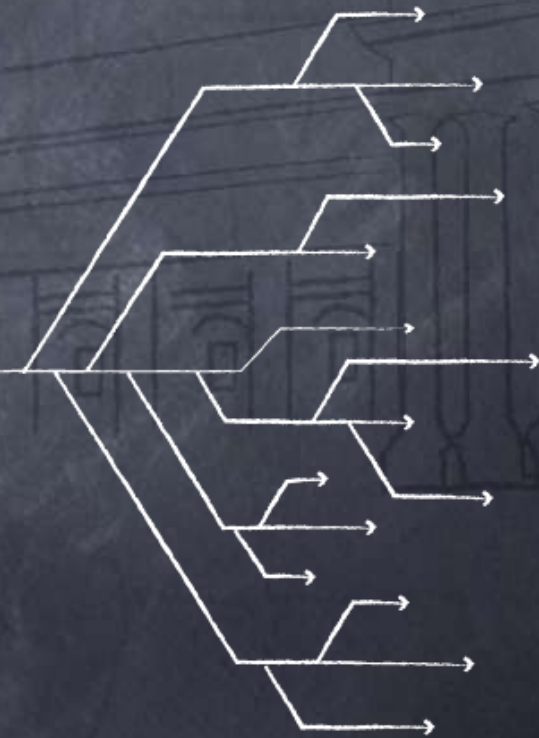


Many Challenges ...

- ① Rising population – from about 1.6 billion in 1900 to currently over 7 Billion, and likely to cross 9 Billion before 2050
- ① Exponentially rising consumption with increased incomes and changes in aspirations and lifestyle, creating un-sustainability
- ① Uneven demographics – rapidly aging populations in some parts, very young populations in another
- ① Nonlinearity of changes in demand across board (energy, minerals, land, human skills)
- ① Inter-connected world more impacted with Black Swan events

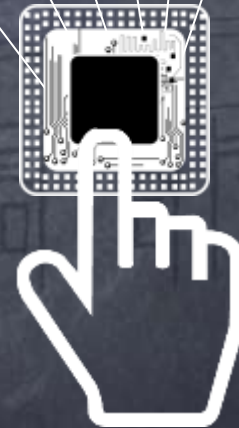


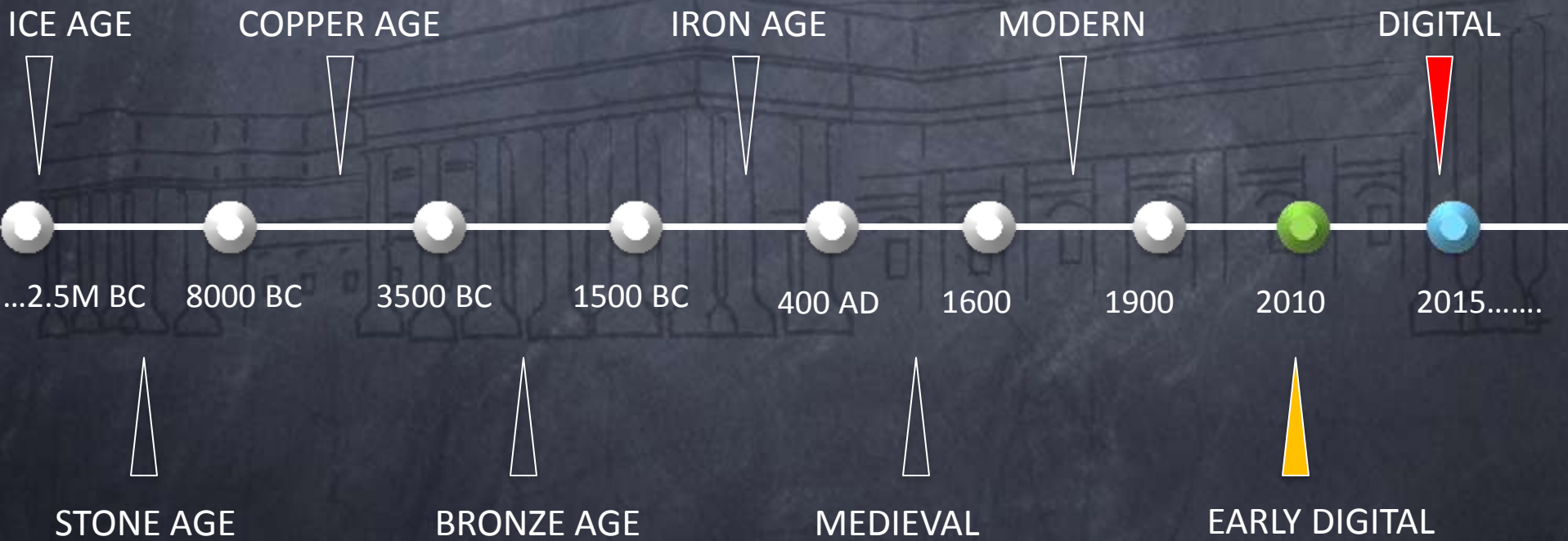
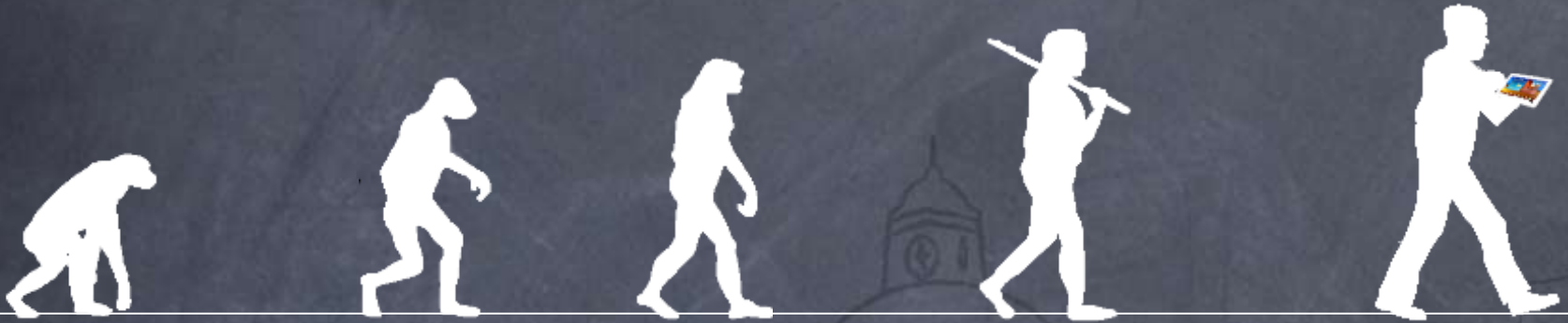
A Transformational Change & A Few Transformational Technologies



