Catanduanes State University
College of Information and Communications Technology
Virac, Catanduanes

LEARNING MATERIALS AND COMPILATION OF LECTURES/ACTIVITIES

ITP931

Seminar on Special Topics in Information Technology

MIDTERM PERIOD

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CatSU – College of Information and Communications Technology

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MODULE 1

History and essence of innovation

Overview

This learning module of "History and essence of innovation" has been written according to the approved syllabus approved by the CICT Dean and CSU.

This learning module aims to assist you understand the history of technological innovation, its principles, its role, know Moore's Law, and how digitization affects other businesses. The treatment of the content is efficient and orderly in the presentation of the theoretical aspects of the topics. Each lesson has been comprehensively covered in scope, content, and furthermore from the assessment perspective.

This learning module endeavors in a basic and clear language with neat and self-explanatory diagrams, which could be simply understood by an average student.

The concise content of this learning module is as follows:

Lesson 1 introduces the emerging technologies and innovation

Lesson 2 covers emerging machine skills

Lesson 3 introduces the essence of innovations

Lesson 4 deals with Moore's Law

Lesson 5 covers digitization

Learning Outcomes

At the end of the course, the students shall be able to:

1. summarize the history of technological innovation
2. state the principles of innovations
3. explain the role of digital technology in society today
4. define Moore's Law and understand the approximate rate of advancement for other technologies
5. explain how digitization is vital for business

Pre-Test

I. TRUE OR FALSE

Direction: Write TRUE if the statement is correct otherwise write FALSE

_____ 1. An invention is most suitable for the practical application of an invention whether it is new or improved features that have a positive outcome in the community or organization.
_____ 2. Innovation and new technologies have led to longer product life cycles and slower product obsolescence.
_____ 3. Innovation is the creation of new ideas.
_____ 4. Most innovative ideas do not become successful new products.
_____ 5. Investing in process innovation helps business lower their costs or production and enable higher output.

II. MULTIPLE CHOICE

Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 1. As a result of the rapid pace of innovation:
a. product life cycles have become short.
b. product development cycles have become significantly longer.
c. Market segmentation has been reduced.
d. product obsolescence has slowed down

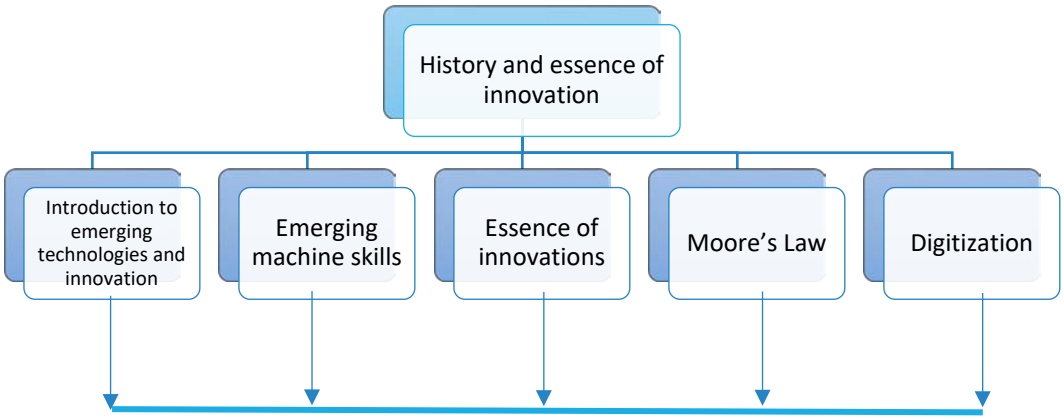
_____ 2. Emerging technology is referred to as:
a. a new technology
b. ongoing enhancement of existing technology
c. formed a new break and making new legal challenges
d. all of the above

_____ 3. Silk Work Inc., a manufacturer of silk garments, is planning to replace hand weaving with some modern machines that run on fuel. Which of the following consequences of this measure can be categorized as negative outside factors?
a. increased amount of output achievable from the given quantity of labor
b. increase in the quality of the silk garments
c. increased pollution as a result of the new technology
d. increased need for investment to finance the modernization

_____ 4. Which of the following is true of technological innovations?
a. Technological innovations help increase a country's gross domestic product.
b. Technological innovations decrease the amount of output achievable from a given quantity of labor and capital.
c. Technological innovations slow down product obsolescence and lengthen product development cycles.
d. Technological innovations increase production costs and reduce product differentiation

_____ 5. Technology is, in its purest essence, _____.
a. Knowledge
b. Dissonance
c. chaos
d. guesswork

Module Map



Supplementary Learning Resource

Self-Assessment Questions/ Assignment/ Activity

Definition of Key Terms/Unlocking of Difficulties

emerging technology	is a term commonly used to describe a new technology that is presently evolving, or that are projected to be accessible for the following five to ten years, and with significant social or financial impacts.
invention	is defined as the creation of new ideas or concepts whereas innovation is the process of transforming a new idea, creative thoughts, and new imaginations in the form of new concepts or methods into commercial success or extensive use.
innovation	is a combination of a new idea, a new technology, it has to be commercialized and mapped to some customer in the real where it will generate value.
digitization	refers to generate a digital representation of physical objects
Moore's Law	refers to Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved.
Emerging machine skills	are the In-Demand technology skills or evolving jobs needed of the industry today.

Lessons

History and Essence of Innovation

Lesson 1 Introduction to emerging technologies and innovation

Emerging technology is a term commonly used to describe a new technology, yet it might likewise refer to the continuing improvement of existing technology. Emerging technology sometimes has a diverse meaning when utilizing in different fields, such as education, business, health, or science. The term generally refers to technologies that are presently evolving, or that are projected to be accessible for the following five to ten years, and normally reserved for technologies that are creating or are projected to build with significant social or monetary impacts.

Emerging digital technologies have produced new chances or breaks while making new lawful challenges, mainly associated with patents, copyrights, royalties, trademarks, and licensing. For instance, the improvement of new digital communication technologies and media has offered increase to novel concerns relating to the digital reproduction and spreading of copyrighted works. The affected businesses, the government, and a group of individuals that advocate or supporter with the same public interest take action in order to make suitable protections and offer legal conviction to innovation or digital technology companies, copyright owners, the general public, and other interested individuals.

In some cases, emerging technologies are not usually incremental or increasing, that is why invention growth and patent in the area of emerging technologies is more interesting

As IT people, we like equations. So we define innovations as “Innovation equals invention”. This innovation equals invention often people mistake these two things for the same thing. Innovation is associated to the invention but not equal-to invention. Innovation is something that generates value for the world. Innovation makes something faster, better, cheaper and it gives someone some great satisfaction.

An invention is an idea, a technology, a patent but it does not generate value. So these innovations and inventions are not the same things. In some cases, you see them interchange and that’s not correct.

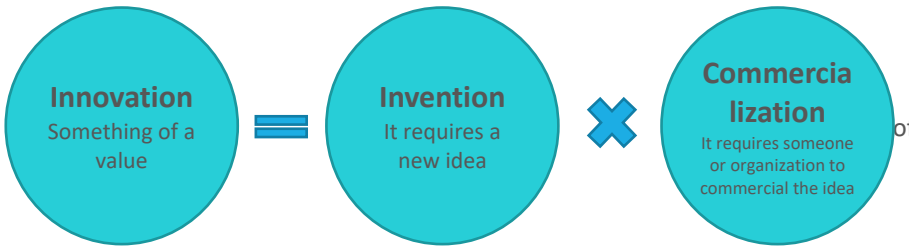


Figure 1.1. **Innovation Definition**

When we look at the equation above, where innovation is equal to invention and multiple it to commercialization. Thus, innovation is something of value that is equal to that requires a new idea (invention) and then it requires someone or some organization that is going to commercialize that idea so that this will make it valuable to the world. Therefore, it is important that an idea by itself is not valuable.

In general, ideas are cheap and when it is combined with commercialization it makes them extraordinarily valuable. Sometimes when we say invention plus commercialization it is in fact, its times or it's a product because if you don't have one either commercialization or invention, then it becomes zero. So, you have no innovation if you have no new idea and you cannot commercialize anything. Therefore, it's zero. If you have an invention and no commercialization, you have no innovation as well. So it is actually a product.

It is very helpful to help explain to people what is innovation when we are talking about innovation-driven entrepreneurship. When we look at the idea (invention), people think that this drives innovation, it is in fact commercialization aspect of it is very difficult. If you look at the innovative organization in the world today, which I would argue is Apple, the underlying inventions that created Apple, great innovations starting with the Mac and it did not come from themselves. It actually comes from Xerox PARC. It was windows, icon, mouse, and pointer. That invention was commercialized to create innovation which created terrific value in the marketplace purposely for their customers, for themselves, and for their investors as well.

Furthermore, when you check again that the invention for the underlying and enabling idea, the technology from the iPod was MP3, which did not come from Apple again. It comes from Fraunhofer.

On the other hand, Apple was terrific on commercialization to create innovation, to create great value for their customers and their stakeholders. Thus, this definition of innovation is very helpful to make clear that innovation is a combination of a new idea, a new technology, it has to be commercialized and mapped to some customer in the real where it will generate value.

The term invention is defined as the creation of new ideas or concepts whereas innovation is the process of transforming a new idea, creative thoughts, and new imaginations in the form of new concepts or methods into commercial success or extensive use. Innovation is frequently viewed as the utilization of better solutions to a problem that meets new desire or requirements, unspecified needs, or existing business sector needs. Innovation happens through the delivery of more-powerful or effective products, services, processes or procedures, or business models that are made accessible to business sectors, government, and society. Innovation is unique

and more effective as an outcome, new, that "breaks into" the market or society. Innovation is related to the invention but not equivalent to the invention. Innovation is more suitable to the real-world application of an invention either new or enhanced capability to have an important effect in the society or in the business sector. All innovations do not require an invention. Innovation often shows itself through the engineering procedures and processes, when a problem is being tackled in terms of scientific and technical in nature.

The following are the Supplementary Learning Resource for this topic:

- read the Julia Kylliäinen (2019, April 26) article, "The Importance of Innovation – What Does it Mean for Businesses and our Society?" by clicking or opening this webpage https://www.viima.com/blog/importance-of-innovation
- read the Evan I. Schwartz (2011, October) article, "Innovation lessons from the life of Steve Jobs" by clicking or opening this webpage https://www.innosight.com/insight/innovation-lessons-from-the-life-of-steve-jobs/
- read the Cyril Bouquet (no date) article, "Innovation lessons from Coca Cola" by clicking or opening this webpage https://www.imd.org/research-knowledge/articles/innovation-lessons-from-coca-cola/
- watch Bill Aulet (no date) video, "What is innovation" by clicking or opening this webpage https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/video-tutorials/lecture-2/

SAQ 1.1

- In your own words, discuss what is emerging technology and innovation.

Lesson 2 Emerging machine skills

The following are the list of In-Demand Technology Skills for 2020

Top Tech Skill #1: Artificial Intelligence (AI).

AI is a fast-moving career in IT, this makes an exciting opportunity for programmers for something new. AI specialist hiring growth is 74% yearly for the past 4 years. AI is a wider concept than with machine-designed that act intelligently like humans while machine learning depends on devices creating a sense of a specific set of data. In 2018, industries said that they implement AI by 31% based on their agenda within 12 months. Usually, the top most cases that they integrate AI in data analysis and user experience. AI specialists can take advantage of the diverse technical profession, from software engineers to data scientists to product managers. Aiming to become an AI tech in order to enroll in an AI course your skill level must be a BS Computer Science or Mathematics and with basic knowledge in statistics, college algebra, calculus, and ease with programming languages.

