Life Skills MOOC (LEVEL 2)
Week 5- ETHICS- CASE STUDIES
Webinar

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Kanpur

Objectives of the Module

- To enable learners to understand the significance of ethics and their responsibilities as professionals
- To provide inputs on code of ethics, ethical dilemmas and factors that affect moral responsibility
- To empower the learners with requisite skills for effective decision- making for social good

Overview of the Module

I. • Background & Introduction

II. • Case Study 1: Bhopal Gas Tragedy

III. • Case Study 2: Space Shuttle Columbia Disaster

IV. • Case Study 3: Delhi Metro

V. • Case Study 4: Fukushima Nuclear Disaster

VI. • Case Study 5: Fourth Industrial Revolution & Conclusion

• Conclusion

Introduction (1)

- **Advent of technologies and the greater public good being targeted at, Ethics now a part of curricula across the world**
  - Decision making, like engineering design, may have multiple solutions
- **A good professional needs to be a perfect amalgamation of the knowledge in his discipline and life skills together.**
- **A Case in Point- COVID- 19**
  - **Ethical standards for research during public health emergencies** *(World Health Organization. (2020). Ethical standards for research during public health emergencies: distilling existing guidance to support COVID-19 R&D (No. WHO/RFH/20.1). World Health Organization.)*

Ethics: Derives from the Greek *ethos*, meaning character

According to Oxford Dictionary, Ethics is "Moral principles that govern a person's behaviour or the conducting of an activity"(*)

(*) Source: Ethics. (n.d.). Accessed from https://en.oxforddictionaries.com/definition/ethics on October 01, 2017.

Introduction (2)

- Ethics- not always **black and white**

- Ethical situations are not always clear cut but that they come in number of shades of **grey**
  - What might be appropriate in one situation may not be appropriate in another

- **Five case studies,** which will facilitate learners to understand the applied aspects of ethical practices:
  - **In- depth, multi- faceted explorations** of complex issues and **in- depth appreciation of an event/ issue/ phenomenon** in its real- life context

  - **Correlation** of real- life circumstances, decisions, incidences, actions and results with the theory/ concepts/ aspects covered in Level 1

  - **Facilitating a logical conclusion and appreciation**, which can guide learners in taking appropriate action in situations in their respective professions

Introduction (3)– Rationale- Selection of Case Studies

- The case studies have been selected from **various streams of engineering** based on:
  - **Positive and negative role- models**
    - Positive: Delhi Metro
    - Negative: Bhopal Gas Tragedy, Space Shuttle Columbia Disaster
  - **Rare and large- scale event**
    - Fukushima Nuclear Disaster
  - **Current and prospective**
    - Fourth Industrial Revolution

Over to Ms. Ramya

Structure of the Case studies

- **Synopsis**
- **About the Case/ Incident**
- **Findings & Discussion**
- **Conclusions**
- **References**

Disclosure

The Case Studies have been prepared for teaching purpose only. The data/ images/ information included are from publicly available sources.

The data, including text, images and other representations, have been duly cited either in the text or references. Though extreme care has been taken in providing the citations/ references, the instructors or the affiliating institutions are not responsible for any errors or any other situation(s) arising from the use of this information.

It may be noted that it is an exercise for teaching purpose only.

The students are requested to make use of the references for further readings and citations of the cases.

Case Study 1: Bhopal Gas Tragedy, India (1984)

Synopsis (1)- The tragedy that struck Bhopal

"All the News That's Fit to Print"

The New York Times

late Edition

VOL. CXXXIV . . . No. 46,249 NEW YORK, TUESDAY, DECEMBER 4, 1984 35 CENTS

FARM PRICE SYSTEM MAY BE CURTAILED, WASHINGTON SAYS

BLOCK GIVES BUDGET PLAN

Congress to Be Asked to End Supports Until Levels Go Sharply Below Average

By PETER T. KILBORN

Regan Foresees Final Tax Plan Like Treasury's

Analysis by Department of Its Proposals Issued

By DAVID E. ROSENBAUM

Residents of Bhopal, India, viewing the bodies of victims of a lethal gas that seeped through the city.

GAS LEAK IN INDIA KILLS AT LEAST 410 IN CITY OF BHOPAL

12,000 REPORTED INJURED

Officials Say the Fumes Came From Insecticide Plant of U.S.-Owned Company

By SANJOY HAZARIKA

Administration Defends Its Policy On South Africa as Protests Grow

By FRANCIS X. CLINES

2 SENATORS PRESS REAGAN ON ARMS

Republicans Urge Scrapping of 1979 Strategic Accord

By BERNARD WEINRAUB

Source: https://archive.nytimes.com/www.nytimes.com/learning/general/onthisday/big/1203.html

Source: https://www.outlookindia.com/magazine/story/graveyard-bullies/262256

Synopsis (2)

- Bhopal is the capital city of Madhya Pradesh, India

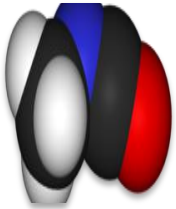
- **December 2-3, 1984:**
  Toxic gas leak at the Union Carbide Pesticide Plant, located in Bhopal, resulting in thousands of deaths and its after- effects continue to this day

  The Union Carbide India Limited (UCIL) is a subsidiary of US- based Union Carbide.

Introduction (1)

1960s
- Green Revolution

1969
- UCIL established a pesticide formulation plant in Bhopal to initially import, mix and package pesticides manufactured in the US



1979
- A 5,000 ton methyl isocyanate (MIC) production unit was installed in the plant to manufacture a pesticide marketed as Sevin

MIC: One of the most dangerous compounds. To be stored at 0 degree C.
So volatile→ a few drops of water or few traces of metal dust→ violent and uncontrollable reaction.

