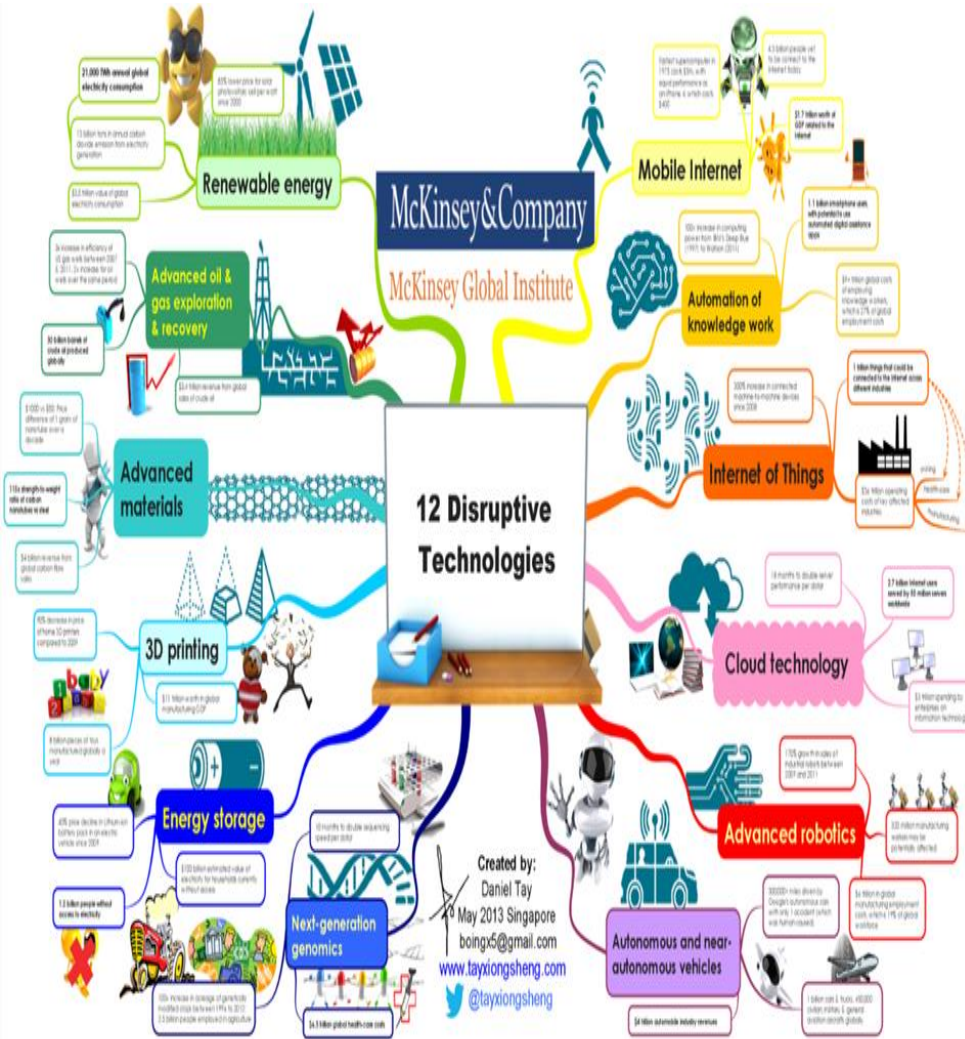


# QUALITATIVE COMPUTING EDUCATION: CATALYST FOR ECONOMIC DEVELOPMENT

BEING A PRESENTATION AT THE 2<sup>ND</sup>  
TECHNOLOGY-ENHANCED LEARNING |  
COMPUTING EDUCATION FORUM

Prof. Charles Ayo  
Trinity University, Yaba, Lagos.

# Lecture Outline



1. Appreciation & Acknowledgements
2. Introduction
3. Quality Computer Education
4. Disruptive Technologies/Irs
5. Impact of Disruptive Technologies on HEIs
6. Innovative & Entrepreneurial Computing
7. Recommendations and Conclusion