Top Tech Skill #2: Machine Learning

Machine learning is one of the top innovative and stimulating grounds which move into the future, this field is one of the most profitable skills that you can learn. From Siri and Alexa to chatbots to predictive analysis to self-driving cars, there are a ton of usages for this futuristic tech. Based on McKinsey, a lot of businesses are presently planning to utilize machine language. Machine-learning can be employed in several companies such as finance, education, healthcare, and so on. With machine learning skills you can apply that fit on your personality and interests. Machine learning engineers was one of the best profession in the US for 2019. Netflix uses machine learning that analyzes and makes a recommendation for particular users. Aiming to become a Machine Learning tech so that you can enroll in a Machine Learning course or training requires a basic understanding of linear equations in order to enroll in training or courses.

Top Tech Skill #3: Data Science and Data Analytics

In Big Data there are two in-demand tech jobs which include data science and data analytics. Profits with the application of Big Data is expected to grow tremendously from $5.3B last 2018 to $19.4B for the next 8 years. Today, 84% of businesses employed data analytics and Big Data initiatives to fast-track their decision-making and convey greater accuracy. It is for this reason why data science employment has become a top spot in the IT industry. A career in this area is Data Analysis as an entry-level skill and Data Science as the highly skilled. A lot of businesses today needed data professionals in the field of health, education, finance, agriculture, and so on.

Assignment 1.1

- Give at least five (5) tech/machine skills that emerge today which are not discuss in the learning modules and discuss each items.

Lesson 3 The Essence of Innovation

Are you genuine about driving innovation in your association? Continuing innovation or development is a procedure with numerous segments that interface in a dynamic and empowering way. As indicated by Bob Rosenfeld, the Center for Creative Leadership's Innovator in Residence and creator of “Making the Invisible Visible: The Human Principles for Sustaining Innovation”, it's very simple to let explicit issues or strategies command your endeavors. By learning the key principles, leaders and associations can remain concentrated on the essence of innovation.

The following are the 5 Principles that offer life to the process of innovation according to Rosenfeld:

1. First: Innovation starts when individuals or groups of people convert problems or issues to ideas. New ideas are brought into the world through questions, inquiries, problems, and difficulties. In order for the innovation process to prosper, it needs an environment that encourages inquiry and welcome issues.

2. Second: Innovation likewise needs a framework or system. All associations have innovation systems. Some are formal, structured by the administration, and some are informal, taking place external established channels. Systems for innovation can be categorized as one of five categories: originator-assisted;

targeted innovation; internal venturing; continuous improvement; or strategic transfer.

3. The third principle: Passion is the fuel, and pain is the hidden component. Passion is what drives ideas. It's what changes different assets into benefits, yet it never appears on the accounting report. Unfortunately, when following a dream, pain or failure is part of the process. Innovation pioneers need to take the pain with the passion and learn to accomplish both effectively.

4. A fourth principle that underlies the strategies for innovation: Co-locating drives effective exchange. Co-location refers to the physical closeness between individuals. It is key for building the trust that is vital to the innovation process. It likewise builds the opportunities for more interchange of information, stimulation of creative thinking in each other and evaluation of ideas during their formative stage.

5. And lastly: Differences ought to be utilized. The differences that usually separate individuals — such as language, culture, and problem-solving or critical thinking styles — can be a boon to innovation. At the point when differences are utilized usefully, they can be utilized to improve and sustain the innovation process.

As an IT student today and as an IT professional tomorrow, use these 5 principles in your organization to stay focused and stay ahead!

Assignment 1.2

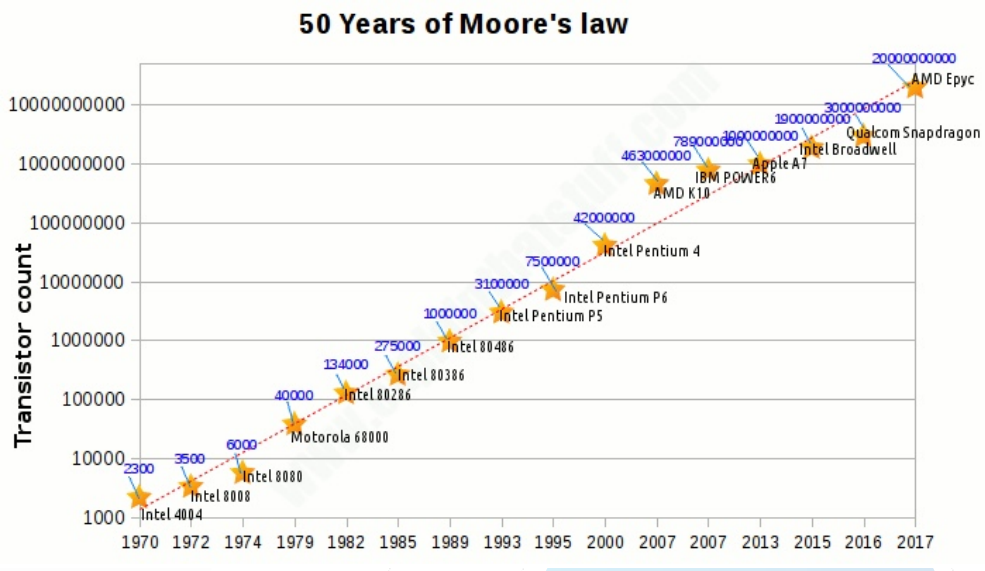
- With the current situation due to COVID treat and since you are being held to stay at home, or your are in a study hub in order for your to learn effectively and to comply with your requirements for your study. Write a short technical new ideas in order for you to be effective as a student.

Lesson 4 Moore's Law

Moore's Law refers to the observation that the number of transistors in an integrated circuit (IC) doubles approximately every 2 years. It is often cited as an explanation for the exponential growth of technology, sometimes even being coined as the 'law of exponential growth'.

Moore's law is named after Gordon Moore, the co-founder of Intel. Moore observed that since the invention of integrated circuits the number of transistors had doubled every year. Moore produced an article in the magazine '**Electronics**' titled '*Cramming More Components Onto Integrated Circuits*' explaining his findings (source). Once noticed, this discovery became widely accepted in the electronics industry and came to be known as Moore's Law.

This short term '**cramming of components**' was expected to continue, if not increase. Yet the long term rate of increase was a little uncertain but was to remain almost constant. Originally, Moore predicted that the number of transistors in an IC would double every year. In 1975 Gordon Moore's prediction was revised at the International Electron Devices Meeting. It was determined that after the year 1980 it would slow down to doubling every two years.



The extrapolation of this data has been used in the semiconductor industry for many years to direct long term planning and set targets for research and advancement. From your laptop, your camera and your phone – any digital electronic device is heavily linked to Moore's Law. Moore's Law became somewhat of a goal for the industry to reach, ensuring timely progression in technology.

Society has benefited greatly from this advancement in all areas, such as education, health, 3D printing, drones, and much more. We can now do things with beginner Arduino starter kits that 30 years ago could only be performed by expensive mega-computers.

At the 1975 IEEE International Electron Devices Meeting, Moore outlined several factors he believed were contributing to this exponential growth:

- As techniques improved, the potential for defects has dramatically decreased.
- This combined with an exponential increase in die sizes meant that chip manufacturers could work with larger areas without losing reduction yields
- Development of smallest dimensions achievable
- Conserving space on a circuit known as circuit cleverness – optimizing how clever components are arranged and eventually find the optimum use of space

Major Enabling Factors

Moore's Law wouldn't be viable without a few innovations by scientists and engineers over the years. This is the timeline of the factors that enabled Moore's Law:

When	Who	Where	What	Why
1947	John BardeenWalter Brattain	Built first working transistor		
1958	Jack Kilby	Texas Instruments	Patented the principle of integration and created the first prototype of an integrated circuit and commercialized them	
Kurt Lehovec	Sprague Electric Company	Invented a way to isolate components on a semiconductor		
Robert Noyce	Fairchild Semiconductor	Created a way to connect components on an IC by aluminum metallization		
Jean Hoerni	Planar technology based the improved version of insulation			
1960	Group of Jay Last's	Fairchild Semiconductor	Made the first operational semiconductor integrated circuit	

When	Who	Where	What	Why
1963	Frank Wanlass	Frank Wanlass Invented complementary metal-oxide-semiconductor (CMOS)	Allowed extremely dense and high-performance IC's	
1967	Robert Dennard	IBM	Created dynamic random-access memory (DRAM)	Enabled the possibility of fabricating single transistor memory cells (led to the invention of flash memory by Fujio Masuoka from in the '80s allowing low-cost high capacity memory in many devices)
1980	Hiroshi ItoC Grant Wilson J. M. J. Frechet	Invented chemically-amplified photoresist (5-10x more sensitive to UV light) – IBM introduced to DRAM productions mid-1980's		
1980	Kanti Jain	IMB	Created deep UV excimer laser photolithography	Enabled the smallest components of an IC to shrink even smaller (1990 800nanometer – 2016 10 nanometers)
Late 1990's	Innovations of interconnects from chemical-mechanical polishing or chemical-mechanical planarization (CMP)	Enables improved wafer yield by additional layers of metal wires, closer spacing and lower electrical resistance (not a direct factor		

When	Who	Where	What	Why
		in smaller transistors, but a major development for improved IC's)		

Is Moore's Law Still True

It's commonly asked and debated whether Moore's Law is still true. While there is disagreement amongst experts as to the answer to this – it is commonly agreed that it is no longer the driving force in the transistor industry.

In the past, expansion of storage and computation capabilities was based on aggressive feature scaling, manifested in Moore's Law. However, scaling will not be able to address the upcoming needs in IC performance and utilization of energy resources. Not only that, but advancements have decreased and other technology options to keep Moore's Law alive are being researched.

Since 1998, the industry has produced roadmaps for semiconductors using Moore's Law to drive advancements. In 2016 the final roadmap was produced. The industry is no longer centered around Moore's Law but it is outlined by a strategy that could be called 'beyond Moore's Law'. It is based around research and development of the needs and applications of chips, rather than scaling sizes. The application of chips varies from smartphone and laptops to artificial intelligence and data centers.

When it comes to the future development of technology, Moore's Law was great as it allowed everyone in the industry to have a common heartbeat, work together and create a bit of healthy competition between companies. Not just that, but consumers and other developers knew what to expect in advancements.