Image Sources: https://www.livemint.com/Politics/3sZiwjDDTpjjcD464CM1qM/Bhopal-gas-tragedy-the-fight-continues.html
https://en.wikipedia.org/wiki/Methyl_isocyanate

About the incident (1)- December 2- 3, 1984…

4. Within an hour or so, most of the toxic MIC spread itself across the city

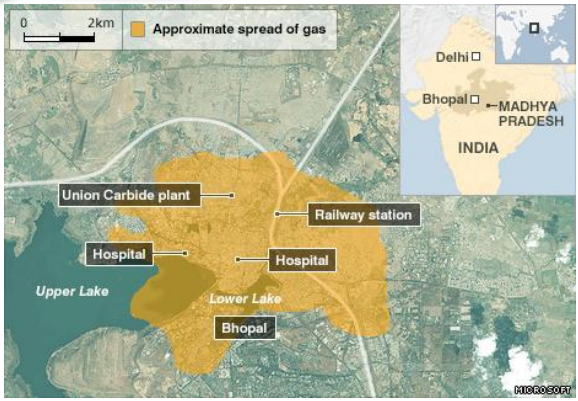
3. A weak wind helped gas to cover more area in a shorter period of time

2. MIC began to release from the tank

1. Pressure- relief valve of a tank (610) containing MIC, opened accidentally

5. Thousands of people and animals got exposed to the toxic gas

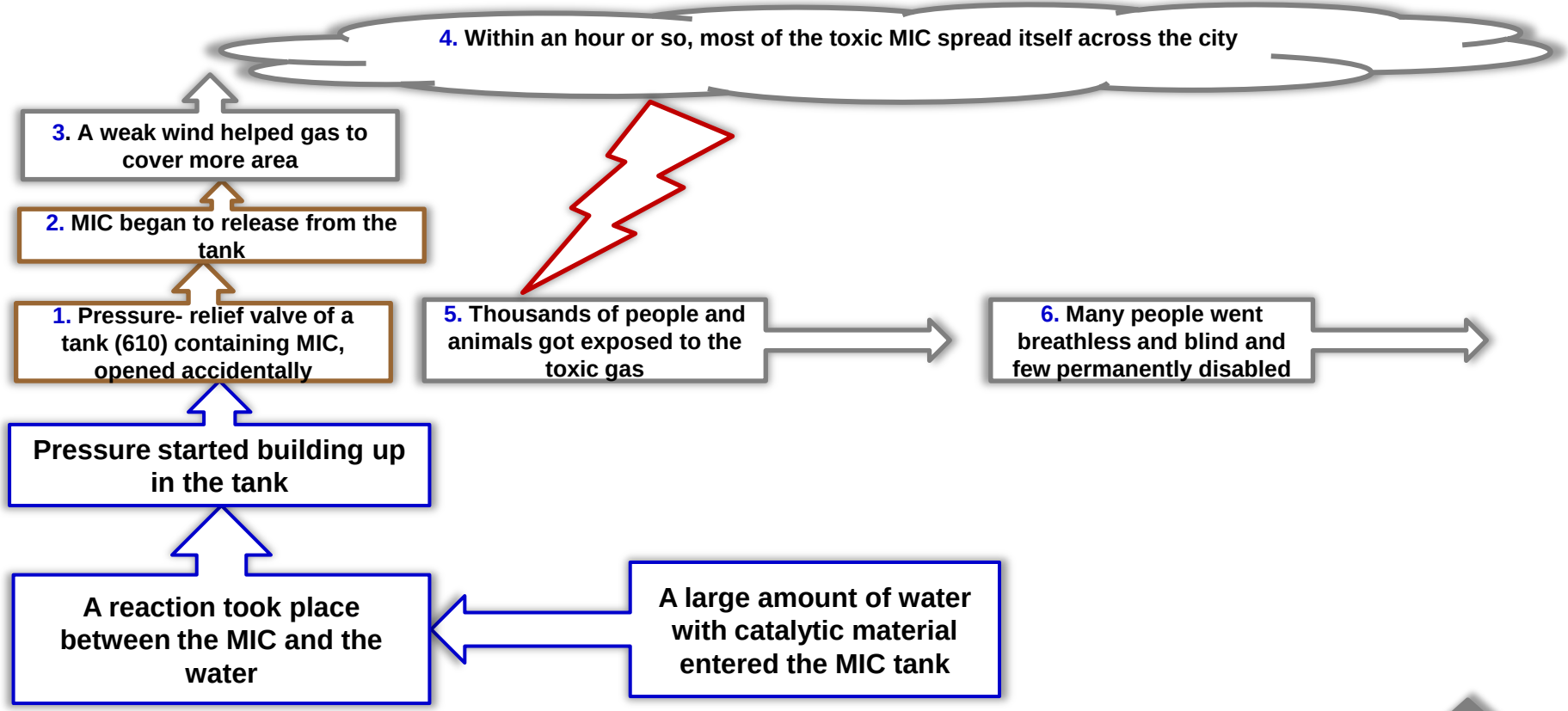
6. Many people went breathless and blind and few permanently disabled



Source: http://news.bbc.co.uk/2/hi/south_asia/8725140.stm

Source: Course Instructors

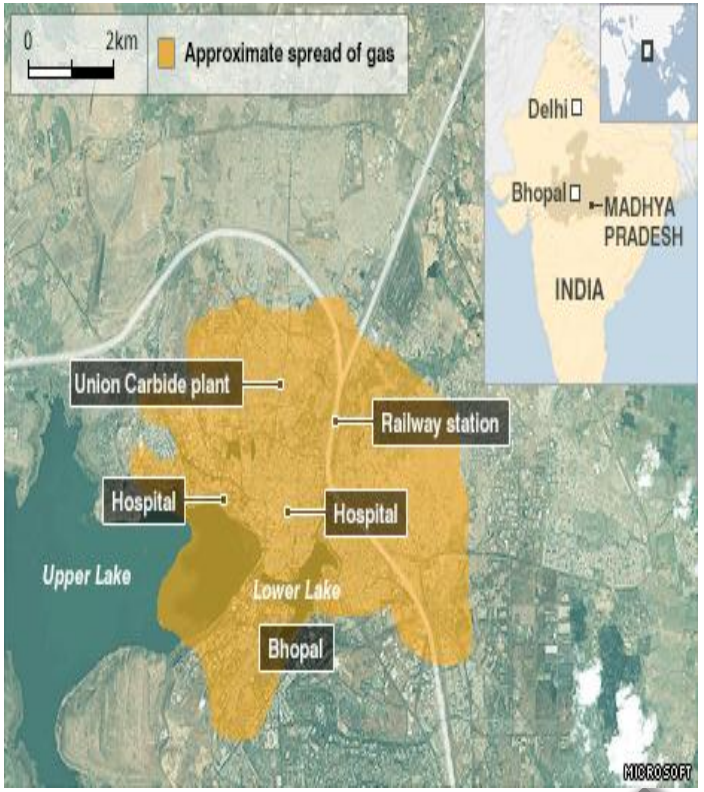
About the incident (2)- December 2- 3, 1984…