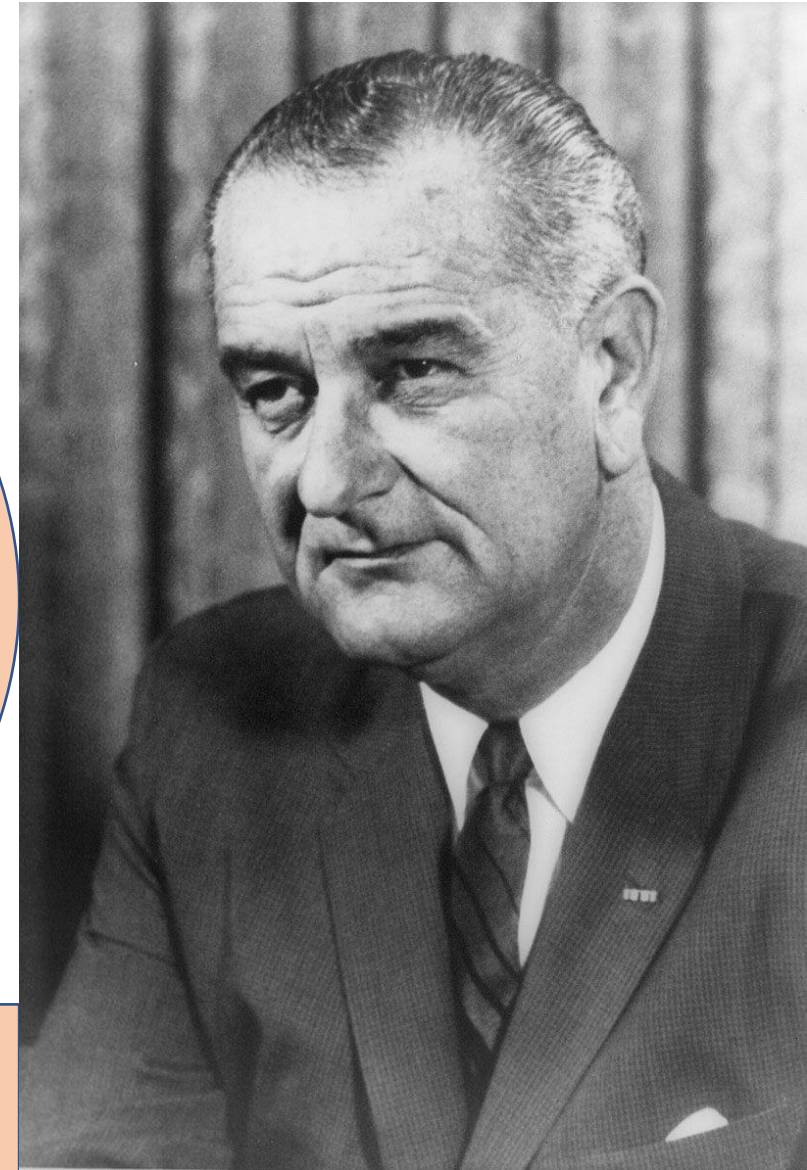
# INTRODUCTION



# Introduction

"At the desk where I sit, I  
have learned one great truth.  
The answer for all our  
national problems – the  
answer for all the problems of  
the world – come to a single  
word. That word is  
“**education.**”

- Lyndon B. Johnson



# Introduction Cont'd

## Early Days

- The first generation of universities produced graduates that were sought after by both local and foreign companies & Institutions (Obasanjo, 2012).
- In the 50s/60s the University of Ibadan was ranked among the top 50 universities in the world.
- Our founding fathers committed between 40% – 50% budget to Education.



# Introduction Cont'd

- Today's education system is faced with:
  - ✓ Inadequate Access.
  - ✓ Poor Quality.
- National consequences: Unemployment/Underemployment, Poor Economic/Developmental Indices, Security Challenge, amongst others.



# Introduction Cont'd

## Why the deplorable state of the Nation?

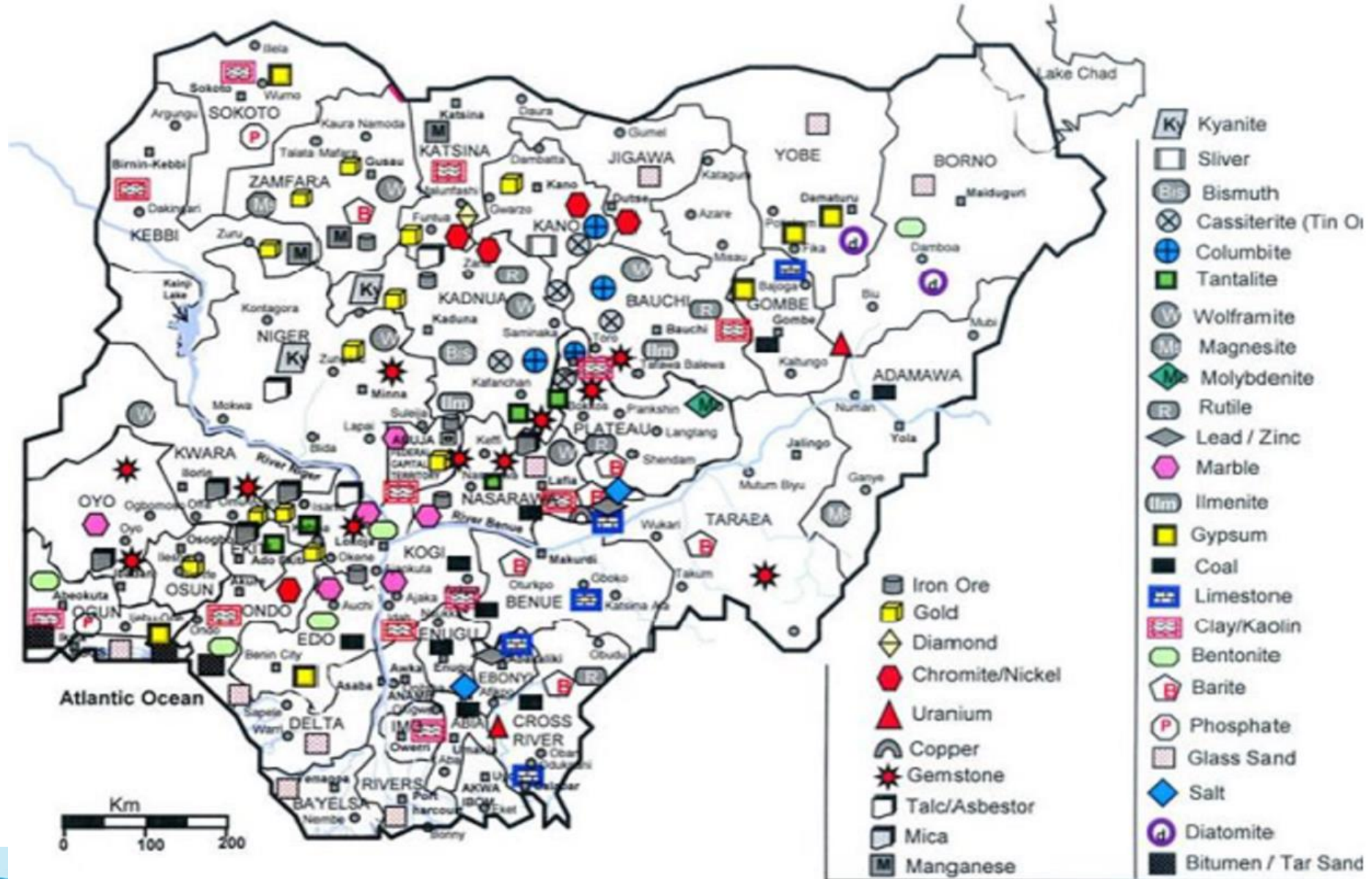
- The quality of Education cannot transform the individual.
  - The quality of Education cannot transform the economy.
  - The quality of Education is poor and not fit for nation building.
- 
- The Country is poor because the Education system is not targeted towards the Socio-Political and Technological transformation of the Country.