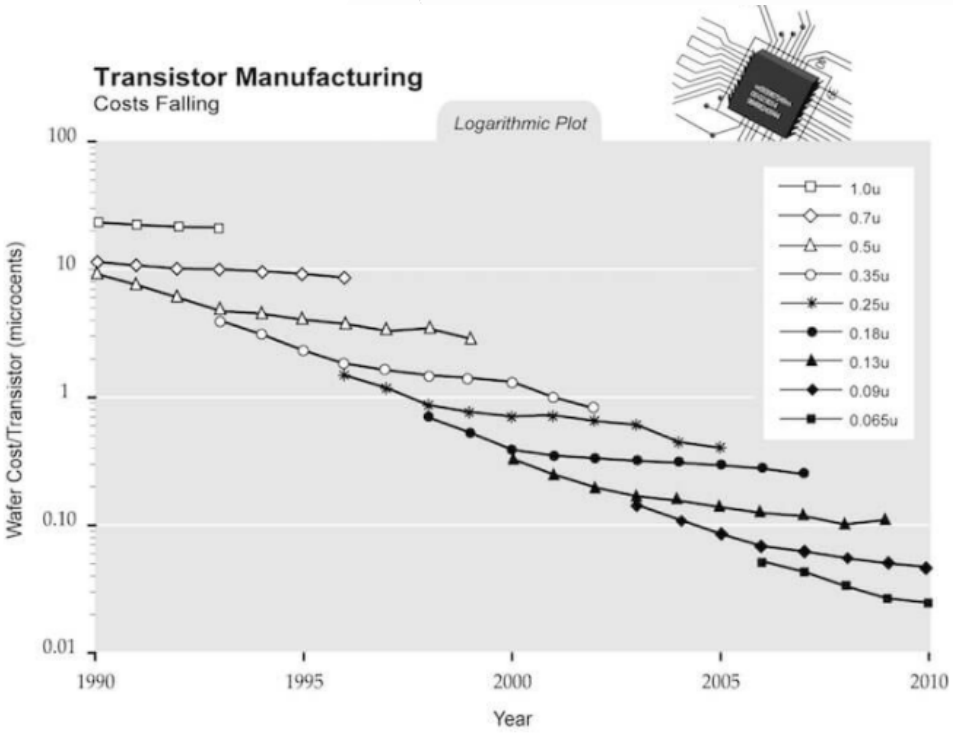
As Moore's Law is finishing up it gives the industry a chance to explore new avenues and get creative. Looking at the physical architecture, such as getting rid of designs from the 1940s could unlock the potential for higher efficiency. By having to redesign the basic architecture of computing, programmers will have to alter their old habits and adopt a new way of thinking – creating new methods of application and software to increase the speed and efficiency of computing in the future. Cloud computing, wireless communication, interconnection via the internet and quantum physics may all play a role in developments in the future.

As the industry moves on to 'beyond Moore's Law' strategy, the question is will companies be able to progress at the same rate of growth and scale? Many believe that the rate of advancement won't be the same, due to the simple fact that companies will have to work together in a new and complicated way, without the common heartbeat which kept all the research and development plans in sync. Therefore, advancements that benefit all could become less common.

Moore's Second Law

The primary driving force of economic growth is the growth of productivity. Moore's Second Law (also known as Rock's Law) looks at the economic flip side of semiconductor production.

The prediction was made in the 1960s by Arthur Rock – a businessman and early investor in tech companies such as Intel. It simply states that the cost of semiconductor fabrication also mimics exponential growth – it doubles every four years while the cost of a product for consumers was halved. The price of a fabrication plant for semiconductors had already reached around 14 Billion US Dollars in 2015.



Moore's Second Law evaluates the ongoing growth of financial investment required in the semiconductor industry. As advancements improved it was possible for manufacturers to have the ability to create better machines to automate the production line. The automation process has created lower priced products for the consumer as the hardware created has lower labor costs. Newer and popular products being sold means more profit to invest in developing new innovative designs and devices of even higher capabilities.

The cost of manufacturing a single unit is always decreasing while money being invested is constantly increasing to continue research and development. At some point, Moore's First Law (the number of components on an IC) and Moore's Second Law (the expenses of producing IC's) will collide – as the rising costs of manufacturing will reach a plateau and become too expensive to maintain and profit from.

- Read Jonathan Strickland (no date) article, “How Moore’s Law Works” by clicking or opening this webpage https://computer.howstuffworks.com/moores-law.htmno

- Watch Randal E. Bryant and David R. O’Hallaron’s lecture (2015) video, “The Future of Computing: Moore’s Law and Its Implication” by clicking or opening this webpage https://demo.hosted.panopto.com/Panopto/Pages/Embed.aspx?id=d99b2cbe-d61d-405d-a8a2-8d451fb0bf88

SAQ 1.2

•What are the three versions of Moore’s Law?

Lesson 5 Digitization

Accuracy is one of the most important aspect in communication which frequently ignores. The effect can be gigantic for both parties. This applies to verbal or written communications. Accuracy in communication puts you and your listeners on the same wavelength or situation. Your message is plainly and accurately conveyed. It is plainly and accurately received. The chance of false impressions, misinterpretations, and even erroneous decisions is dramatically lessened. Constant communications additionally make future discussions simpler, in light of the fact that the definitions are solid, conversations about mistaken assumptions doubts are evaded and at the same time trust is established.

Digitization refers to generate a digital representation of physical objects. Moreover, digitization is the process of converting analog signals or information of any form into a digital format that can be understood by computer systems or electronic devices. The term is used when converting information, like text, images or voices, and sounds, into binary code. For example, you scan a document such as a Birth Certificate and save it as a digital document (e.g., PDF, DOCX). Meaning, digitization is tied with changing over something non-computerize or non-digital into a digital representation. As an example, the rhythm of a piano which in analog signal is converted into a digital form this conversion is done by using a digitizer. Digitized information is easier to store, access, and transmit, and digitization

is used by a number of consumer electronic devices. Computerized systems or applications would then be able to utilize it for several use cases.

Digitization involves capturing analog signals and storing the results in digital form. This is usually done via sensors, which sense analog signals like light and sound and transform them into their equivalent digital forms via an analog-to-digital converter chip or a whole circuit dedicated to converting a specific analog signal.

This works by converting the continuous stream of signal or data found in most analog data types into discontinuous values. These are then sampled at regular intervals to produce a digitalized output.

For example, an audio file is generally sampled in rates of 44.1 kHz to 192 kHz. If an audio file is sampled at a rate of 48.1 kHz it is sampled 48,000 times per second. The digitization process is more effective and of higher quality, if performed at higher sampling rates.

All areas of the company whether small or big are affected by digitalization. For instance, seeing British travel giant – Thomas Cook collapse is a sad day for a lot of people. There were several hundred thousand customers who were stranded and about 22,000 people were left jobless worldwide including 9000 in the UK itself. Thomas Cook had a legacy of about 178 Years in the travel industry with asset-based operations owning hotels, airline, etc. Mr. Cook was the first person to pioneer the concept of package tourism long back in the 18th century. Thomas Cook enjoyed such a strong market position for several years and then what happened over the last few years, which made this giant fall flat? Many connect this as an impact of Brexit related issues, Exchange rate fluctuations, etc. but one of the main reasons is that the company failed to adapt to changing times.

Same with how Nokia failed to understand markets in Mobile space, similarly, Thomas Cook failed to understand Travel space.

The company was failed to cope up with the internet age. Their management planned a lot to adjust with the changing times but it was not easy to transform this asset-heavy organization with huge investments along with several offices and staff globally. In other words, the company failed to successfully pivot the business model to take advantage of current markets and changing customers' requirements. What we can learn from this?

There's a fundamental difference between Digitization, Digitalization, and Digital Transformation, which many still fail to understand. As you can see most of the Maritime businesses are asset-heavy in nature with huge investment and operations globally. It’s a responsibility of senior management to understand the clear difference between these terms which almost sounds similar.

Figure 1.2

Digitization is converting analog to digital, meaning digitization of data, digitalization is the process of using digital technology to assist business operations which means digitalization of a process, and a digital transformation is a digital-first approach encompassing all aspects of business, leading to the creation of entirely new markets and businesses.

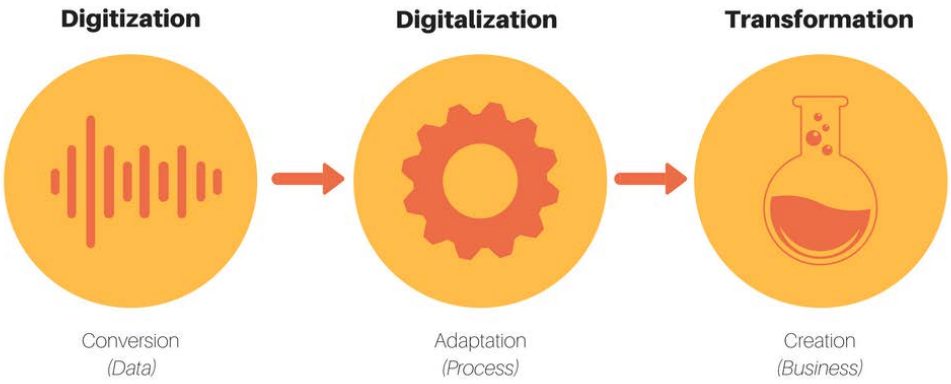


Figure 1.3. **Difference between digitization, digitalization, and transformation**

The above figure is the simplest explanation but to further simplify. When we use the website, Social media tools, content marketing for business - We are just Digitizing. When we adopt certain SAAS product to improve the operational process - We are Digitalizing. When we use various digital approaches to completely change the fundamental business model of the company and develop new kind of revenue streams - We are doing Digital Transformation

Thomas Cook did Digitize, they also Digitalized their processes, but they fundamentally failed to Digitally Transform the organization and the fate is in front of us. This failure to adopt made so many customers, investors, and employees suffer. Failure to understand this mere simple concept has put so many lives, hopes, and faith of many people in such a big brand at risk. Thomas Cook failed to understand the changing

customer needs, which resulted in losing the market share to newcomers with a better customer-centric approach.

This is similar to how Apple impacted Nokia. We have to accept that times are changing fast and many companies similar to Thomas Cook are still completely unaware of the risks which surround them. Asset heavy models are the biggest risk as the same hinders the necessary agility required to fight such digital fights.

Digital transformation should be a company-wide approach and each employee should understand the strategy behind management decisions and should participate in this transforming activity. To survive, we need to focus on bringing a big change in the business model creating new revenue streams. Either we disrupt ourselves or be ready to be disrupted!

Additional Supplementary Learning Resource for this topic:

- read Mark Sen Gupta (2020, March 24) article, “What is Digitization, Digitalization, and Digital Transformation?” by clicking or opening this webpage https://www.arcweb.com/blog/what-digitization-digitalization-digital-transformation
- watch Adatta Palekar (no date) video, “Lecture 4.1 Digitization of the Supply Chain” clicking or opening this webpage https://www.coursera.org/lecture/process-improvement/lecture-4-1-digitization-of-the-supply-chain-EFofn

Assignment 1.3

- What's your view on Digital transformation and how it can be simplified for better adoption?

ACTIVTY 1.1

Create a report using the Internet or any other resources and analyses emerging technologies of your interest on a single aspect of information and computing technologies such as Internet of Things, space-time trending, 3D printing, digitization, machine learning, natural language, grid computing, spatial crowdsourcing, etc.

- Your report will be shared with the class purposely to build up a comprehensive list as a foundation of the course
- Your report must follow APA 7 format with a minimum of 3 pages in length (excluding cover, abstract, and reference pages), 12 pt. font, and will include background on the emerging technology as well as potential economic and social impacts of the emerging technology. You report must be submit in the digital Learning Management System (LMS) assigned by your professor entitled <Lastname>_Activity_1.1. You report must be in PDF format and must include an abstract limited to 150 words.
- Use any grammar software to help your check your grammar and your report will be check for plagiarism. The acceptable percentage for plagiarisms is below 20% only

Synthesis

The overall impact of emerging technologies in the field of agriculture, education, finance, and other disciplines have made a tremendous influence on our life. Emerging technologies have created new chances while making new amendments in our laws specifically related to patents, copyrights, royalties, trademarks, and licensing. As to innovation, this is connected with the real-world application of the invention whether it is new or improved features of an invention with commercial value. As technology evolves, it enables even faster change and progress, causing an acceleration of the rate of change, until eventually, it will become exponential.

Staying up-to-date with technology trends means keeping your eyes on the future to know which skills you'll need to know and what types of jobs you want to be qualified to do. There are a lot of evolving technical careers today such as AI specialists, machine learning engineers, data analysts, and so on.