Source: Course Instructors

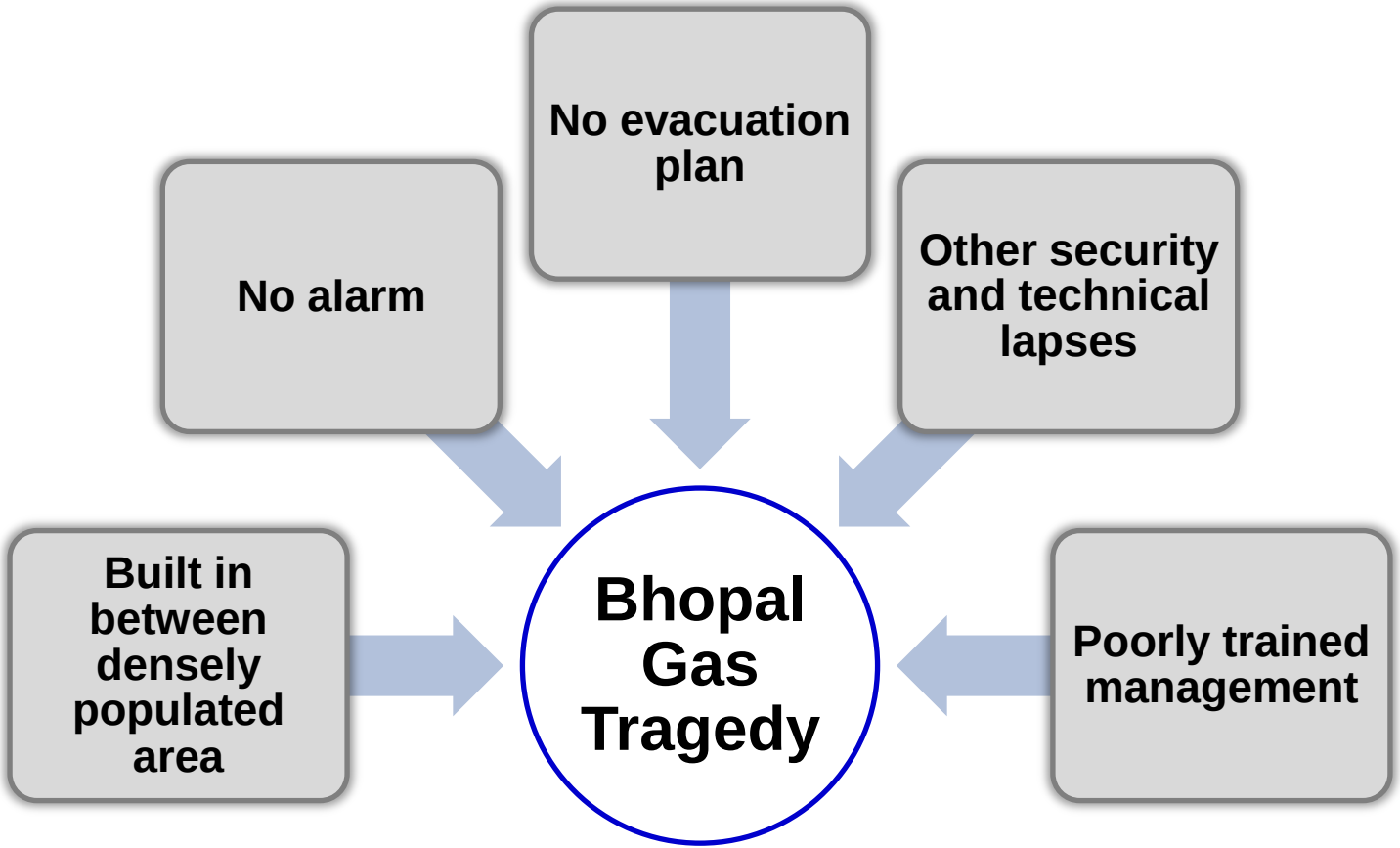
The aftermath- Spread of gas

- Over 5,00,000 exposed to the toxic gas
- Many people went breathless and many of them have sight disorders
- Immediate death toll: about 3,000; many animals too died
- Continuing after- effects



Source: http://news.bbc.co.uk/2/hi/south_asia/8725140.stm

Findings and Discussion (1)



Findings and Discussion (2)

Lack of safety and security measures	• Construction of plant in a densely populated area • No evacuation plan and community awareness • Disaster management plan across industries not in place
Critical technical issues	• Tank filled to more than permissible capacity; not stored at 0° C • Flare tower and scrubber not in working condition • One of the tanks lost the ability to contain the pressure of nitrogen, which contained about 42 tons of MIC. • Refrigeration and cooling systems were turned off months before
Downsizing of the Bhopal plant by the parent company	• Lack of manpower • Losses in the first ten months of 1984. • Plans to dismantle the plant, which furthered negligence
Lack of appropriate action by Union Carbide on previous leaks	• Of MIC or phosgene in Bhopal Plant and similar incidents in its Virginia Plant
Safety concerns	• Lack of robust safety standards and policies mandated by state government

Findings and Discussion (3)

- **Ignored basic green chemistry principles**
- **Medical information on chemicals withheld**

Critical departure in terms of Design, ethical and environmental considerations, Safety of employees and Moral responsibility

- **Civil and criminal cases**
  - The Government of India as the sole representative of the victims
    - Bhopal Gas leak (Processing of Claims) Act, 1985.
    - Compensation of US $470 million and other measures

Conclusion

- Robust policies for safety of individuals and environment
  - Waste management
  - Environment Act, 1986

- **“Moral responsibility is an idea that applies to individual engineers, groups of engineers, and the corporations in which most engineers do their work. It is also a multifaceted idea that combines obligations, ideals of character, accountability, praiseworthiness, and blameworthiness.”** (Martin, Mike W., Schinzinger, R. 2010)

- Design and implementation of safer processes

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Paul Shrivastava, *Bhopal, Anatomy of a Crisis (Cambridge, MA: Ballinger,* 1987)

https://en.wikipedia.org/wiki/Bhopal_disaster#Causes_of_the_disaster:_The_%22corporate_negligence%22_argument

http://www.indiaenvironmentportal.org.in/media/iep/infographics/Bhopal%20Gas%20Disaster/index.htm

http://www.icmrindia.org/free%20resources/casestudies/The%20Bhopal%20Gas%20Tragedy1.htm

http://www.ijaera.org/manuscript/20160206006.pdf

https://www.downtoearth.org.in/coverage/30-years-of-bhopal-gas-tragedy-a-continuing-disaster-47634

https://www.outlookindia.com/website/story/bhopal-gas-tragedy-victims-continue-to-suffer-dna-damage-study/305249

https://web.archive.org/web/20120518015922/http://www.mp.gov.in/bgtrrdmp/facts.htm

Martin, Mike W., Schinzinger, R. (2010). Introduction to engineering ethics. Retrieved from http://course.sdu.edu.cn/G2S/eWebEditor/uploadfile/20131018102149728.pdf on November 15, 2017.