# Introduction Cont'd

## Mineral Deposits in Nigeria





# Introduction Cont'd



River systems of Nigeria and their organization into 11 River Basin Dev. Authorities.

Besides the challenge of feeding, what of power generation?

China generates about 20,000 MW (20 GW) from solar alone.

The Power generation in Nigeria is less than (4GW).  
Wind, Solar, etc.

# QUALITY COMPUTER EDUCATION



# Quality Computer Education

- Learning Outcomes of Computing Education
  - Hitherto, Computer Science was taught as one (1) omnibus programme leaving each institution and teacher to decide the future of the students within a globalised economy.
  - A lot of graduates are not employable and had to retrain at Computer institutes to acquire the required skillset.
  - The Software driving the various sectors of the Economy are largely imported.



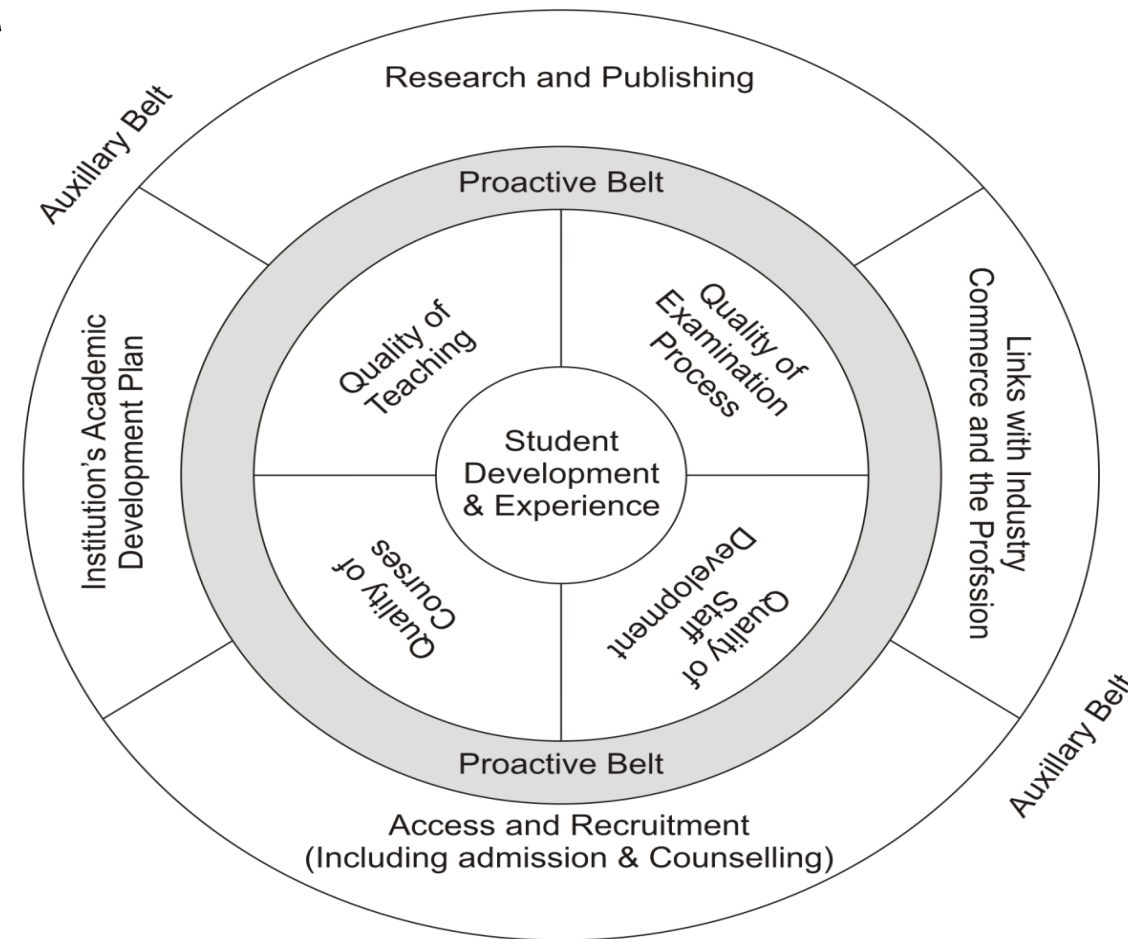


# Quality Computer Education Cont'd

■ A tertiary institution is as important as:

- The quality of faculty.
- Research/Patents outputs.
- Its impact on the immediate community and the nation in general.

■ **Quality** - Fitness for purpose.