As drawn from Moore's Law and with the semiconductor company is that pure research can yield beneficial results for the society. One of the most important lessons we can take from Moore's Law is that we shouldn't be too quick to say something is impossible. Henry L. Ellsworth, the commissioner of the U.S. Patent Office in 1843, pointed out that the rate of human inventiveness and innovation was so impressive that it was hard to believe.

As to digitalization, it influences consumer behaviors and will fundamentally shift how many industries operate. Businesses will have to prepare to embrace that change and think ahead about what these changes will mean for their own operations. In the future, technology will not only be an auxiliary function of business operations but will become a fundamental part of the value creation.

Post-Test

I. TRUE OR FALSE

Direction: Write TRUE if the statement is correct otherwise write FALSE

_____ 1. Innovation is the creation of new ideas.
_____ 2. An invention is most suitable for the practical application of an invention whether it is new or improved features that have a positive outcome in the community or organization.
_____ 3. Investing in process innovation helps business lower their costs or production and enable higher output.
_____ 4. Innovation and new technologies have led to longer product life cycles and slower product obsolescence.
_____ 5. Most innovative ideas do not become successful new products.

II. MULTIPLE CHOICE

Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 1. Emerging technology is referred to as:
e. a new technology
f. ongoing enhancement of existing technology
g. formed a new break and making new legal challenges
h. all of the above

_____ 2. As a result of the rapid pace of innovation:
e. product life cycles have become short.
f. product development cycles have become significantly longer.
g. Market segmentation has been reduced.
h. product obsolescence has slowed down

_____ 3. Which of the following is true of technological innovations?
e. Technological innovations help increase a country's gross domestic product.
f. Technological innovations decrease the amount of output achievable from a given quantity of labor and capital.
g. Technological innovations slow down product obsolescence and lengthen product development cycles.
h. Technological innovations increase production costs and reduce product differentiation

_____ 4. Silk Work Inc., a manufacturer of silk garments, is planning to replace hand weaving with some modern machines that run on fuel. Which of the following consequences of this measure can be categorized as negative outside factors?
e. increased amount of output achievable from the given quantity of labor
f. increase in the quality of the silk garments
g. increased pollution as a result of the new technology
h. increased need for investment to finance the modernization

_____ 5. Technology is, in its purest essence, _____.
e. Knowledge
f. Dissonance
g. chaos
h. guesswork

Answers to SAQs

1. In your own words, discuss what is emerging technology and innovation.

   Answer:

   Emerging technology is referred to as the continuous improvement of existing technology. Innovation is the process of transforming a new concept into a marketable success or extensive utilization.

2. What are the three versions of Moore's Law?

   Answer:

   1. Moore's Law 1.0: Scaling up
      - Only applies to Flash and supercomputers today
   2. Moore's Law 2.0: Scaling down
      - Higher costs are putting this version in danger
   3. Moore's Law 3.0: Scaling Out (Innovation through Integration)
      - New materials (e.g., HkMG)
      - 3D integration
      - Silicon photonics
      - Memory on microprocessor
      - Smart sensors and actuators,
      - MEMS
      - More… (More than Moore)

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MODULE 2

Artificial Intelligence

Overview

This learning module of “Artificial intelligence (AI)” has been written according to the approved syllabus approved by the CICT Dean and CSU.

This learning module aims to assist you understand what Artificial intelligence (AI) is, equate human vs. computer intelligence, and its application. The treatment of the content is efficient and orderly in the presentation of the theoretical aspects of the topics. Each lesson has been comprehensively covered in scope, content, and furthermore from the assessment perspective.

This learning module endeavors in a basic and clear language with neat and self-explanatory diagrams, which could be simply understood by an average student.

The concise content of this learning module is as follows:

Lesson 1 introduces the Artificial intelligence

Lesson 2 covers the applications of Artificial intelligence

Learning Outcomes

At the end of the course, the students shall be able to:

1. explain the definition of artificial intelligence
2. compare how human and computer intelligence
3. discuss the various areas where AI can be applied

Pre-Test

I. MULTIPLE CHOICE
Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 6. Artificial Intelligence has its expansion in the following application.

a. Planning and Scheduling
b. Game Playing
c. Robotics
d. All of the above

_____ 7. This person developed laws for reasoning
a. Rene Descartes
b. Aristotle
c. Socrates
d. Wilhelm Leibnitz

_____ 8. What is Artificial intelligence?

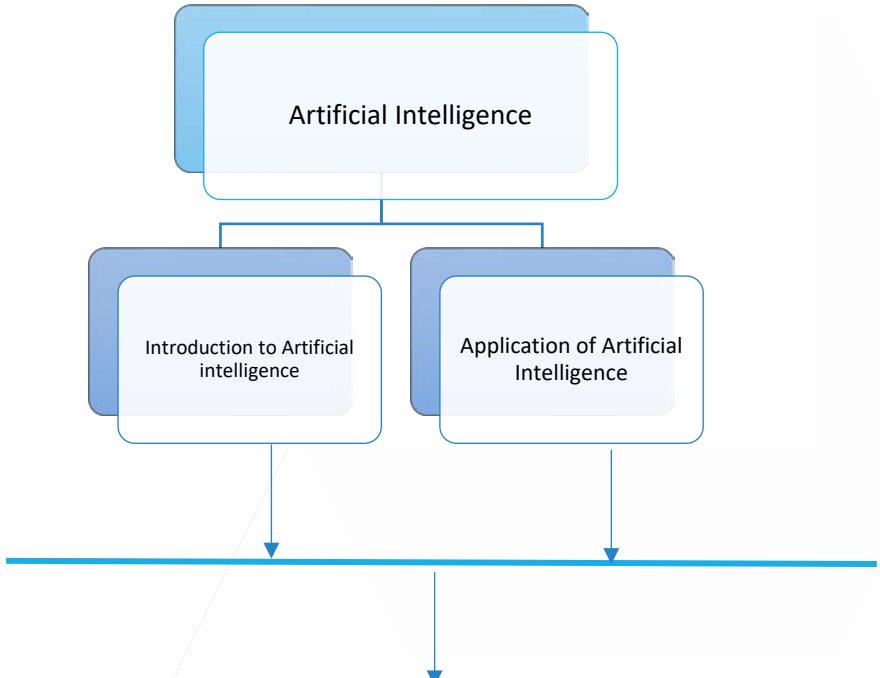
a. Putting your intelligence into Computer
b. Programming with your own intelligence
c. Making a Machine intelligent
d. Playing a Game

_____ 9. Weak AI is
a. the embodiment of human intellectual capabilities within a computer.
b. a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans.
c. the study of mental faculties through the use of mental models implemented on a computer.
d. All of the above
e. None of the above

_____ 10. Strong Artificial Intelligence is _____

a. the embodiment of human intellectual capabilities within a computer
b. a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans
c. the study of mental faculties through the use of mental models implemented on a computer
d. all of the mentioned

Module Map



Supplementary Learning Resource

Self-Assessment Questions/ Assignment/ Activity

Definition of Key Terms/Unlocking of Difficulties

Artificial Intelligence (AI)	is a branch of Science which deals with helping machines find solutions to complex problems in a more human-like fashion.
Deep learning	is a type of machine learning that runs inputs through a biologically-inspired neural network architecture.
LISP (LISt Processor)	is a functional programming language with procedural extensions.
Machine learning (ML)	is the study of computer algorithms that improve automatically through experience
Artificial general intelligence (AGI)	is the hypothetical intelligence of a machine that has the capacity to understand or learn any intellectual task that a human being can.
Artificial Narrow Intelligence (ANI)	is a term used to describe artificial intelligence systems that are specified to handle a singular or limited task.

Lessons

Artificial Intelligence

Lesson 1 Introduction to Artificial Intelligence

Artificial Intelligence (AI) is a branch of Science which deals with helping machines find solutions to complex problems in a more human-like fashion. This generally involves borrowing characteristics from human intelligence, and applying them as algorithms in a computer friendly way. A more or less flexible or efficient approach can be taken depending on the requirements established, which influences how artificial the intelligent behavior appears.

Artificial intelligence can be viewed from a variety of perspectives.

1. From the perspective of intelligence artificial intelligence is making machines "intelligent" -- acting as we would expect people to act.
    - The inability to distinguish computer responses from human responses is called the Turing test.
    - Intelligence requires knowledge
    - Expert problem solving - restricting domain to allow including significant relevant knowledge

2. From a business perspective AI is a set of very powerful tools, and methodologies for using those tools to solve business problems.

3. From a programming perspective, AI includes the study of symbolic programming, problem solving, and search.
    - Typically AI programs focus on symbols rather than numeric processing.
    - Problem solving - achieve goals.
    - Search - seldom access a solution directly. Search may include a variety of techniques.
    - AI programming languages include:
        - LISP, developed in the 1950s, is the early programming language strongly associated with AI. LISP is a functional programming language with procedural extensions. LISP (LISt Processor) was specifically designed for processing heterogeneous lists -- typically a list of symbols. Features of LISP are run- time type checking, higher order functions (functions that have other functions as parameters), automatic memory management (garbage collection) and an interactive environment.
        - The second language strongly associated with AI is PROLOG. PROLOG was developed in the 1970s. PROLOG is based on

first order logic. PROLOG is declarative in nature and has facilities for explicitly limiting the search space.

- Object-oriented languages are a class of languages more recently used for AI programming. Important features of object-oriented languages include: concepts of objects and messages, objects bundle data and methods for manipulating the data, sender specifies what is to be done receiver decides how to do it, inheritance (object hierarchy where objects inherit the attributes of the more general class of objects). Examples of object-oriented languages are Smalltalk, Objective C, C++. Object oriented extensions to LISP (CLOS - Common LISP Object System) and PROLOG (L&O - Logic & Objects) are also used.

Artificial Intelligence is a new electronic machine that stores large amount of information and process it at very high speed. The computer is interrogated by a human via a teletype. It passes if the human cannot tell if there is a computer or human at the other end. AI has the ability to solve problems and it is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence.

SAQ 2.1

- In your own words, what is Artificial Intelligence

Assignment 2.1

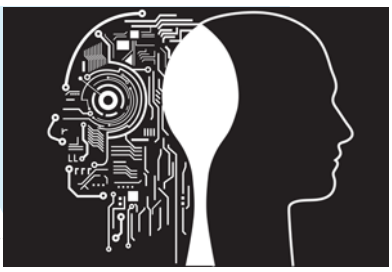
- Search at least three (3) definition of Artificial Intelligence (cite your sources) and then create your own definition of Artificial Intelligence .

How does Artificial Intelligence work?

Can machines think? — Alan Turing, 1950

Less than a decade after breaking the Nazi encryption machine Enigma and helping the Allied Forces win World War II, mathematician Alan Turing changed history a second time with a simple question: "Can machines think?"

Turing's paper "Computing Machinery and Intelligence" (1950), and it's subsequent Turing Test, established the fundamental goal and vision of artificial intelligence.



At it's core, AI is the branch of computer science that aims to answer Turing's question in the affirmative. It is the endeavor to replicate or simulate human intelligence in machines.

The expansive goal of artificial intelligence has given rise to many questions and debates. So much so, that no singular definition of the field is universally accepted.