Case Study 2: Space Shuttle Columbia Disaster, United States (2003)

Background

- **Space Shuttle Columbia-** the first space-rated orbiter of the fleet of National Aeronautics and Space Administration (NASA), an agency of the United States government.

- Launched first on April 12, 1981.

- Completed 27 missions before it disintegrated during re- entry at the end of the 28th mission.

The launch of Columbia

Image Source: ttps://www.flickr.com/photos/nasacommons/16085788627/in/album-72157650279651165/

About the Case (1)

- Columbia on a mission STS- 107 to conduct experiments ranging from material sciences to life sciences in space:
  - FREESTAR (Fast Reaction Experiments Enabling Science, Technology, Applications and Research)
  - SHI Research Double Module (SHI/ RDM), known as SPACEHAB.
- Space Shuttle Columbia disintegrated upon re- entering Earth's atmosphere, killing all seven crew members on February 1, 2003

The Crew of Columbia
Source: https://www.flickr.com/photos/nasa2explore/

About the Case (2)

- **3**. Details not known. Foam strikes- don't cause significant damage; request to examine **rejected**
- **4**. No action taken

- **2. January 16, 2003, a few seconds after the launch:** A piece of the insulating foam broke off, hit the orbiter's left wing and created a hole in the edge, which went unnoticed

- **1. January 16, 2003, 10:39 AM (EST):** Columbia lifted off for a 16- day mission in space from the Kennedy Space Centre, US with a crew of seven members to conduct experiments

- **5. February 1, 2003:** Re-entry into the earth's atmosphere- superheated air exceeding 5000° F entered in the wing
  - Burnt the wing
  - Bottom surface of the wing began to cave into interior

- **6.** Columbia went out of control and disintegrated over east Texas
- The entire crew were killed and the spacecraft destroyed

About the Case (3)*

- All the seven astronauts were killed
- US$4 billion- worth spacecraft destroyed
- Debris scattered over 2000 square miles across Texas
- NASA grounded shuttle fleet for 2-1/2 years

* Source= https://www.aiche.org/ccps/topics/elements-process-safety/commitment-process-safety/process-safety-culture/building-safety-culture-tool-kit/Lessons-From-the-Columbia-Disaster

Findings and discussion (1)

- According to Columbia Accident Investigation Report (CAIB), 2003,
  - The physical cause of the accident was a breach in the leading edge of the left wing, caused by insulating foam shed during launch.
  - Heat first entered the wing in the location where photo analysis indicated the foam had struck.
- Highly critical of NASA's decision- making and risk- assessment processes.
- Recommendations for significant changes in processes and organizational culture.

Findings and discussion (2)

- Although circulatory systems functioned for a brief time, the **effects of the depressurization were severe enough that the crew could not have regained consciousness.** This event was lethal to the crew." *(Columbia Crew Survival Investigation Report, December 30, 2008 produced by a second commission, the Spacecraft Crew Survival Integrated Investigation Team (SCSIIT))*

- No time for the crew to prepare themselves.
  - Some not wearing their safety gloves; one crew member was not wearing a helmet.
  - The crew's safety harnesses malfunctioned during the violent descent.

- **The key recommendations of the report included that future spacecraft crew survival systems should not rely on manual activation to protect the crew.**

Findings and discussion (3)

- No lessons learnt from the Challenger incident,
  - Liquid hydrogen tank exploded within 73 seconds from the launch resulting in a massive explosion and destroying of the shuttle and killing its seven crew members in January 1986.
- Lack of eye for details
  - Ignorance to the foam
- Imperatives for safety, risk assessments

Conclusion (*)

- NASA's two space shuttle accidents (Challenger 1986 & Columbia 2003) Patterned and systemic, not random or chance occurrences, thus both could have been prevented.

- Ethical and other issues as mentioned below leading to these occurrences:
  - **Interaction, decisions, and the normalization of deviance:**
    - Production of a ***cultural belief that the problems were not a threat*** to flight safety
  - **NASA's institutional environment and the culture of production:**
    - NASA's original ***pure technical culture was converted into a culture of production***
    - Engineers were made to think like Managers
  - **Structural secrecy**
    - Both problems had gone on for years (O Ring erosion & Foam debris)
    - Individuals trying to keep bad news from top management- unethical behaviour
  - Accidents of such magnitude and scale tell engineers that each one of you need to
    - Imbibe a work culture where we work without external pressures and biases
    - Make appropriate decisions in spite of ethical dilemmas
    - Adherence to professional code of ethics

(*) Source:
http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=B948B2714D26A276E4FB59F4E88CA3B5?doi=10.1.1.473.447&rep=rep1&type=pdf

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Case Study 3: Delhi Metro, India (1995- Present)

Synopsis

Source: http://www.delhimetrorail.com/about_us.aspx

- **Delhi Metro:** Pioneer in transforming the sphere of mass urban transportation in India.
- The largest and busiest metro in India.
- An evidence: an infrastructure project of this size→ completed on time and within budget.
- In addition to adopting the best design, planning and project management techniques, one of the primary reasons for success→ implementation of a Code of Ethics and Values. *(IC Centre for Governance (ICCfG), June 2018)*

Introduction (1)

- Delhi is the **capital city of the India**; Population of 19 million (2020);
- Increasing transport congestion and vehicular pollution
- Second metro project in the country after Kolkata
- **One of the largest in the world** in terms of length and no. of stations

Introduction (2)- Network

http://www.delhimetrorail.com/about_us.aspx

Source: http://www.delhimetrorail.com/Zoom_Map.aspx

- Network: **296 kms; 8 colour- coded lines**
- Stations: **214**
- **Mix of underground, at- grade and elevated stations**
- **270 train sets** of four, six and eight coaches.
- Ridership: Crossed more than **3 million** passengers per day

Introduction (4)- Phases

Phase (Year)	Total Length (Km.s)	No. of stations
I (1998- 2005)	65	58
II (2006- 2011)	124.93	85
III (2011- 2018)	167.27	About 109
IV (2017- 2021)	*103*	*Planning stage*

Source: http://www.delhimetrorail.com/projectpresent.aspx#

http://www.delhimetrorail.com/about_us.aspx

Investment of around Rs. 70,000 Cr. for three phases

Issues Vs. Practices

Design & Planning

Pressures and bureaucratic delays

Protecting heritage structures

Technical and systemic hurdles

Land acquisitions

Environmental issues

Quality issues

DELHI METRO

- Phase- wise implementation of the project
- Autonomy on all major matters
- Leaner
- Efficient Leadership and management
- Direct correlation b/w institution's performance and implementation a proper code of ethics
- Ownership and accountability
- Reverse countdown clocks
- Quality consciousness across the organisation
- Timely payment to various stakeholders
- Zero Tolerance Policy for any deviation in work/ ethical practice
- First in the world: Carbon Credits for reducing Green House gas emission; ISO 14001 in the construction stage itself for environmental management system
- Punctuality over 99.95%

Findings and Discussion (1)

- **Innovative approach** in dealing with technical and project management challenges

- **Popular globally** for its technological advancement *and will soon become the fourth largest Metro system in the world*

- **Significant contribution towards controlling pollution** and reducing vehicular congestion on the roads.
  - Helped in removing about four lakh vehicles from the streets of Delhi. *(DMRC Sustainability report 2015- 16)*

- One of the primary reasons for success- implementation of a Code of Ethics and Values. (IC Centre for Governance (ICCfG), June 2018)

  - Excellent performance in areas such as exemplary leadership, punctuality, fair and transparent processes in procurement, prevention of corruption, employee welfare, adherence to safety norms etc.