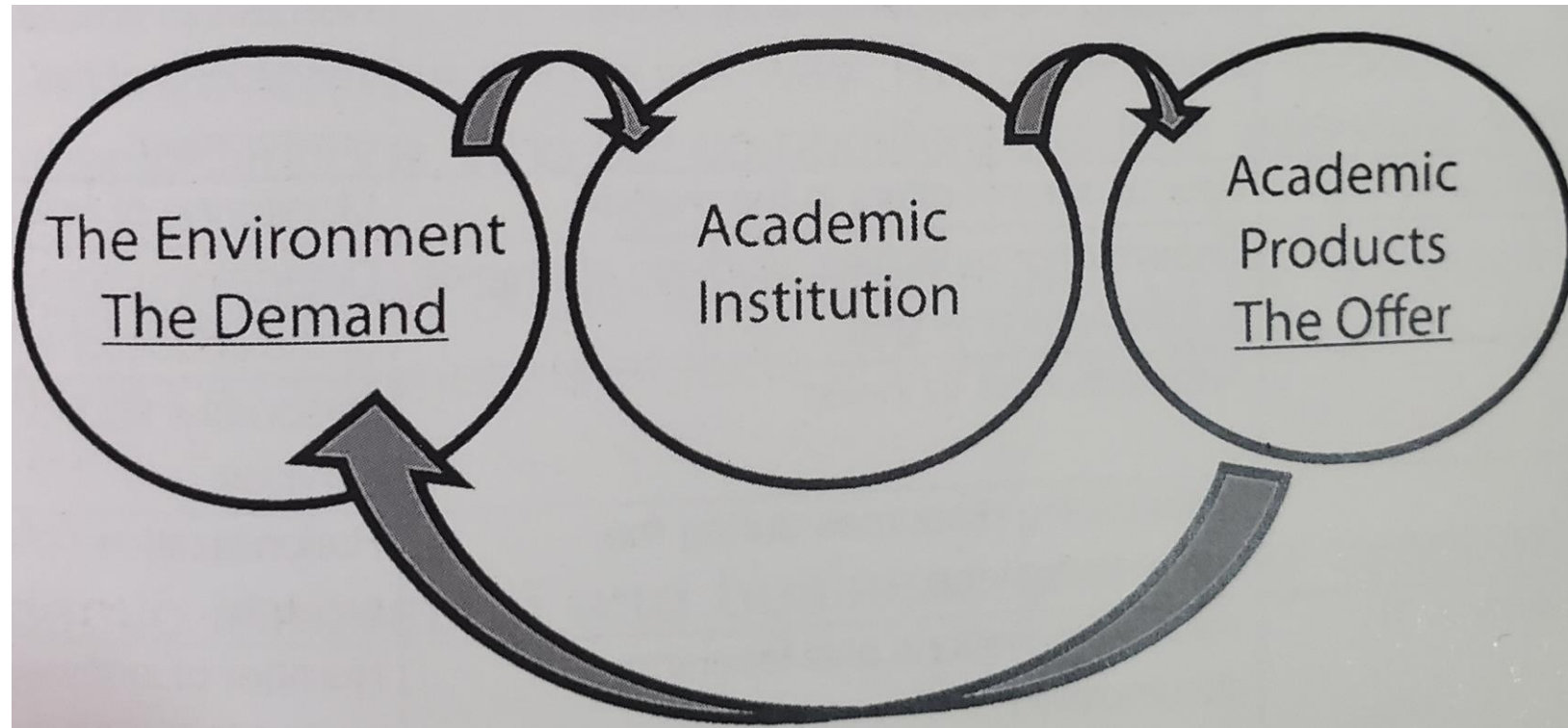
Overview of Quality Framework (Barnett, 2002)



# Quality Computer Education Cont'd

## ■ Relationship with the Society:

- Curriculum Design
- SIWES
- Employment

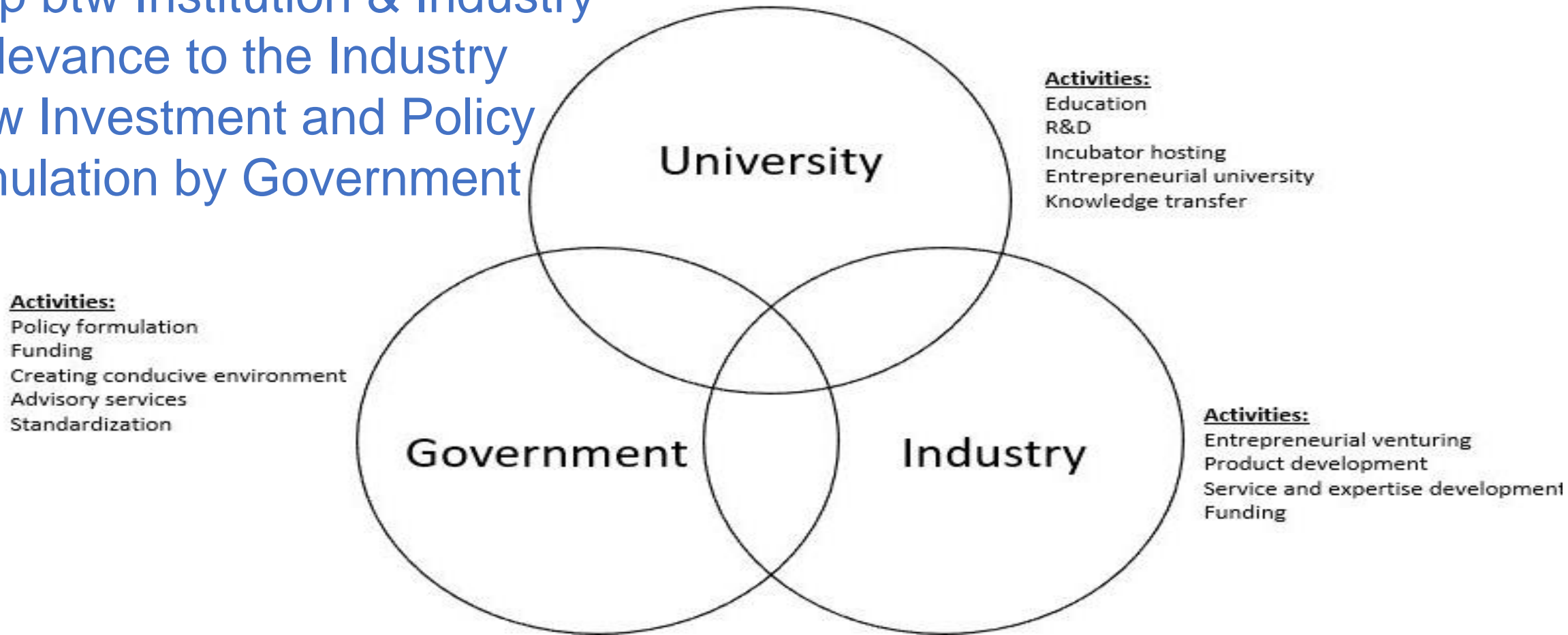


Relationship Between the Environment and the University



# Quality Computer Education Cont'd

- Why the shortage in skillset?
  - Gap btw Institution & Industry
  - Relevance to the Industry
  - Low Investment and Policy formulation by Government



Triple Helix Framework





# Quality Computer Education Cont'd

## ■ Disciplines in Computing Science

- Computer Science
- Cybersecurity
- Data Science
- Information and Communication Science
- Information Science
- Information Technology
- Software Engineering

Great Development but what's our strength in these areas?