The major limitation in defining AI as simply "building machines that are intelligent" is that it doesn't actually explain *what artificial intelligence is? What makes a machine intelligent?*

In their groundbreaking textbook *Artificial Intelligence: A Modern Approach*, authors Stuart Russell and Peter Norvig approach the question by unifying their work around the theme of intelligent agents in machines. With this in mind, AI is "the study of agents that receive percepts from the environment and perform actions." (Russel and Norvig viii)

Norvig and Russell go on to explore four different approaches that have historically defined the field of AI:

1. Thinking humanly
2. Thinking rationally
3. Acting humanly
4. Acting rationally

The first two ideas concern thought processes and reasoning, while the others deal with behavior. Norvig and Russell focus particularly on rational agents that act to achieve the best outcome, noting "all the skills needed for the Turing Test also allow an agent to act rationally." (Russel and Norvig 4).

Patrick Winston, the Ford professor of artificial intelligence and computer science at MIT, defines AI as "algorithms enabled by constraints, exposed by representations that support models targeted at loops that tie thinking, perception and action together."

While these definitions may seem abstract to the average person, they help focus the field as an area of computer science and provide a blueprint for infusing machines and programs with machine learning and other subsets of artificial intelligence.

While addressing a crowd at the Japan AI Experience in 2017, DataRobot CEO Jeremy Achin began his speech by offering the following definition of how AI is used today:

"AI is a computer system able to perform tasks that ordinarily require human intelligence. Many of these artificial intelligence systems are powered by machine learning, some of them are powered by deep learning and some of them are powered by very boring things like rules."

How is AI used?

Artificial intelligence generally falls under two broad categories:

1. Artificial Narrow Intelligence (ANI)

Artificial Narrow Intelligence (ANI) is a term used to describe artificial intelligence systems that are specified to handle a singular or limited task. Narrow AI sometimes referred to as "Weak AI," this kind of artificial intelligence operates within a limited context and is a simulation of human intelligence. Narrow AI is often focused on performing a single task extremely well and while these machines may seem intelligent, they are operating under far more constraints and limitations than even the most basic human intelligence.

ANI is all around us and is easily the most successful realization of artificial intelligence to date. With its focus on performing specific tasks, ANI has experienced numerous breakthroughs in the last decade that have had "significant societal benefits

and have contributed to the economic vitality of the nation," according to "Preparing for the Future of Artificial Intelligence," a 2016 report released by the Obama Administration.

A few examples of Narrow AI include:

a. Google search
b. Image recognition software
c. Siri, Alexa and other personal assistants
d. Self-driving cars
e. IBM's Watson

Machine Learning & Deep Learning

Much of Narrow AI is powered by breakthroughs in machine learning and deep learning. Understanding the difference between artificial intelligence, machine learning and deep learning can be confusing. Venture capitalist Frank Chen provides a good overview of how to distinguish between them, noting:

> "Artificial intelligence is a set of algorithms and intelligence to try to mimic human intelligence. Machine learning is one of them, and deep learning is one of those machine learning techniques."

Machine learning feeds a computer data and uses statistical techniques to help it "learn" how to get progressively better at a task, without having been specifically programmed for that task, eliminating the need for millions of lines of written code. Machine learning consists of both supervised learning (using labeled data sets) and unsupervised learning (using unlabeled data sets). Simply put, Machine learning (ML) is the study of computer algorithms that improve automatically through experience

Deep learning is a type of machine learning that runs inputs through a biologically-inspired neural network architecture. The neural networks contain a number of hidden layers through which the data is processed, allowing the machine to go "deep" in its learning, making connections and weighting input for the best results.

2. **Artificial General Intelligence (AGI)**

AGI, sometimes referred to as "Strong AI," is the kind of artificial intelligence we see in the movies, like the robots from Westworld or Data from Star Trek: The Next Generation. AGI is a machine with general intelligence and, much like a human being, it can apply that intelligence to solve any problem.

The creation of a machine with human-level intelligence that can be applied to any task is the Holy Grail for many AI researchers, but the quest for AGI has been fraught with difficulty.

The search for a "universal algorithm for learning and acting in any environment," (Russel and Norvig 27) isn't new, but time hasn't eased the difficulty of essentially creating a machine with a full set of cognitive abilities.

AGI has long been the muse of dystopian science fiction, in which super-intelligent robots overrun humanity, but experts agree it's not something we need to worry about anytime soon. To simply this, AGI general intelligence is the hypothetical intelligence of a machine that has the capacity to understand or learn any intellectual task that a human being can.

SAQ 2.2

- Differentiate Narrow AI and Artificial General Intelligence

Importance of AI

a. Game Playing

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

b. Speech Recognition

In the 1990s, computer speech recognition reached a practical level for limited purposes. Thus United Airlines has replaced its keyboard tree for flight information by a system using speech recognition of flight numbers and city names. It is quite convenient. On the other hand, while it is possible to instruct some computers using speech, most users have gone back to the keyboard and the mouse as still more convenient.

c. Understanding Natural Language

Just getting a sequence of words into a computer is not enough. Parsing sentences is not enough either. The computer has to be provided with an understanding of the domain the text is about, and this is presently possible only for very limited domains.

d. Computer Vision

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

e. Expert Systems

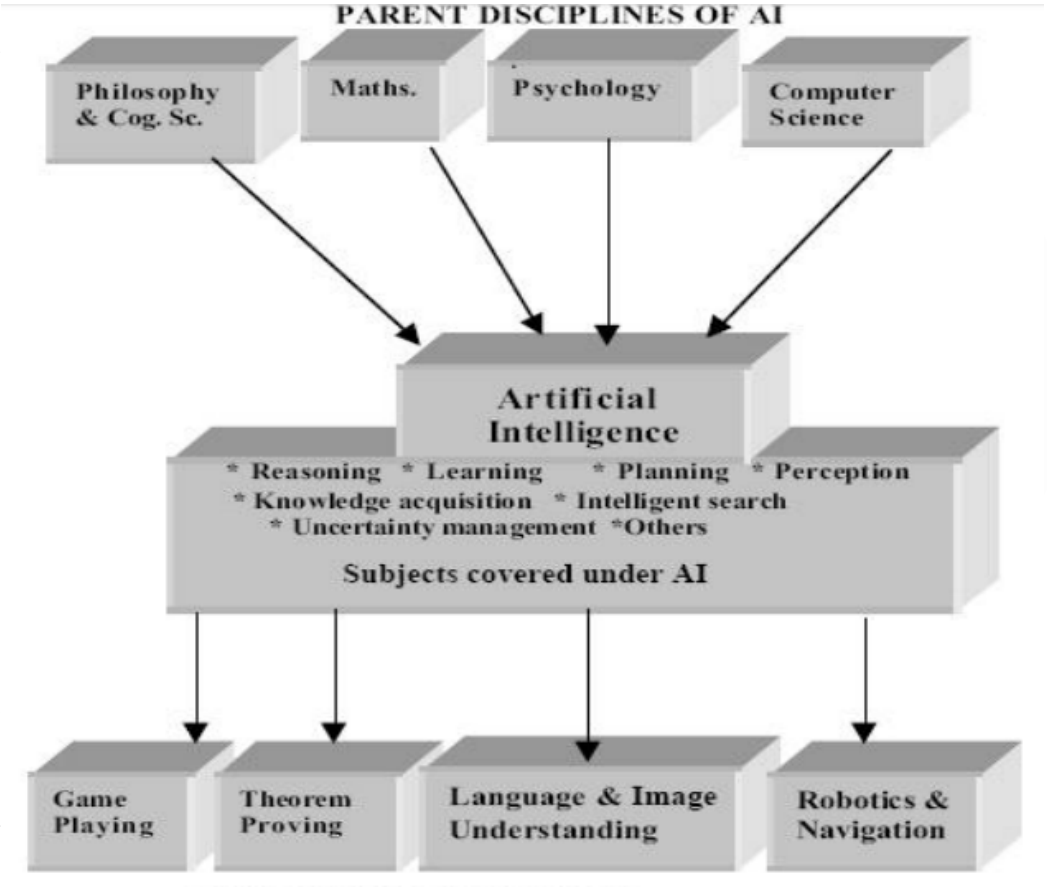
A “knowledge engineer" interviews experts in a certain domain and tries to embody their knowledge in a computer program for carrying out some task. How well this works depends on whether the intellectual mechanisms required for the task are within the present state of AI. When this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Namely, its ontology included bacteria, symptoms, and treatments and did not include patients, doctors, hospitals, death, recovery, and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, death, recovery, etc., it is clear that the knowledge engineers forced what the experts told them into a predetermined framework. The usefulness of current expert systems depends on their users having common sense.

f. Heuristic Classification

One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

Lesson 2 The applications of AI

As shown in the figure the applications areas of AI.



Consumer Marketing

- Have you ever used any kind of credit/ATM/store card while shopping?
- if so, you have very likely been "input" to an AI algorithm
- All of this information is recorded digitally
- Companies like Nielsen gather this information weekly and search for patterns
  - ✓ general changes in consumer behavior
  - ✓ tracking responses to new products
  - ✓ identifying customer segments: targeted marketing, e.g., they find out that consumers with sports cars who buy textbooks respond well to offers of new credit cards.

- Algorithms ("data mining") search data for patterns based on mathematical theories of learning

Identification Technologies

- ID cards e.g., ATM cards
- can be a nuisance and security risk: cards can be lost, stolen, passwords forgotten, etc

- Biometric Identification, walk up to a locked door
  - ✓ Camera
  - ✓ Fingerprint device
  - ✓ Microphone
  - ✓ Computer uses biometric signature for identification
  - ✓ Face, eyes, fingerprints, voice pattern
  - ✓ This works by comparing data from person at door with stored library
  - ✓ Learning algorithms can learn the matching process by analyzing a large library database off-line, can improve its performance.

Intrusion Detection

- Computer security
  - ✓ we each have specific patterns of computer use times of day, lengths of sessions, command used, sequence of commands, etc
  - ✓ would like to learn the "signature" of each authorized user
  - ✓ can identify non-authorized users
- How can the program automatically identify users?
  - ✓ record user's commands and time intervals
  - ✓ characterize the patterns for each user
  - ✓ model the variability in these patterns
  - ✓ classify (online) any new user by similarity to stored patterns

Machine Translation

- Language problems in international business
  - ✓ e.g., at a meeting of Japanese, Korean, Vietnamese and Swedish investors, no common language
  - ✓ If you are shipping your software manuals to 127 countries, the solution is; hire translators to translate
  - ✓ would be much cheaper if a machine could do this!
- How hard is automated translation
  - ✓ very difficult!
  - ✓ e.g., English to Russian
  - ✓ not only must the words be translated, but their meaning also!

Early work in AI

Artificial Intelligence (AI) is the part of computer science concerned with designing intelligent computer systems, that is, systems that exhibit characteristics we associate with intelligence in human behaviour – understanding language, learning, reasoning, solving problems, and so on."

Scientific Goal is used to determine which ideas about knowledge representation, learning, rule systems, search, and so on, explain various sorts of real intelligence.

Engineering Goal is used to solve real world problems using AI techniques such as knowledge representation, learning, rule systems, search, and so on.

Traditionally, computer scientists and engineers have been more interested in the engineering goal, while psychologists, philosophers and cognitive scientists have been more interested in the scientific goal.