Findings and Discussion (3)

- Fairness in dealing with **land acquisition hurdles ;**
  - Sensitive to “Rehabilitation & Resettlement” issues

- **Project management skills→** Technology transfer on one side and preparing Indian contracting agencies on the other side
  - Working with diverse technologies and skills

- **Protecting heritage buildings** while route planning and construction
  - To minimise structural damages or demolition and caring for sensitivities of citizens and traders

- Maintaining ecological balance

- Meticulous planning to cause minimum disturbance to existing traffic in major junctions

- **Care in waste disposal of construction material and clearing** the area fast after construction/ excavation to avoid water logging etc.

Conclusion

- Adherence to a code of ethics and values
  - Continuous review and monitoring, timely action on deviations not only in project management issues but also in ethical matters.
- Moral responsibility and leadership
  - Lead by example and transparency in decision- making
- Punctuality, Integrity, Professional Competence and Social Accountability
  - The guiding principles of Delhi Metro
- Committed and conscious public service delivery
- Benchmark of an ethical public institution

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https://economictimes.indiatimes.com/industry/transportation/railways/metroman-e-sreedharan-hails-integrity-of-delhi-metro-officials/articleshow/51746513.cms

http://www.iccfg.net/

http://www.delhimetrorail.com/default.aspx

http://www.delhimetrorail.com/press_reldetails.aspx?id=FMfq9rbdyX8lld

http://www.delhimetrorail.com/otherdocuments/Sustainability-Report.pdf

Over to Mr. Viswanath

Case Study 4: Fukushima Nuclear Disaster, Japan (2011)

Synopsis

- Nuclear energy is considered as a sustainable energy source that reduces green house gas emission and produces far less wastes than conventional energy.

- On the other hand, nuclear fuel and wastes are highly radioactive, posing many threats to public health and the environment.

- Nuclear accidents are catastrophic and have a far-reaching impact on global health.

- The Japan nuclear disaster raised the ethical issues of nuclear energy programs.

- Based on the **ethical analysis & moral philosophy (Utilitarianism, Deontological etc.)** mankind needs to take a more stringent approach on nuclear programs.

About the Case (1) – 4700 MW (6 Units) Nuclear Power Plant

The plant before the accident on 11th Mar 2011

Source: A collection of images and data by Toro Laszlo Member of the Council of the RSRP National Institute of Public Health Regional Centre of Public Health Timisoara

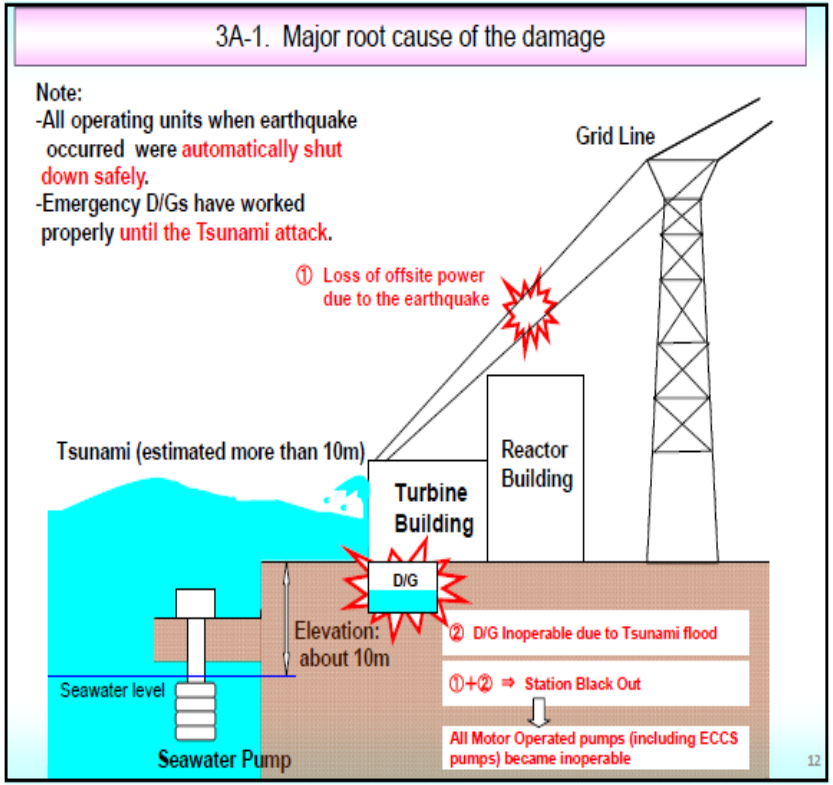
About the Case (2)

- Mar. 11, 2011- 14:46 Hrs: The Fukushima Daiichi (240 KM from Tokyo) Nuclear Power Station hit by an earthquake of 9.1 magnitude near island of Honshu
- The quake had an impact on the section of north-east coast of Japan where a series of nuclear power plants (NPP) are located.
- 15.27 Hrs: Ist Tsunami strikes plant; destroyed fuel tanks , flooded diesel generators resulting in loss of cooling water & exposing nuclear fuel rods
- Next four days - Meltdown of reactors, hydrogen gas explosions, and massive release of radioactive material into land, sea, and air.