# DISRUPTIVE TECHNOLOGIES



# Disruptive Technologies

## Global Developmental Strides:

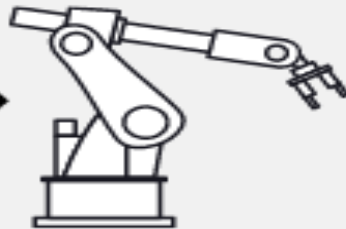
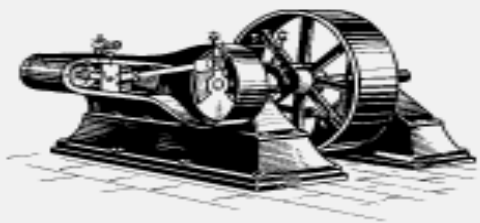
- Generally, the world has witnessed several Industrial Revolutions (IR), ranging from the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> to lately the 5<sup>th</sup>, referred to as 5IR/Industry 5.0.
- Both Industrial Revolutions and Digital Revolutions (Disruptive Technologies) have changed the demands in the world of work.
- It has been reported that:
  - The future of work won't be about college degrees, it will be about job skills.
  - Tech giants such as Apple, IBM and Google no longer require a degree, well-paying jobs are offered to those with non-traditional education or a high-school diploma.





# Disruptive Technologies Cont'd

## Industrial REVOLUTIONS



### Industry 1.0

mechanization,  
water and steam  
powers

1800

### Industry 2.0

mass production,  
electric power,  
assembly line

1900

### Industry 3.0

computers,  
automated  
production,  
electronics

2000

### Industry 4.0

cyber-physical  
systems, IoT,  
networking,  
machine learning

2010

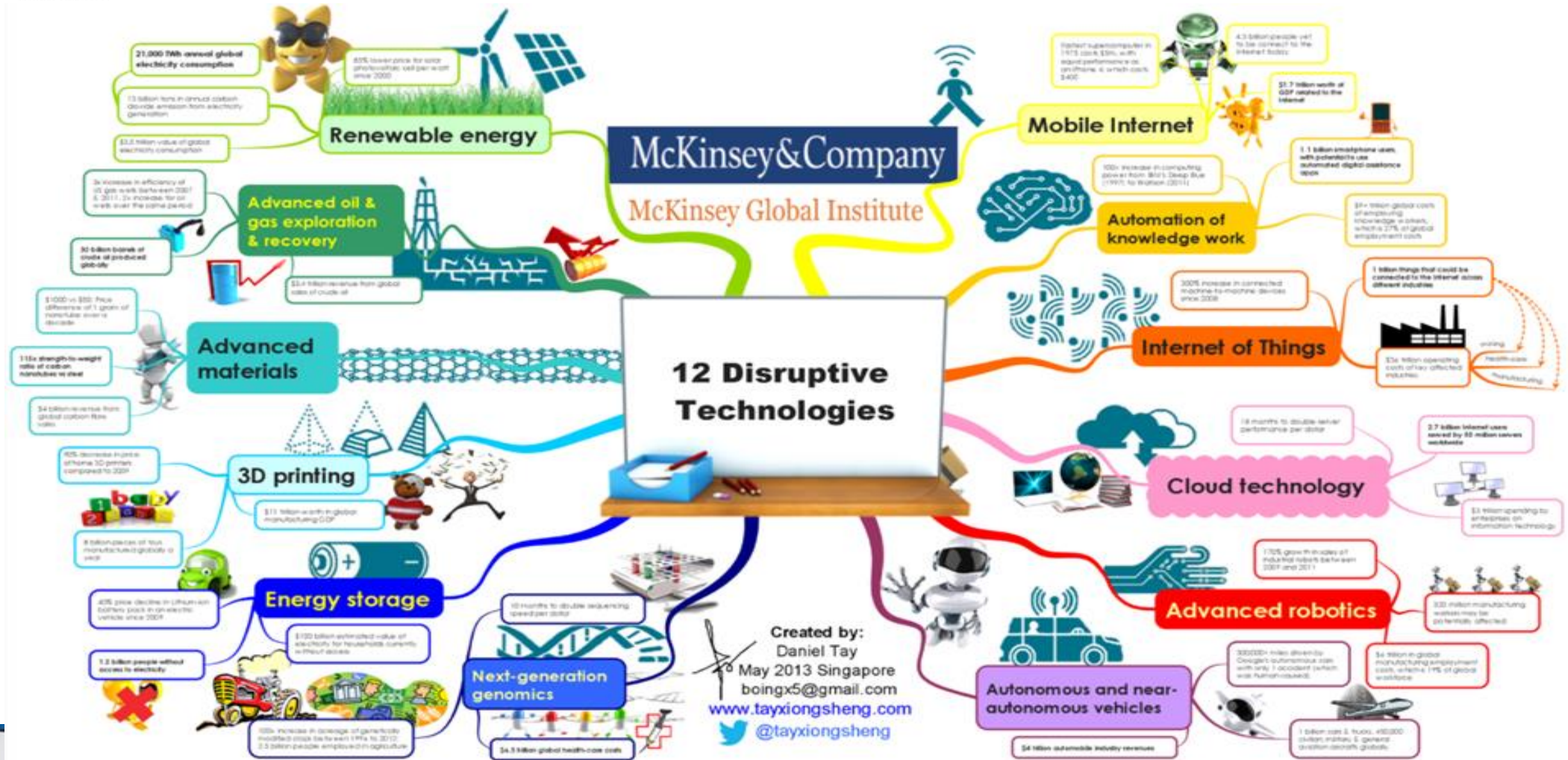
### Industry 5.0

human-robot  
collaboration,  
cognitive systems,  
customization

2020



# Disruptive Technologies Cont'd





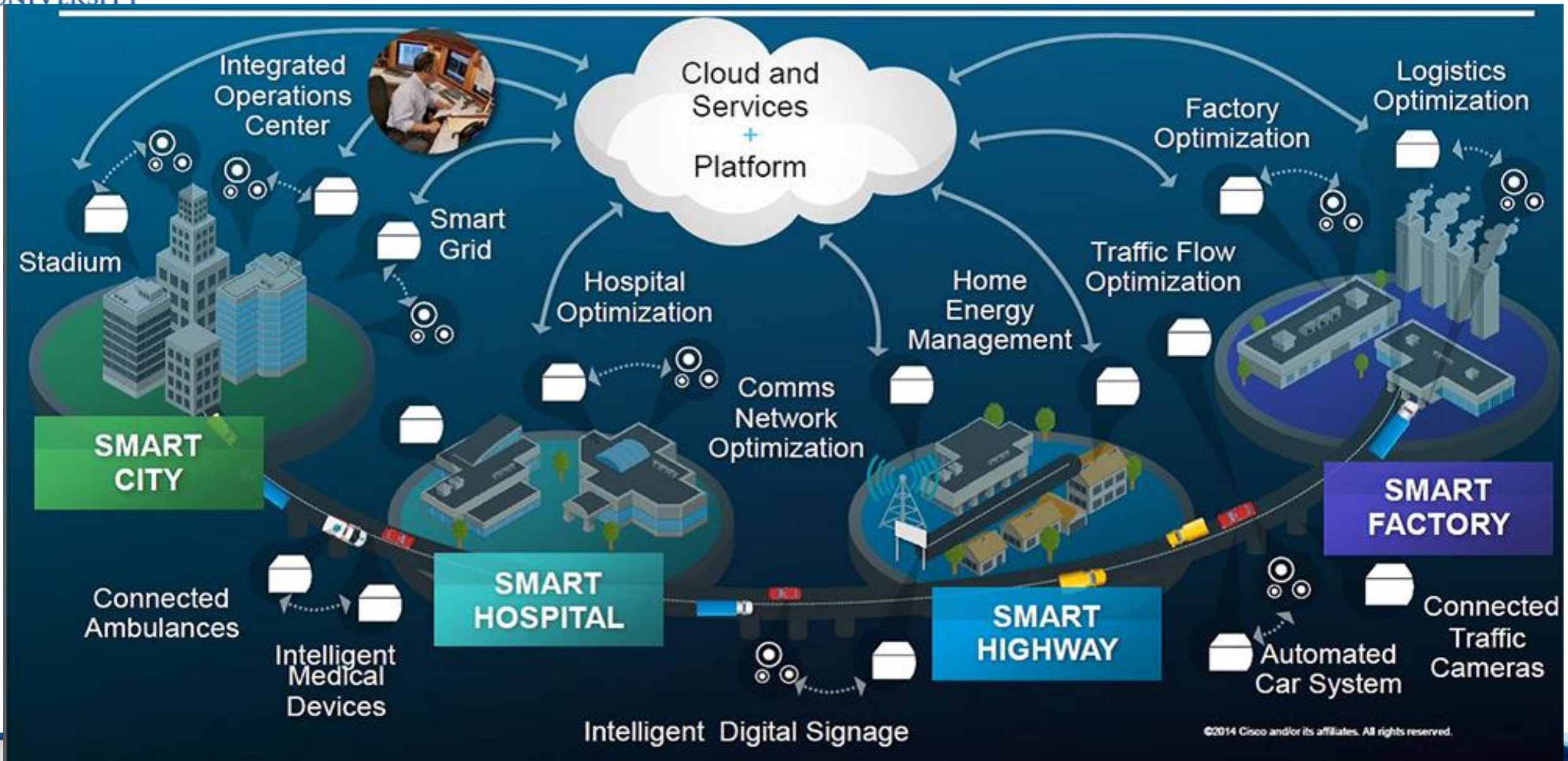
# Disruptive Technologies Cont'd

1. Cloud computing
  2. Unmanned Aerial Vehicles – Drones