Artificial Intelligence has identifiable **roots** in a number of older disciplines, particularly: (a) Philosophy, (b) Logic/Mathematics, (c) Computation, (d) Psychology/Cognitive Science, (e) Biology/Neuroscience, and (f) Evolution

There is inevitably much overlap, e.g. between philosophy and logic, or between mathematics and computation. By looking at each of these in turn, we can gain a better understanding of their role in AI, and how these underlying disciplines have developed to play that role.

a. Philosophy

- ✓ ~400 BC Socrates asks for an algorithm to distinguish piety from non-piety.
- ✓ ~350 BC Aristotle formulated different styles of deductive reasoning, which could mechanically generate conclusions from initial premises, e.g. Modus Ponens

If A ? B and A then B
If A implies B and A is true then B is true when it's raining you get wet and it's raining then you get wet

- ✓ 1596 – 1650 Rene Descartes idea of mind-body dualism – part of the mind is exempt from physical laws.
- ✓ 1646 – 1716 Wilhelm Leibnitz was one of the first to take the materialist position which holds that the mind operates by ordinary physical processes – this has the implication that mental processes can potentially be carried out by machines.

b. Logic/Mathematics

- ✓ Earl Stanhope's Logic Demonstrator was a machine that was able to solve syllogisms, numerical problems in a logical form, and elementary questions of probability.
- ✓ 1815 – 1864 George Boole introduced his formal language for making logical inference in 1847 – Boolean algebra.
- ✓ 1848 – 1925 Gottlob Frege produced a logic that is essentially the first-order logic that today forms the most basic knowledge representation system.
- ✓ 1906 – 1978 Kurt Gödel showed in 1931 that there are limits to what logic can do. His Incompleteness Theorem showed that in any formal logic powerful enough to describe the properties of natural numbers, there are true statements whose truth cannot be established by any algorithm.
- ✓ 1995 Roger Penrose tries to prove the human mind has non-computable capabilities.

c. Computation

- ✓ 1869 William Jevon's Logic Machine could handle Boolean Algebra and Venn Diagrams, and was able to solve logical problems faster than human beings.
- ✓ 1912 – 1954 Alan Turing tried to characterise exactly which functions are capable of being computed. Unfortunately it is difficult to give the notion of computation a formal definition. However, the Church-Turing thesis, which states that a Turing machine is capable of computing any computable function, is generally accepted as providing a sufficient definition. Turing also showed that there were some functions which no Turing machine can compute (e.g. Halting Problem).
- ✓ 1903 – 1957 John von Neumann proposed the von Neuman architecture which allows a description of computation that is independent of the particular realisation of the computer.
- ✓ 1960s Two important concepts emerged: Intractability (when solution time grows atleast exponentially) and Reduction (to 'easier' problems).

d. Psychology / Cognitive Science

- ✓ Modern Psychology / Cognitive Psychology / Cognitive Science is the science which studies how the mind operates, how we behave, and how our brains process information.
- ✓ Language is an important part of human intelligence. Much of the early work on knowledge representation was tied to language and informed by research into linguistics.
- ✓ It is natural for us to try to use our understanding of how human (and other animal) brains lead to intelligent behavior in our quest to build artificial intelligent systems. Conversely, it makes sense to explore the properties of artificial systems (computer models/simulations) to test our hypotheses concerning human systems.
- ✓ Many sub-fields of AI are simultaneously building models of how the human system operates, and artificial systems for solving real world problems, and are allowing useful ideas to transfer between them.

e. Biology / Neuroscience

- ✓ Our brains (which give rise to our intelligence) are made up of tens of billions of neurons, each connected to hundreds or thousands of other neurons.
- ✓ Each neuron is a simple processing device (e.g. just firing or not firing depending on the total amount of activity feeding into it). However, large networks of neurons are extremely powerful computational devices that can learn how best to operate.
- ✓ The field of Connectionism or Neural Networks attempts to build artificial systems based on simplified networks of simplified artificial neurons.
- ✓ The aim is to build powerful AI systems, as well as models of various human abilities.
- ✓ Neural networks work at a sub-symbolic level, whereas much of conscious human reasoning appears to operate at a symbolic level.

- ✓ Artificial neural networks perform well at many simple tasks, and provide good models of many human abilities. However, there are many tasks that they are not so good at, and other approaches seem more promising in those areas.

f. Evolution

- ✓ One advantage humans have over current machines/computers is that they have a long evolutionary history.
- ✓ Charles Darwin (1809 – 1882) is famous for his work on evolution by natural selection. The idea is that fitter individuals will naturally tend to live longer and produce more children, and hence after many generations a population will automatically emerge with good innate properties.
- ✓ This has resulted in brains that have much structure, or even knowledge, built in at birth.
- ✓ This gives them at the advantage over simple artificial neural network systems that have to learn everything.
- ✓ Computers are finally becoming powerful enough that we can simulate evolution and evolve good AI systems.
- ✓ We can now even evolve systems (e.g. neural networks) so that they are good at learning.
- ✓ A related field called genetic programming has had some success in evolving programs, rather than programming them by hand.

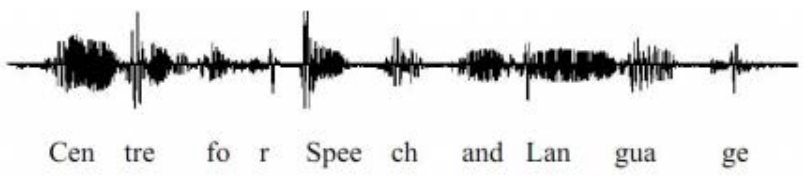
The following are the sub-fields of Artificial Intelligence

- ☐ Neural Networks – e.g. brain modelling, time series prediction, classification
- ☐ Evolutionary Computation – e.g. genetic algorithms, genetic programming
- ☐ Vision – e.g. object recognition, image understanding
- ☐ Robotics – e.g. intelligent control, autonomous exploration
- ☐ Expert Systems – e.g. decision support systems, teaching systems
- ☐ Speech Processing– e.g. speech recognition and production
- ☐ Natural Language Processing – e.g. machine translation
- ☐ Planning – e.g. scheduling, game playing
- ☐ Machine Learning – e.g. decision tree learning, version space learning

Speech Processing

As well as trying to understand human systems, there are also numerous real world applications: speech recognition for dictation systems and voice activated control; speech production for automated announcements and computer interfaces.

How do we get from sound waves to text streams and vice-versa?



Natural Language Processing

For example, machine understanding and translation of simple sentences:

Planning

Planning refers to the process of choosing/computing the correct sequence of steps to solve a given problem. To do this we need some convenient representation of the problem domain. We can define states in some formal language, such as a subset of predicate logic, or a series of rules.

A plan can then be seen as a sequence of operations that transform the initial state into the goal state, i.e. the problem solution. Typically we will use some kind of search algorithm to find a good plan.

Common Techniques

Even apparently radically different AI systems (such as rule based expert systems and neural networks) have many common techniques. Four important ones are:

- **Knowledge Representation**: Knowledge needs to be represented somehow – perhaps as a series of if-then rules, as a frame based system, as a semantic network, or in the connection weights of an artificial neural network.
- **Learning**: Automatically building up knowledge from the environment – such as acquiring the rules for a rule based expert system, or determining the appropriate connection weights in an artificial neural network.
- **Rule Systems**: These could be explicitly built into an expert system by a knowledge engineer, or implicit in the connection weights learnt by a neural network.
- **Search:** This can take many forms – perhaps searching for a sequence of states that leads quickly to a problem solution, or searching for a good set of connection weights for a neural network by minimizing a fitness function.

AI and related fields

1. **Logical AI.**

What a program knows about the world in general the facts of the specific situation in which it must act, and its goals are all represented by sentences of some mathematical logical language. The program decides what to do by inferring that certain actions are appropriate for achieving its goals.

2. **Search**

AI programs often examine large numbers of possibilities, e.g. moves in a chess game or inferences by a theorem proving program. Discoveries are continually made about how to do this more efficiently in various domains.

3. **Pattern Recognition**

When a program makes observations of some kind, it is often programmed to compare what it sees with a pattern. For example, a vision program may try to match a pattern of eyes and a nose in a scene in order to find a face. More complex patterns, e.g. in a natural language text, in a chess position, or in the history of some event are also studied.

4. **Representation**

Facts about the world have to be represented in some way. Usually languages of mathematical logic are used.

5. **Inference**

From some facts, others can be inferred. Mathematical logical deduction is adequate for some purposes, but new methods of non-monotonic inference have been added to logic since the 1970s. The simplest kind of non-monotonic reasoning is default reasoning in which a conclusion is to be inferred by default, but the conclusion can be withdrawn if there is evidence to the contrary. For example, when we hear of a bird, when man infer that it can fly, but this conclusion can be reversed when we hear that it is a penguin. It is the possibility that a conclusion may have to be withdrawn that constitutes the non-monotonic character of the reasoning. Ordinary logical reasoning is monotonic in that the set of conclusions that can the drawn from a set of premises is a monotonic increasing function of the premises.

6. **Common sense knowledge and reasoning**

This is the area in which AI is farthest from human-level, in spite of the fact that it has been an active research area since the 1950s. While there has been considerable progress, e.g. in developing systems of non-monotonic reasoning and theories of action, yet more new ideas are needed.

7. **Learning from experience**

Programs do that. The approaches to AI based on connectionism and neural nets specialize in that. There is also learning of laws expressed in logic. Programs can only learn what facts or behaviors their formalisms can represent, and unfortunately learning systems are almost all based on very limited abilities to represent information.

8. **Planning**

   Planning programs start with general facts about the world (especially facts about the effects of actions), facts about the particular situation and a statement of a goal. From these, they generate a strategy for achieving the goal. In the most common cases, the strategy is just a sequence of actions.

9. **Epistemology**

   This is a study of the kinds of knowledge that are required for solving problems in the world.

10. **Ontology**

    Ontology is the study of the kinds of things that exist. In AI, the programs and sentences deal with various kinds of objects, and we study what these kinds are and what their basic properties are. Emphasis on ontology begins in the 1990s.

11. **Heuristics**

    A heuristic is a way of trying to discover something or an idea imbedded in a program. The term is used variously in AI. Heuristic functions are used in some approaches to search to measure how far a node in a search tree seems to be from a goal. Heuristic predicates that compare two nodes in a search tree to see if one is better than the other, i.e. constitutes an advance toward the goal, may be more useful.

12. **Genetic Programming**

    Genetic programming is a technique for getting programs to solve a task by mating random Lisp programs and selecting fittest in millions of generations.

Assignment 2.2

- What are the legal, moral and ethical questions technologists are asking About AI?

The following are the Supplementary Learning Resource for this topic:

- read the Alexander S. Rich & Todd M. Gureckis (2019, April 19) study, “Lessons for artificial intelligence from the study of natural stupidity” by clicking or opening this webpage https://www.nature.com/articles/s42256-019-0038-z
- watch the Garry Kasparov (2017) TEDTalk video, “Don't fear intelligent machines. Work with them” by clicking or opening this webpage https://www.ted.com/talks/garry_kasparov_don_t_fear_intelligent_machines_work_with_them?referrer=playlist-how_to_live_with_robots

Synthesis

To sum up, introduced you’re the basic Artificial Intelligence (AI) concepts such as what Artificial Intelligence (AI) is, how it works, categories of AI, its importance, AI applications were presented, early works in AI and other related fields,

Post-Test

I. MULTIPLE CHOICE
Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 1. This person developed laws for reasoning
e. Rene Descartes

f. Aristotle
g. Socrates
h. Wilhelm Leibnitz

_____ 2. Strong Artificial Intelligence is _____

e. the embodiment of human intellectual capabilities within a computer
f. a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans
g. the study of mental faculties through the use of mental models implemented on a computer
h. all of the mentioned

_____ 3. What is Artificial intelligence?

e. Putting your intelligence into Computer
f. Programming with your own intelligence
g. Making a Machine intelligent
h. Playing a Game

_____ 4. Artificial Intelligence has its expansion in the following application.

e. Planning and Scheduling
f. Game Playing
g. Robotics
h. All of the above

_____ 5. Weak AI is

f. the embodiment of human intellectual capabilities within a computer.
g. a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans.
h. the study of mental faculties through the use of mental models implemented on a computer.
i. All of the above
j. None of the above

Answers to SAQs

1. In your own words, what is Artificial Intelligence

   Answer:

   Artificial Intelligence (AI) is a branch of Science which deals with helping machines find solutions to complex problems in a more human-like fashion.