Source: A collection of images and data by Toro Laszlo Member of the Council of the RSRP National Institute of Public Health Regional Centre of Public Health Timisoara

About the Case (3)

- 6 workers received radiation doses apparently over the 250 mSv (Milli Sievert) level set by NISA (Nuclear & Industrial Safety Agency), but at levels below those which would cause radiation sickness.
- Mar 11, 21.00 Hrs: Evacuation order issued by govt. to persons with in 3 KM radius
- Mar 12, 21.40 Hrs: Evacuation order issued within 20KM
- Nearly 160,000 people were evacuated from their homes.
- According to a report 32 Million people are exposed to radiation due to this accident (Ref 11)



NISA- Nuclear and Industrial Safety Agency

Source: A collection of images and data by Toro Laszlo Member of the Council of the RSRP National Institute of Public Health Regional Centre of Public Health Timisoara

About the Case (4)

Daiichi NPP after multiple hydrogen explosions (16.03.2011)

Findings

- Pre warnings were ignored

- Review of the tsunami countermeasures in accordance with IAEA guidelines which required taking into account high tsunami levels, but NISA continued to allow the Fukushima plant to operate without sufficient countermeasures such as

  – Moving the backup generators up the hill, sealing the lower part of the buildings, and having some back-up for seawater pumps, despite clear warnings.*

*** Warnings ignored**

Discussion (1)

- Good practices are “not sufficient” if applied mechanically.
  - Need to go beyond the strict implementation so that all duties important to safety are carried out correctly, with alertness, due thought and full knowledge, sound judgment and a proper sense of accountability.
- Adherence to relevant ***ethical codes & practices*** **is an integral part of** Safety culture .
  - Ethical perspective is one of education and training, marked by a reliance on the discretion of scientists, engineers, and corporate leaders.
  - The fundamental canons of Ethics are not just for information but to have belief in them, adopt them and implement them in letter & spirit
- Similarly the overall approach followed in decision making which have massive & large implications on the people & environment needs an in-depth ethical analysis & based on moral principles too

Discussion (2)

At every stage and phase of Fukushima Nuclear power plant (right from plant location decision to safeguarding the nuclear waste) there were deviations in ethical principles and practices

Stage/Phase	Decision Criteria	Deviation in Ethical principle /practice
NPP -Seismic qualification	Location based on “very low probability” of earthquake	Location selected in spite of the project area being highly earthquake prone
NPPs design	Considerations- to be designed to prevent any accidents . Design based on “reduce uncertainty & improvement of accuracy”	In 2006, a seismic design guideline for NPPs has been revised but not followed for Fukushima –Reliability ,risk and safety compromised
Plant layout	To avoid loss of any emergency system / equipment	Shifting / relocating Emergency Diesel generators was not done – Whistleblowing , cultural belief that problems are not threats
Public hearing	Disclosure to locals on all the Risks associated with NPPs	Low level of transparency and unclear decision hierarchy
Governance	Avoid Conflict of Interest	NISA was department of the ministry of economy, trade and industry (METI). METI’s job is to push for Nuclear power, while NISA is tasked with safety.

Does the Fukushima accident provide an opportunity to induce a paradigm shift from a safety culture to applied ethics?

Discussion (3)

- Medicine→ risks and benefits between individuals (physician and patient).
- Nuclear power plant → risks and benefits in a more complex context encompassing a company and a group of people (electric power utility and residents around the plant and the end users of electricity).
- Two approaches used to discuss such multifaceted issues

Utilitarian or risk-based approach	**Deontological or rights- based approach.**
Possible to rank various options by appropriately evaluating the risks and benefits of NPPs	Raise the question of who is qualified to participate in decision making in such evaluations

Discussion (4)

The Utilitarian Approach

- Conflict of interests between local residents and national goals and disclosure of relevant information are extremely important ethical issues.
- Government authority to regulate nuclear technologies and holds relevant information → dictatorship if the government makes decisions solely based on national interests.
- Effective measures to restrict the govt.'s authority over risk assessment and information disclosure
- A low level of transparency is disadvantageous to the public; the question of who should be involved in decision making.

The Deontological Approach

- In terms of NPPs and nuclear waste, discussion on intergenerational ethics.
- Justifiability of making future generations bear the risks of managing radioactive substances
- Risks for the various sections of people; Sufficient information in order to choose the energy policies they want.

Conclusions (1)

- Nuclear power regulators and industry→ follow ethical values and principles to make decisions in order to maximize the benefits and minimize the harm;
- Different stakeholders may have different opinions

Proponents	Opponents
• Accidents are isolated cases→ should not dissuade mankind from using nuclear energy. • Utilitarianism→ does the nuclear energy program maximize well- being to most people and are there alternatives to accomplish the same outcome? • They cite that the troubled nuclear reactors in Fukushima used technologies in the 1970s, which had safety concerns even before the accident occurred.	• Despite no green house gas emissions, nuclear reactors produce nuclear wastes through mining, refining into nuclear fuels, and transporting both the fuels and wastes • Currently, no permanent solution for waste disposal. 10s of millions could be affected. • As natural disasters and technological disasters become increasingly linked, compounded effects will have broad and complex impacts that could cascade into crises around the globe.

Conclusions (2)

- Ethical behaviours and adherence to ethical practices is mandatory and not a choice

- Improve safety standards to minimize harm to environment and global health
  - Implementing more stringent safety checks and review measures
  - Decommissioning aging plants and those that fail to address safety concerns;

- Cultural beliefs that problems are not threats and structural secrecy (not sharing bad news) will only add to unethical behaviours and lead to major accidents

- Mandate sharing of timely, accurate, and credible information with public- to reduce damages of radiation emergencies and for public trust and confidence.

- Enhance international cooperation between govt.s., international org.s & industry on guidance, law enforcement, monitoring, follow-up.

Conclusions (3)

- Integrate medical care and psychosocial support for high risk populations after nuclear accidents to help reduce the psychosocial damage on the public
- Any nuclear accident has a far-reaching impact on global health.
- In terms of utilitarian principles, there is a need for authorities and nuclear industry to take a more robust and stringent approach on the nuclear programs and its allied activities.
- A Deontological approach appears better than Utilitarian approach

Engineering students and practicing engineers need to be aware of these ethical issues and appropriately apply them in their professions/careers.