  3. Internet of Things/Everything (IoT/E):
  4. Blockchain Technology
  5. 3-D Printing
  6. Big Data/ Data Science
  7. Green/Renewable Energy
  8. Quantum Computing
- Etc.





# Impact Disruptive Technologies On Professional Practice



# IMPACT OF DISRUPTIVE TECHNOLOGIES ON HEIs



# Impact of Disruptive Technologies on HEIs

The impact is 3-fold:

1. Impact on Curriculum
2. Impact on Employment
3. Impact on Institution:
  - Staff
  - Students
  - Infrastructure





# Impact of Disruptive Technologies on HEIs Cont'd

Coursera provides a wide selection of job-relevant content that can supplement existing curricula. As a result, the following academic disciplines and skills emphasis combinations are also possible by leveraging content currently offered on our platform.

## Engineering

ACADEMIC DISCIPLINE	SKILLS EMPHASIS
Biochemical Engineering	Bioinformatics
Biomedical Engineering	Precision Medicine
Chemical Engineering	Battery Technology
Civil Engineering	Smart Cities
Electrical Engineering	IoT and Embedded Sensors
Mechanical Engineering	Digital Manufacturing
Textile Engineering	Nanotechnology

## Business

ACADEMIC DISCIPLINE	SKILLS EMPHASIS
Master of Business Administration	Digital Marketing
Bachelor of Business Administration	AI/ML
Bachelor of Business Administration	Entrepreneurship

## Other

ACADEMIC DISCIPLINE	SKILLS EMPHASIS
Architecture	Urban Design
Nursing	Healthcare Tech & Analytics
English	Digital Marketing

Coursera for Campus (2021)