2. Differentiate Narrow AI and Artificial General Intelligence

   Answer:

   Artificial Narrow Intelligence (ANI), these AI systems are designed to solve one single problem and would be able to execute a single task really well. By definition, they have narrow capabilities, like recommending a product for an

e-commerce user or predicting the weather. This is the only kind of Artificial Intelligence that exists today, while Artificial General Intelligence (AGI) is still a theoretical concept. It's defined as AI which has a human-level of cognitive function, across a wide variety of domains such as language processing, image processing, computational functioning and reasoning and so on.

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Russell, S. and Norvig, P. (2010).Artificial Intelligence A Modern Approach Third Edition.
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MODULE 3

Information Access and Cloud Computing

Overview

This learning module of “Artificial intelligence (AI)” has been written according to the approved syllabus approved by the CICT Dean and CSU.

This learning module endeavors in a basic and clear language with neat and self-explanatory diagrams, which could be simply understood by an average student.

The concise content of this learning module is as follows:

Lesson 1 introduces the globalization and digital divide

Lesson 2 covers the emerging cloud and mobile environments

Learning Outcomes

At the end of the course, the students shall be able to:

1. explain the concept of globalization and digital divide
2. describe the role of IT in globalization

Pre-Test

I. MULTIPLE CHOICE

Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 1. The growth in global communication has
a. Been limited to international phone calls
b. Meant people now rely on different sources for the news
c. Decreased the need for the internet
d. Brought information to more people from the same sources

_____ 2. It is the process of expanding globalism and refers to the increasing integration of economics, communications and culture across national boundries.
a. Digital divide
b. globalization
c. cloud computing
d. mobile environment

_____ 3. The key components of M2M systems include:
a. RFID
b. Sensors
c. Wi-Fi networks
d. All of the above.

_____ 4. Globalization represents an increasing integration of all of the following except
a. Culture
b. Morals
c. Communications
d. Economics

_____ 5. Students directly affected the most by the Digital Divide are:
a. Students in rural areas
b. Students from low income, minority families
c. Students in sub-urban areas
d. Students in rural and urban areas

_____ 6. It is more concerned with the fact that “technology remains so complicated that many people couldn’t use a computer even if they got one for free”, is it know as:
a. empowerment divide
b. Equality Divide
c. Economic Divide

d. usability divide

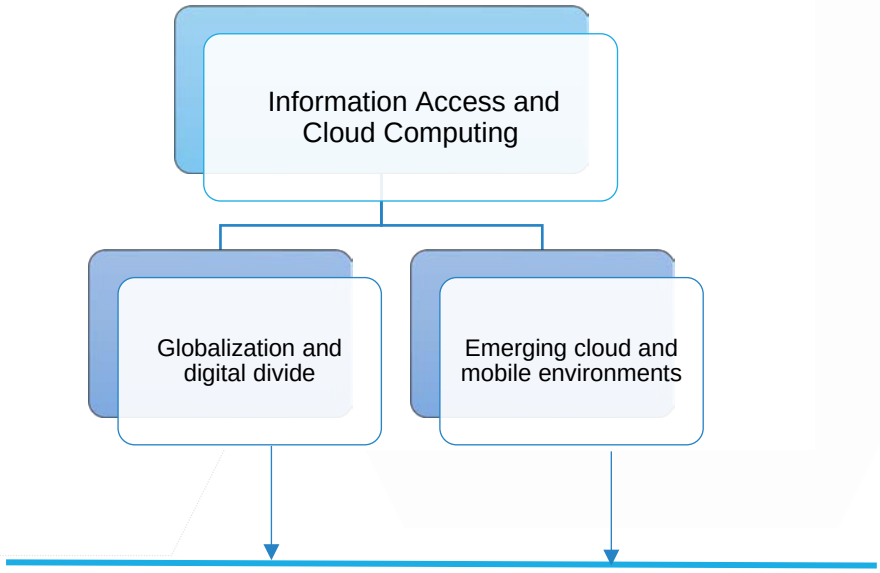
_____ 7. Google Docs is a type of cloud computing.
a. True
b. False

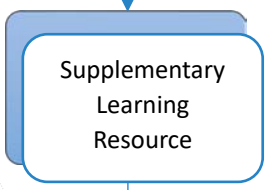
_____ 8. What is Cloud Computing replacing?
a. Corporate data centers
b. Expensive personal computer hardware
c. Expensive software upgrades
d. All of the above

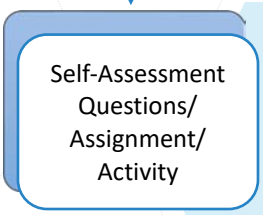
_____ 9. What is the number one concern about cloud computing?
a. Too expensive
b. Security concerns
c. Too many platforms
d. Accessibility

_____ 10. To protect applications and data on mobile devices the following measures must utilize:
a. Mobile Device Management.
b. Antivirus
c. Online security
d. All of the above

Module Map


Information Access and Cloud Computing
Globalization and digital divide
Emerging cloud and mobile environments


Supplementary Learning Resource


Self-Assessment Questions/ Assignment/ Activity

Definition of Key Terms/Unlocking of Difficulties

Globalization	refers to the integration of goods, services, and cultures among the nations of the world
digital divide	is the separation between those who have access to the global network and those who do not. The digital divide can occur between countries, regions, or even neighbourhoods.
Cloud Computing	is the practice of using large groups of remote servers, hosted on Internet, to store and access applications and computer data, instead of saving them on the local server or personal computer.
Public Cloud	It is owned by a third party cloud service provider or CSP who makes cloud services available to the general public.
Private Cloud	is dedicatedly operated for a particular organization, managed by the organization themselves or a third party
Community Cloud	is maintained and used by a group of organizations with shared concerns that is they have similar security or compliance requirements
Hybrid Cloud	is the composition of two or more clouds,
Mobile payment,	is where payment is made using a mobile device through payment services that are financially regulated.
digital wallet	is an electronic device that allows individuals to make electronic commerce transaction
M2M	refers to the communication between multiple devices through wireless or wired systems

Lessons

Information Access and Cloud Computing

Lesson 1 Globalization and Digital Divide

Introduction

The Internet has wired the world. Today it is just as simple to communicate with someone on the other side of the world as it is to talk to someone next door. In this lesson, we will look at the implications of globalization and the impact it is having on the world.

- **What Is Globalization?**

Globalization is the term used to refer to the integration of goods, services, and culture among the nations of the world. Globalization is not necessarily a new phenomenon; in many ways, we have been experiencing globalization since the days of European colonization. Further advances in telecommunication and transportation technologies accelerated globalization. The advent of the worldwide Internet has made all nations next-door neighbors.

The Internet is truly a worldwide phenomenon. As of 2012, the Internet was being used in over 150 countries by a staggering 2.4 billion people worldwide and growing.[1] From its initial beginnings in the United States in the 1970s to the development of the World Wide Web in the 1990s to the social networks and e-commerce of today, the Internet has continued to increase the integration between countries, making globalization a fact of life for citizens all over the world.

WORLD INTERNET USAGE AND POPULATION STATISTICS
As of June 30, 2012

World Regions	Population (2012 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2012	Users % of Table
Africa	1,073,380,925	4,514,400	167,335,676	15.6%	3,606.7%	7.0%
Asia	3,922,066,987	114,304,000	1,076,681,059	27.5%	841.9%	44.8%
Europe	820,918,446	105,096,093	518,512,109	63.2%	393.4%	21.5%
Middle East	223,608,203	3,284,800	90,000,455	40.2%	2,639.9%	3.7%
North America	348,280,154	108,096,800	273,785,413	78.6%	153.3%	11.4%
Latin America / Caribbean	593,688,638	18,068,919	254,915,745	42.9%	1,310.8%	10.6%
Oceania / Australia	35,903,569	7,620,480	24,287,919	67.6%	218.7%	1.0%
WORLD TOTAL	7,017,846,922	360,985,492	2,405,518,376	34.3%	566.4%	100.0%

Source: Internet World Stats

The Network Society

In 1996, social-sciences researcher Manuel Castells published **The Rise of the Network Society**, in which he identified new ways in which economic activity was being organized around the networks that the new telecommunication technologies have provided. This new, global economic activity was different from the past, because "it is an economy with the capacity to work as a unit in real time on a planetary scale."[2] We are now into this network society, where we are all connected on a global scale.

The World Is Flat

In 2005, Thomas Friedman's seminal book, **The World Is Flat**, was published. In this book, Friedman unpacks the impacts that the personal computer, the Internet, and communication software have had on business, specifically the impact they have had on globalization. He begins the book by defining the three eras of globalization [3]:

- "Globalization 1.0" occurred from 1492 until about 1800. In this era, globalization was centered around countries. It was about how much horsepower, wind power, and steam power a country had and how creatively it was deployed. The world shrank from size "large" to size "medium."

- "Globalization 2.0" occurred from about 1800 until 2000, interrupted only by the two World Wars. In this era, the dynamic force driving change was multinational companies. The world shrank from size "medium" to size "small."

- "Globalization 3.0" is our current era, beginning in the year 2000. The convergence of the personal computer, fiber-optic Internet connections, and software has created a "flat-world platform" that allows small groups and even individuals to go global. The world has shrunk from size "small" to size "tiny."

According to Friedman, this third era of globalization was brought about, in many respects, by information technology. Some of the specific technologies he lists include:

- **The graphical user interface for the personal computer popularized in the late 1980s**. Before the graphical user interface, using a computer was relatively difficult. By making the personal computer something that anyone could use, it became commonplace very quickly. Friedman points out that this digital storage of content made people much more productive and, as the Internet evolved, made it simpler to communicate content worldwide.

- **The build-out of the Internet infrastructure during the dot-com boom during the late-1990s.** During the late 1990s, telecommunications companies laid thousands of miles of fiber-optic cable all over the world, turning network communications into a commodity. At the same time, the Internet protocols, such as SMTP (e-mail), HTML (web pages), and TCP/IP

(network communications) became standards that were available for free and used by everyone.

- **The introduction of software to automate and integrate business processes**. As the Internet continued to grow and become the dominant form of communication, it became essential to build on the standards developed earlier so that the websites and applications running on the Internet would work well together. Friedman calls this "workflow software," by which he means software that allows people to work together more easily, and allows different software packages and databases to integrate with each other more easily. Examples include payment-processing systems and shipping calculators.

These three technologies came together in the late 1990s to create a "platform for global collaboration." Once these technologies were in place, they continued to evolve. Friedman also points out a couple more technologies that have contributed to the flat-world platform – the open-source movement and the advent of mobile technologies.

The World Is Flat was published in 2005. Since then, we have seen even more growth in information technologies that have contributed to global collaborations.

The Global Firm

The new era of globalization allows any business to become international. By accessing this new platform of technologies, Castells's vision of working as a unit in real time on a planetary scale can be a reality. Some of the advantages of this include the following:

- The ability to locate expertise and labor around the world. Instead of drawing employees from their local area, organizations can now hire people from the global labor pool. This also allows organizations to pay a lower labor cost for the same work based on the prevailing wage in different countries.