Case Study 5:
Fourth Industrial Revolution –Emerging and readily available technologies, Around the world (Present)

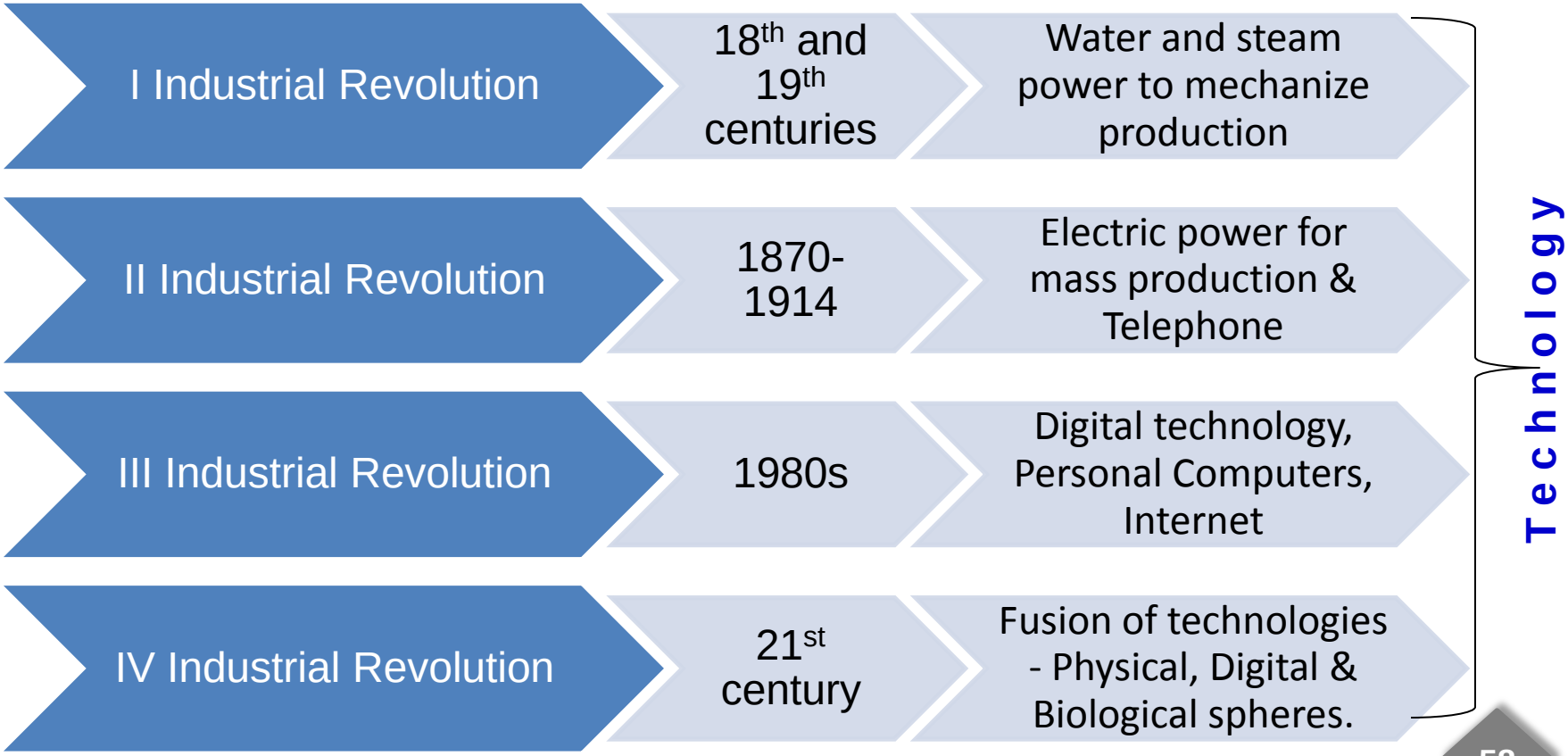
Synopsis

- The Fourth Industrial Revolution or Industry 4.0 as it is called is coming together of the **Physical, Digital and Biological** Systems.
  - Artificial Intelligence (AI), 3D Bio- printing, Synthetic biology*, nanotechnology, robotics, Internet of Things (IOT), automatic vehicles, quantum computing

- Growing at an exponential speed
  - However, it raises some fundamental questions about the future
    - Need for better governance and regulation
    - Development Vs. Ethics

*An emerging discipline that uses engineering principles to design and assemble biological components

Background

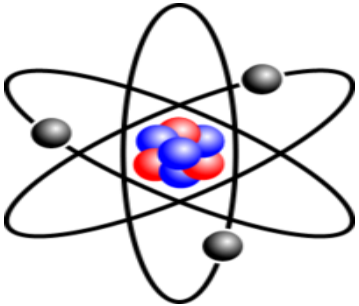

I Industrial Revolution
18th and 19th centuries
Water and steam power to mechanize production
II Industrial Revolution
1870-1914
Electric power for mass production & Telephone
III Industrial Revolution
1980s
Digital technology, Personal Computers, Internet
IV Industrial Revolution
21st century
Fusion of technologies - Physical, Digital & Biological spheres.
Technology

Introduction (1)

- **The word "Fourth industrial revolution"** was first used In the World Economic Forum in 2016.

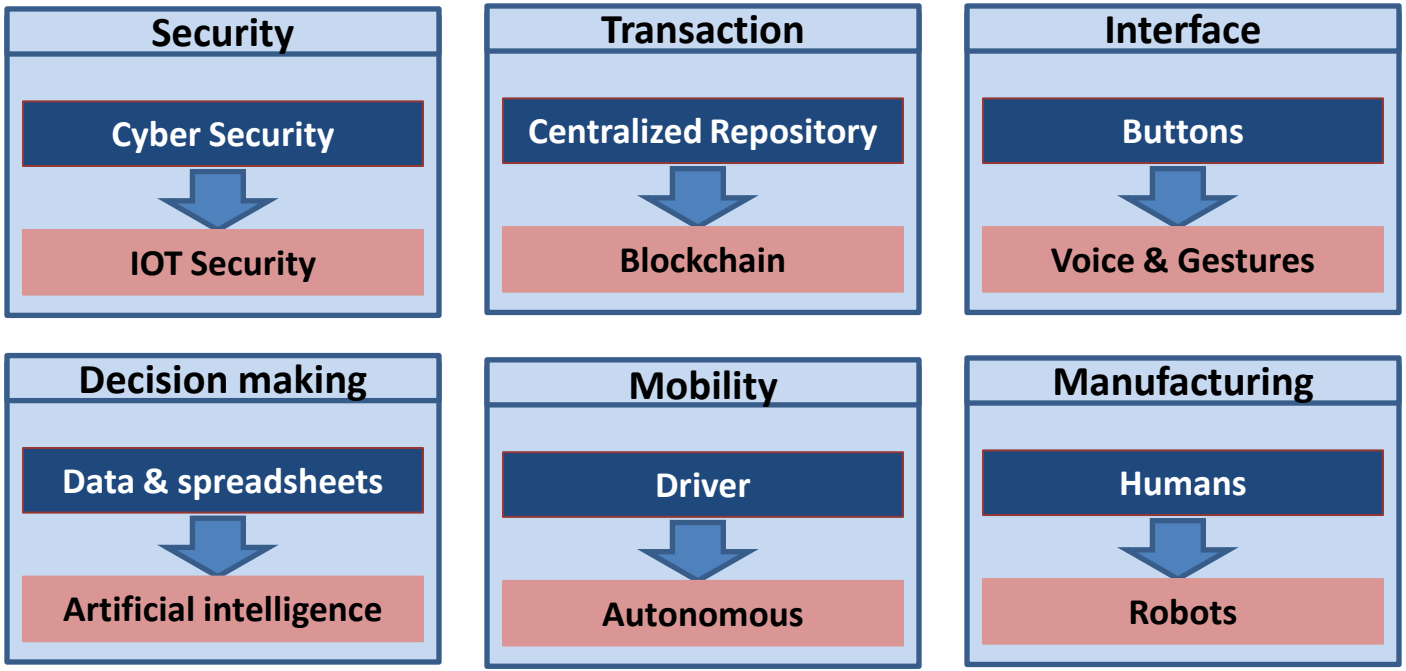
- The Fourth Industrial Revolution or Industry 4.0 → in its nascent stages but is fast catching pace.