# Impact of Disruptive Technologies on HEIs Cont'd

List of Relevant IT Certifications  
& Salaries

S/N	Certification	Salary		Certification	Salary (\$)
1	Big Data Engineer:	\$166,500	16	Google Certified Professional Cloud Architect	40,000 to 175,000
2	DevOps Engineer:	\$120,000	17	AWS Certified Solutions Architect	114,000 to 149,000
3	Information Systems Security Manager:	\$149,000	18	Certified Information Security Manager (CISM)	132,000 to 149,000
4	Mobile Apps Developer:	\$135,750	19	Certified in Risk and Inf Systems Control (CRISC)	About 146,000
5	Applications Architect:	\$144,500	20	Project Management Professional (PMP)	About 144,000
6	Data Architect:	\$145,500	21	Certified Info. System Security Prof (CISSP)	About 141,000
7	Database Manager:	\$137,500	22	Certified ScrumMaster (CSM)	About 135,000
8	Data Security Analyst:	\$134,000	23	AWS Certified Solution Architect (Professional)	About 135,000



# Impact of Disruptive Technologies on HEIs Cont'd

List of Relevant IT Certifications  
& Salaries

S/N	Certification	Salary		Certification	Salary(\$)
9	Data Scientist:	\$129,000	24	Microsoft Certified: Azure Solutions Architect Expert	About 135,000
10	Network/Cloud Architect:	\$146,000	25	Certified Information Systems Auditor (CISA)	About 132,000
11	Network/Cloud Engineer:	\$115,250	26	<a href="#">AWS Certified Cloud Practitioner – Foundational</a>	113,000 to 131,000
12	Senior Web Developer:	\$124,750	27	VMware Certified Prof 6 – Data Center Virtualization (VCP6-DCV)	About 130,000
13	Site Reliability Engineer:	\$123,250	28	Info. Tech. Infrastructure Library (ITIL) Foundation	About 129,000
14	Systems Engineer:	\$107,000	29	<a href="#">Microsoft Certified: Azure Fundamentals</a>	126,000
15	Software Engineer:	\$123,250	30	Citrix Certified Associate – Networking (CCA-N)	About 125,000



# Impact of Disruptive Technologies on HEIs Cont'd

## Computing Programmes in the UK

University of Cambridge – A 3-year programme (Admission through A' Level)

- 4 Courses per Term (3 Terms/Year)
- Final Year Courses
  - Applications (Including Bioinformatics and Natural Language Processing) or Theory; Cloud Computing; Data Science and Robotics; Dissertation and Computer Architecture
- The course is broad and deep
  - The course offers an optional fourth year leading to an MEng degree (progression to the fourth year is dependent on satisfactory performance).





# Impact of Disruptive Technologies on HEIs Cont'd

## Computing Programmes in US

### University of North Texas – A 4-year programme

- Admission through College is 2 years.
- 4 Courses per Semester (12 Units per Semester)
- The programme is skill-based and practical-oriented.
- CA emphasized and final year exam is multiple choice and almost optional.
- Internship is encouraged:
  - providing students with skills highly prized in industry and for research,
  - and giving skills to create future technology.
  - Underlying theory and foundations in economics, law and business.



## Computing Programmes in India

### VIT University – A 3-year programme

- Admission directly from the Secondary School.
- Very Comprehensive and Specialized Programmes.
- Detailed Core Courses
- Detailed and Extensive Programme and University Electives
- The Programme is industry focused with lots of Industry certifications.



# Impact of Disruptive Technologies on HEIs Cont'd

- **ALTSCHOOL** - Adewale Yusuf (<https://www.altschoolafrica.com/>)
  - Building the biggest (ICT) University in Africa
  - IT Skills based
  - Target 10m graduates over 10 years
  - Students from over 17 countries
  - Tuition is \$30/month for 12 months
    - School of Engineering – F/End Engng, B/End Engng, and Cloud Engng
    - School of Product – Prdt. Design, Prdt. Management and Prdt. Marketn
    - School of Data -.....
  - Lecturers drawn from the industry – Tesla, Google, etc.
  - Graduates readily employed abroad (\$70k - \$80k)
  - **Current Enrolment is about 3,000 Globally.**



# INNOVATIVE & ENTREPRENEURIAL COMPUTING





# Innovative & Entrepreneurial Computing

- ✓ The lessons to learn from Stanford University, USA, that housed the *numero uno* Department of Computer Science in the world.
  - In terms of incubation centre (Tech-Hub), the Silicon Valley, is the economic epicenter of San Francisco and the USA in general.
  - Silicon Valley was founded by Frederick Terman, the legendary Dean of Stanford Engineering School during the 1940s and 1950s.
  - He created the tradition of Stanford Faculty starting their own companies.



# Innovative & Entrepreneurial Computing Cont'd

- Today, it is home to many of the world's largest technology companies including:
  - Apple, Cisco, Google, Yahoo, LinkedIn, eBay, HP, Intel and Oracle, Adobe, Tesla...and the list goes on and on ad infinitum.
- Other Tech-hubs in the US are:
  - Silicon Beach
  - Silicon Alley



# Innovative & Entrepreneurial Computing Cont'd

- China is fast emerging as the Economic Leadership of the world through her Tech-hubs and are innovating at faster speed.
- The hubs are based in:
  - Shanghai
  - Shenzhen
  - Hangzhou
- Entrepreneurs work harder in China than in the US with:
  - Four times the population
  - Four times the consumer consumption market, etc.





# Innovative & Entrepreneurial Computing Cont'd

- AI – Baidu/Tesla
- Retail Commerce – Alibaba/Amazon
- Mobile payment – WeChat Pay and Alipay already exceeds US Credit/Debit Cards (Apple Pay and Google Pay) etc.
- At the fore front of China's Tech boom are (BAT):
  - Baidu (Robin Li)
  - Alibaba (Jack Ma)
  - Tencent (Ma Huateng)



# Innovative & Entrepreneurial Computing Cont'd

- Areas of Research include:
  - AI, Biotech, Green Energy, Robotics, Drones, A/VR, Smart Technologies – Cars, Deliveries, etc
- WeChat is super innovative.
- It combines functions of:
  - FB, Twitter, Skype, WhatsApp, Instagram and Amazon
- China is at war with the US Technology wise.



# Innovative & Entrepreneurial Computing Cont'd

- Name: Bill Gates
- Date of Birth: October 28, 1955.
- Age: 67 years.
- Product/Company: **Microsoft** Corporation (Founded in 1975 at **age 20**).
- Total Number of users: 2.1 Billion.
- Personal Worth: \$103 Billion.
- Companies Net-worth: \$1,791.2 Billion as of January 23, 2023.