A Transformational Change ...

Onset Of Digital Age





Dramatically Accelerated Penetration Of Information Technology (2010 vs. 2020)

	2005	2010	2016*	2020*
Mobile phone users (million)	150	720	870	950
Access to Internet (million people)	25	80	300	750
Smart phone users (million)	1	25	250	450
Laptops / Tablets (million)	1	8	50	250
Access to Digital TV (million people)	5	100	300	600
Credit/ Debit Cards Issued (million)	67	200	300	450
Mobile Money users (million)	NA	11	100	400



And A Few Transformational Technologies ...



Extraordinary Impact Potential Of ...

1. 3-D printing (manufacturing)
2. Nanotechnology
3. Engineered materials
4. Bio-medical engineering / life sciences
5. Mass “peer-to-peer” networking



Extraordinary Impact Potential Of ...

1. 3-D printing (manufacturing)
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1: 3-D Printing (Manufacturing)

- Technology rapidly becoming mainstream
- Implications:
 - Global manufacturing
 - Distribution & retail
 - Healthcare
 - Entrepreneurship



2: Nanotechnology

- Molecule level manufacturing
- Applications cut across many industries including:
 - Building surfaces (e.g. self cleaning glass)
 - Healthcare (including nano-bots)
 - Packaging
 - Transportation (new engineered materials for aviation and automobile applications)
 - Consumer products (clothing, scratch resistant eye-glasses, bandages, sunscreen, etc.)
 - Many, many others



3: Re-engineered Materials

- Confluence of many sources (natural mineral, synthetic, biological)
- Fascinating applications emerging in just about every sphere of industrial activity, including:
 - Next generation of (biological) semi-conductors
 - Next generation of solar cells (graphene composites)
 - Next generation of fibers (clothing, automobile, healthcare applications)
 - Next generation of composites (aviation, aerospace, and defense applications)



4: Bio-medical Engineering / Life Sciences

- Extraordinary developments taking place across the entire spectrum of human life including:
 - DNA mapping and emergence of disease predicting markers
 - Imaging and diagnostics
 - Stem cell based therapies
 - Robot assisted / robotic surgeries
 - Body parts regeneration / organ transplants
- Fascinating confluence of many streams of basic sciences, several streams of engineering, and computing & information technology



5: Peer-to-Peer Global Networks

- First time in human history that almost every individual has the opportunity to connect directly with another individual (or groups of individuals) without (almost) any geographic, political, socio-economic, caste / community, or ideological barriers
- Potentially the most efficient platform for exchange / trade of myriad ideas, goods, and services without the need of external “exchanges” or intermediaries
- Ultimate democratization of intellectual resources of the human race?



Implications ...

(Over A 10 – 20 Year Horizon)



Implications ...

- ① Unprecedented convergence of several streams of sciences, engineering, arts, and even philosophy
- ① Emergence of a new world order in the next 10-20 years
- ① Emergence of new ways of living our lives
- ① Emergence of new class of industries, while partial or total decimation of many current industries



Implications ...

- ◉ Impending decline of some currently glamorous jobs (e.g. fighter pilots, surgeons, “managers”) and employers (e.g. brick & mortar big-box retailers, TV media companies, book publishing companies, etc.)
- ◉ Emergence of new highly-prized jobs (e.g. bio-medical engineers, industrial designer, whiz kids in analytics, etc.) in companies at the leading edge or straddling the transformational technologies (Intuitive, Palantir, Amazon, etc.)



Suggestions For Upcoming Engineers ...



A Few Suggestions For Engineers

- Continue to invest significant time and some money in continuing your learning after you graduate from IIT-R
- Don't think merely like a “mechanical” or “civil” or “electrical” engineer – think first like an “engineer” in a holistic manner, and then think beyond just being an engineer by aspiring to become an innovator, a creator of something that innovatively solves some challenge or provides a better solution
- Technology has the potential to solve many of India's (and world's) seemingly insurmountable challenges – continuously scan the emergence of new technologies across a very wide spectrum, and then try to apply these new technologies using lateral thinking



Suggestions For The Faculty...



A Few Words For The Faculty

- 🌀 Refresh and reinvent yourselves
- 🌀 Be both a “student” and a “teacher”
- 🌀 Diversify your reading significantly
- 🌀 Imbibe and then preach “non-linearity” in thinking
- 🌀 Innovate and foster / reward innovative thinking and innovative approaches



Suggestions For The Administrative Leadership At IIT- Roorkee ...



IIT-R's Administrative Leadership Should ...

- Rethink further on increasing diversity of:
 - Student body
 - Faculty
 - Academic programs
 - Curriculum
 - Exposure for students and faculty
 - Information resources for all on the campus, and then even access to those who have already graduated



For Further Dialogue, Please Contact :

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