- **Coming together of the Physical ,Digital and Biological Systems.**



Introduction (2)

4th Industrial Revolution will affects almost every facets of business sectors and arenas



Presentation format obtained from : file:///C:/Users/admin/Downloads/MIGHT_Making_Sense_of_the_4th_Industrial_Revolution.pdf

Introduction (3)

- Transformation of the world in many ways
  - Changes the way we live our lives, work and relate.
  - Curing and preventing diseases
  - Improving productivity in various domains
  - Improving quality of life
  - Transformation evident- automation, robots
- This is all one side of the coin.
  - **Let us now look at the flipside.**

The flip side could be:

- Mismanagement, design vulnerabilities, accidents
- Rapid spread of misinformation
- Affect employment opportunities
- AI applications can have unanticipated real-world impacts,
- Machine-learning algorithms can develop their own biases
- Breach or loss of data - Billions of people connected digitally, cloud computing etc.

Findings and Discussion (1)

- The new age technologies like AI, bioengineering, robotics, programming tools etc. can be used as weapons of mass destruction

- Social media and networking can enhance the social divide and lead to episodes like the recent lynching, hate speech, fake news etc.
  - Infodemic is, of late, becoming a trend.

- Biased data → inaccuracy; if care is not taken, there may also be adverse impact

- Non- adherence to ethical practices in this scenario may lead to undesirable externalities, unintended, & unprecedented and sometimes deadly outcomes

Should there be a limit of human intervention that is exceeding its limit or hubris, or something that is disturbing the harmony between humans and nature?

Findings and Discussion (2)

- Rethinking the processes of technological development is needed, asking first what long-term future is wanted, and then how to orient technological development towards achieving it.

- Need for a multi stakeholder platform for " Technology facilitation mechanism"

  - A future oriented agenda that promotes responsible development and adoption of new technologies,
  - A mechanism which drives a higher quality of life with greater public participation in how technologies are employed &
  - Taking seriously the roles of values and ethics in technological development

WEF White paper 9August 2018) : Values, Ethics and Innovation Rethinking Technological Development in the Fourth Industrial Revolution

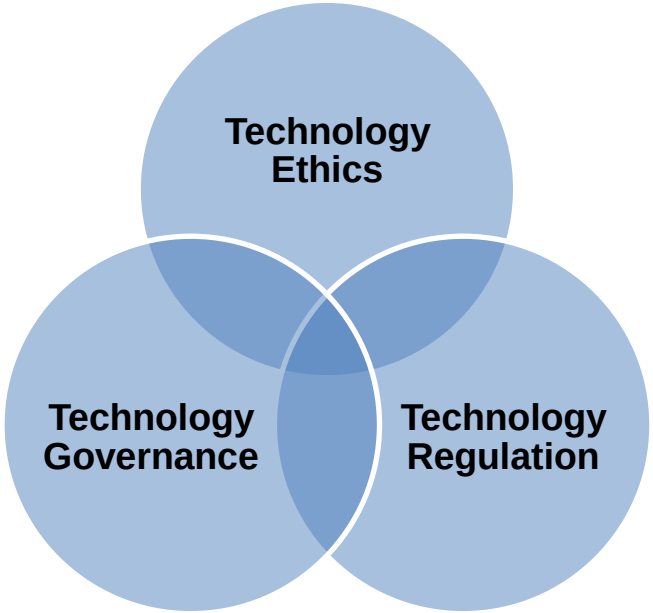
Conclusion (1)

- Values and ethics need to be aligned with technological development
- Even though free market is preferred ,there is a global recognition on the need for regulation & governance

Technology governance and regulation

– Establishing and implementing policies, procedures & standards for proper development of technologies

– Technology regulation involves development, adoption and adhering to the relevant legislations



Conclusion (2)

- Systemic risks can come from many directions – whether cyber attacks or software/ hardware glitches, unethical practices etc.

- **Need for building checks and balances** with ethical principles at every stage of conceptualising, design and execution to mitigate risks

- To meet the challenges of 4th Industrial revolution a globally competent engineer needs to have following fundamental elements :
  - Technically competent
  - Ethically sensitive &
  - Socially aware.

Conclusion (3)

To ensure that various emerging technologies of fourth Industrial revolution stay within the boundaries that we set for it:

- **Focus on building trust in systems** that will transform our social, political and business environments, make decisions for us, and become an indispensable faculty for interpreting the world around us &

- Look at technological development from a broader view and **address values and ethics issues** throughout the process

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CONCLUSION (1)

- Not always possible to have mistake- free or flawless organisations
  - Unanticipated consequences.

- Not every event can be predicted
  - Social context and its impact on individual's actions, ethics not black and white
  - External conditions not in control

- **In- depth and meticulous study** of every slide, negative outputs/ outcomes can lead to better outcomes
  - **Need for greater synergy** in the vision, mission, core values and the professional principles and code of ethics

  - Compliance with the policies and codes of conduct→ ethical ecosystem

CONCLUSION (2)

- Even in the time of the pandemic, ethical considerations need to be fulfilled.
  - "Importantly, political leaders must enact quarantine and social-distancing policies that do not bias against any population group.
  - It is important that policy makers maintain the public's trust through use of evidence-based interventions and fully transparent, fact-based communication."
- And, we as citizens, **should strictly adhere to the guidelines and advisories while restraining from spreading infodemic**.
  - Such information should be imparted to the population through recognised academics, professionals,
  - We need firm, evidence-based, informed, and consequent scientific knowledge to be put at work, institutionally

We have attempted to **bring this awareness to the learners** that through an ethical understanding and behavior, there can **be effective decision- making for social good.**

Social scientists can play a significant role in addressing these issues*

* SYSTEM EFFECTS: ON SLIPPERY SLOPES, REPEATING NEGATIVE PATTERNS, AND LEARNING FROM MISTAKE- Diane Vaughan

THANK YOU