# Innovative & Entrepreneurial Computing Cont'd



- Name: Larry Ellison
- Date of Birth: August 17, 1944
- Age: 78 years
- Product/Company: **Oracle** Corporation (Founded in 1977 at **age 33**).
- Total Number of users: Over 70 million.
- Personal Worth: \$111.1 Billion.
- Companies Net-worth: \$235.25 Billion as of January 23, 2023.

# Innovative & Entrepreneurial Computing Cont'd



- Name: Steven Paul Jobs.
- Date of Birth: February 24, 1955 – October 5, 2011.
- Age: 56 years
- Product/Company: **Apple** Inc (Founded in 1976 at **age 21**)
- Total Number of users: 1.2 Billion.
- Personal Worth: \$10.3 Billion.
- Companies Net-worth: \$2,183.34 Billion as of January 20, 2023.



# Innovative & Entrepreneurial Computing Cont'd

- Name: Mark Elliot Zuckerberg.
- Date of Birth: May 14, 1984.
- Age: 38 years.
- Product/Company: Meta Platform (**Facebook**)  
(Founded in 2004 at age 20)
- Total Number of users: Over 3.59 Billion.
- Personal Worth: \$51.8 Billion.
- Companies Net-worth: \$369.55 Billion as of January 20, 2023.





# Innovative & Entrepreneurial Computing Cont'd



- Name: Evan Spiegel
- Date of Birth: June 4, 1990
- Age: 31 years
- Product/Company: **Snapchat (Snap) Inc**  
(Founded in September 16, 2011 at **age 21**)
- Total Number of users: Over 363 million.
- Personal Worth: \$ 2.6 Billion.
- Companies Net-worth: \$15.59 Billion as of January 20, 2023.



# Innovative & Entrepreneurial Computing Cont'd



- Name: Zhang Yiming.
- Date of Birth: April 5, 1983.
- Age: 39 years.
- Product/Company: **TikTok**.
- Total Number of users: Over 1.3 Billion.
- Personal Worth: \$49.5 Billion.
- Companies Net-worth: \$65 Billion as of January 07, 2023.



# Innovative & Entrepreneurial Computing Cont'd



- Name: Jack Ma.
- Date of Birth: September, 1964
- Age: 58 years.
- Product/Company: **Alibaba** (Founded 1999).
- Total Number of users: 1.18 Billion.
- Personal Worth: \$26.1 Billion.
- Companies Net-worth: \$317.41 Billion as of January 22, 2023.





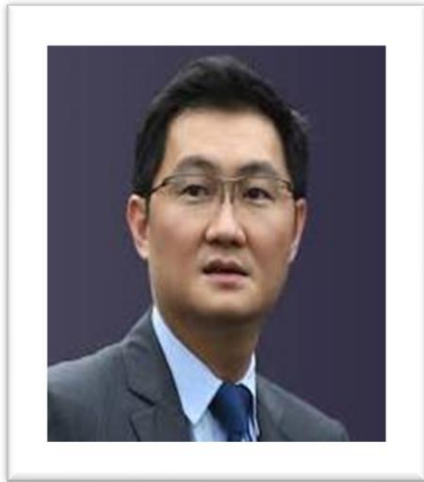
# Innovative & Entrepreneurial Computing Cont'd



- Name: Robin Li.
- Date of Birth: November, 1968
- Age: 54 years.
- Product/Company: **Baidu** (Founded 2000).
- Total Number of users: Over 544 Million.
- Personal Worth: \$7.9 Billion.
- Companies Net-worth: \$46.91 Billion as of January 22, 2023.



# Innovative & Entrepreneurial Computing Cont'd



- Name: Ma Huateng.
- Date of Birth: October, 1971
- Age: 51 years.
- Product/Company: **WeChat** (Founded 1998).
- Total Number of users: 1.2 Billion.
- Personal Worth: \$41.6 Billion.
- Companies Net-worth: \$482.46 Billion as of January 20, 2023.



# Innovative & Entrepreneurial Computing Cont'd



- Name: Olugbenga Agboola.
- Date of Birth: April 5, 1985
- Age: 37 years
- Product/Company: **Flutterwave** ( Founded 2016
- Total Number of users: About 1 Billion
- Personal Worth: \$13 Million
- Companies Net-worth: \$ 3.44 Billion as of January 03, 2023.



# Innovative & Entrepreneurial Computing Cont'd



- Name: Shola Akinade.
- Date of Birth: June 1987.
- Age: 35 years.
- Product/Company: **Paystack** ( Founded in 2015).
- Total Number of users: Over 80,000
- Personal Worth: \$150M.
- Companies Net-worth: \$200M as of December 29, 2022.





# RECOMMENDATIONS AND CONCLUSION



# Recommendations and Conclusion

## ■ Lessons Learnt From China and US:

Every Faculty/Department of Computing should:

- ✓ Create Research Clusters focusing on each of the Disruptive Innovations/ Technologies. (**The CU Example**)
- ✓ Develop Capacities through Training and Industrial Partnership. (PG Students and Staff Internship - **The CU Example**)
- ✓ Capitalize on our population and skills in Africa to dominate the continent. (New Horizons is popular within Private Universities to bridge the gap to certain extent)
- ✓ **Lecturers should emphasize Practical Components (Individual and Group Assignments) – It's demeaning that Graduates would have to go retrain by the road side). My US Example of Networking and Programming.....**



# Recommendations and Conclusion

- Curricula and pedagogy reviews:
  - Problem-based Learning or Research-informed Learning.
  - A good blend of theory and practice, where both the hands and minds are trained.
- Incorporation of Certifications to HEIs degrees.
- Establishment of Tech-hubs in HEIs.
- Coursera for Campus Collaboration as guidance.
- Monumental Economic benefits from Innovation and Cyberpreneurship.
- Monumental contributions to Nation Building.



Thank You