- The ability to operate 24 hours a day. With employees in different time zones all around the world, an organization can literally operate around the clock, handing off work on projects from one part of the world to another. Businesses can also keep their digital storefront (their website) open all the time.

- A larger market for their products. Once a product is being sold online, it is available for purchase from a worldwide consumer base. Even if a company's products do not appeal beyond its own country's borders, being online has also made the product more visible to consumers within that country.

In order to fully take advantage of these new capabilities, companies need to understand that there are also challenges in dealing with employees and customers from different cultures. Some of these challenges include:

- Infrastructure differences. Each country has its own infrastructure, many of which are not of the same quality as the US infrastructure (average 4.60 MBps). For every South Korea (16 MBps average speed) there is an Egypt (0.83 MBps) or an India (0.82 MBps). A business cannot depend on every country it deals with having the same Internet speeds. See the sidebar called “How Does My Internet Speed Compare?”

- Labor laws and regulations. Different countries (even different states in the United States) have different laws and regulations. A company that wants to hire employees from other countries must understand the different regulations and concerns.

- Legal restrictions. Many countries have restrictions on what can be sold or how a product can be advertised. It is important for a business to understand what is allowed. For example, in Germany, it is illegal to sell anything Nazi related; in China, it is illegal to put anything sexually suggestive online.

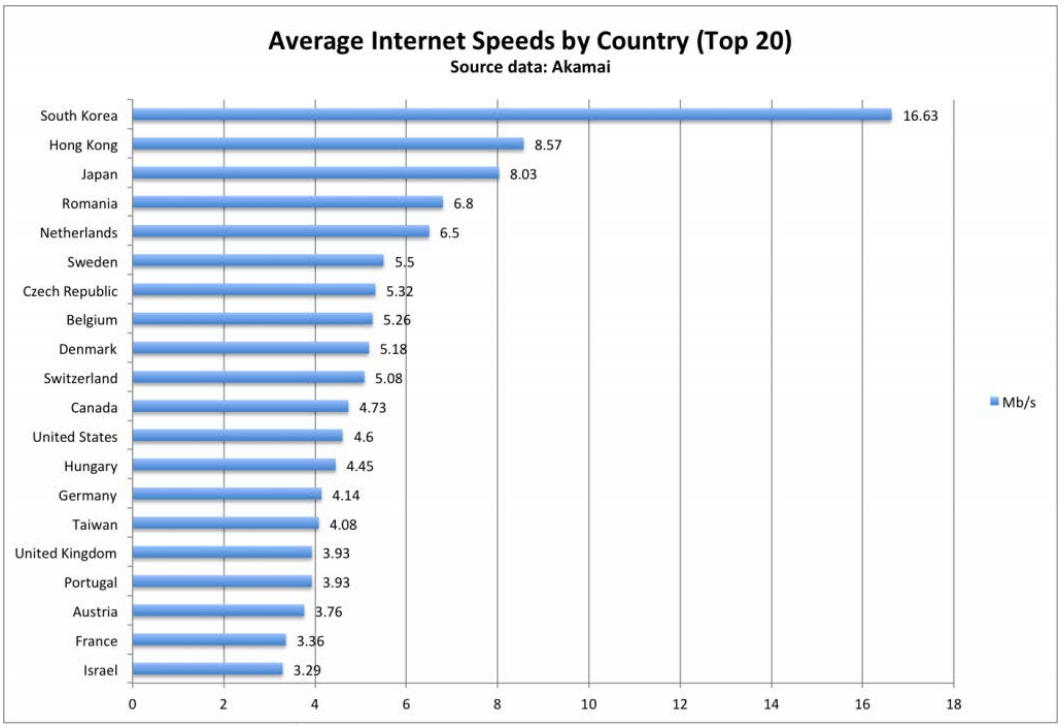
- Language, customs, and preferences. Every country has its own (or several) unique culture(s), which a business must consider when trying to market a product there. Additionally, different countries have different preferences. For example, in some parts of the world, people prefer to eat their french fries with mayonnaise instead of ketchup; in other parts of the world, specific hand gestures (such as the thumbs-up) are offensive.

- International shipping. Shipping products between countries in a timely manner can be challenging. Inconsistent address formats, dishonest customs agents, and prohibitive shipping costs are all factors that must be considered when trying to deliver products internationally.

Because of these challenges, many businesses choose not to expand globally, either for labor or for customers. Whether a business has its own website or relies on a third-party, such as Amazon or eBay, the question of whether or not to globalize must be carefully considered.

Sidebar: How Does My Internet Speed Compare?

How does your Internet speed compare with others in your state, country, or around the world? The chart below shows how Internet speeds compare in different countries. You can find the full list of countries by going to this article (http://royal.pingdom.com/2010/11/12/real-connection-speeds-for-internet-users-across-the-world/). You can also compare the evolution of Internet speeds among countries by using this tool (http://www.akamai.com/stateoftheinternet/).



So how does your own Internet speed compare? There are many online tools you can use to determine the speed at which you are connected. One of the most trusted sites is speedtest.net, where you can test both your download speeds and upload speeds.

- **Digital Divide**

As the Internet continues to make inroads across the world, it is also creating a separation between those who have access to this global network and those who do not. This separation is called the "digital divide" and is of great concern. An article in *Crossroads* puts it this way [4]:

> Adopted by the ACM Council in 1992, the ACM Code of Ethics and Professional Conduct focuses on issues involving the Digital Divide that could prevent certain categories of people — those from low-income households, senior citizens, single-parent children, the undereducated, minorities, and residents of rural areas — from receiving adequate access to the wide variety of resources offered by computer technology. This Code of Ethics positions the use of computers as a fundamental ethical consideration: "In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin, or other similar factors." This article summarizes the digital divide in its various forms, and analyzes reasons for the growing inequality in people's access to Internet

services. It also describes how society can bridge the digital divide: the serious social gap between information “haves” and “have-nots.”

The digital divide can occur between countries, regions, or even neighborhoods. In many US cities, there are pockets with little or no Internet access, while just a few miles away high-speed broadband is common.

Solutions to the digital divide have had mixed success over the years. Many times, just providing Internet access and/or computing devices is not enough to bring true Internet access to a country, region, or neighborhood.

One Laptop per Child

One attempt to repair the digital divide was the One Laptop per Child effort. As stated on the organization’s website, “The mission of One Laptop per Child (OLPC) is to empower the children of developing countries to learn by providing one connected laptop to every school-age child. In order to accomplish our goal, we need people who believe in what we’re doing and want to help make education for the world’s children a priority, not a privilege.”[5] Announced to great fanfare in 2005 by Nicholas Negroponte, the OLPC project seemed destined for success.

The XO laptop. Click to enlarge. (CC-BY: Mike McGregor)

The centerpiece of the project was the laptop itself: an inexpensive computer designed to withstand a lot of punishment. It utilized a revolutionary “mesh” network, allowing the laptops to act as repeaters, extending a Wi-Fi network far beyond their normal range. They also used minimal power, making them practical for remote areas with limited access to the electrical grid.

Unfortunately, the OLPC project failed to live up to expectations, running into many of the problems related to globalization discussed above: different cultures, corruption, and competition. In an article that examined the success and failures of OLPC, the authors state, “Expecting a laptop to cause such a revolutionary change showed a degree of naivete, even for an organization with the best of intentions and

the smartest of people."[6] Today, OLPC is evolving their methods and their technology, trying to deliver an OLPC tablet computer.

A New Understanding of the Digital Divide

In 2006, web-usability consultant Jakob Nielsen wrote an article that got to the heart of our understanding of this problem. In his article, he breaks the digital divide up into three stages: the economic divide, the usability divide, and the empowerment divide [7].

What is usually called the digital divide is, in Nielsen's terms, the ***economic divide***: the idea that some people can afford to have a computer and Internet access while others cannot. Because of Moore's Law (see chapter 2), the price of hardware has continued to drop and, at this point, we can now access digital technologies, such as smartphones, for very little. This fact, Nielsen asserts, means that for all intents and purposes, the economic divide is a moot point and we should not focus our resources on solving it.

The ***usability divide*** is concerned with the fact that "technology remains so complicated that many people couldn't use a computer even if they got one for free." And even for those who can use a computer, accessing all the benefits of having one is beyond their understanding. Included in this group are those with low literacy and seniors. According to Nielsen, we know how to help these users, but we are not doing it because there is little profit in doing so.

The ***empowerment divide*** is the most difficult to solve. It is concerned with how we use technology to empower ourselves. Very few users truly understand the power that digital technologies can give them. In his article, Nielsen explains that his (and others') research has shown that very few users contribute content to the Internet, use advanced search, or can even distinguish paid search ads from organic search results. Many people will limit what they can do online by accepting the basic, default settings of their computer and not work to understand how they can truly be empowered.

Understanding the digital divide using these three stages provides a more nuanced view of how we can work to alleviate it. While efforts such as One Laptop per Child are an excellent start, more work needs to be done to address the second and third stages of the digital divide for a more holistic solution.

Sidebar: Using Gaming to Bridge the Digital Divide

Paul Kim, the Assistant Dean and Chief Technology Officer of the Stanford Graduate School of Education, designed a project to address the digital divide for children in developing countries. [8] In their project, the researchers wanted to understand if children can adopt and teach themselves mobile learning technology, without help from teachers or other adults, and the processes and factors involved in this phenomenon. The researchers developed a mobile device called TeacherMate, which contained a game designed to help children learn math. The unique part of this research was that the researchers interacted directly with the children; they did not channel the mobile devices through the teachers or the schools. Another important

factor to consider: in order to understand the context of the children's educational environment, the researchers began the project by working with parents and local nonprofits six months before their visit. While the results of this research are too detailed to go into here, it can be said that the researchers found that children can, indeed, adopt and teach themselves mobile learning technologies.

What makes this research so interesting when thinking about the digital divide is that the researchers found that, in order to be effective, they had to customize their technology and tailor their implementation to the specific group they were trying to reach. One of their conclusions stated the following:

> Considering the rapid advancement of technology today, mobile learning options for future projects will only increase. Consequently, researchers must continue to investigate their impact; we believe there is a specific need for more in-depth studies on ICT [information and communication technology] design variations to meet different challenges of different localities.

SAQ 3.1

- a. Which technologies have had the biggest effect on globalization?
- b. What are Jakob Nielsen's three stages of the digital divide?

ACTIVTY 3.1

- Go to speedtest.net to determine your Internet speed. Compare your speed at home to the Internet speed at two other locations, such as your school, place of employment, or local coffee shop. Write up a one-page summary that compares these locations.

Supplementary Learning Resource for this topic:

- read The Internet Society Global Internet Report (2017) study, "Paths to Our Digital Future" by clicking or opening this webpage https://future.internetsociety.org/2017/wp-content/uploads/sites/3/2017/09/2017-Internet-Society-Global-Internet-Report-Paths-to-Our-Digital-Future.pdf

- read the Wikipedia with help from Bart Pursel (no date) book, "The Digital Divide" by clicking or opening this webpage https://psu.pb.unizin.org/ist110/chapter/9-3-the-digital-divide/

- read the Carmen Steele (2018, Sept 20) article, "The Impacts of Digital Divide" by clicking or opening this webpage http://www.digitaldividecouncil.com/the-impacts-of-digital-divide/

Lesson 2 Emerging cloud and Mobile Environments

Cloud Computing Overview

Cloud Computing is the practice of using large groups of remote servers, hosted on Internet, to store and access applications and computer data, instead of saving them on the local server or personal computer.

Cloud Computing provides easy access to information technology resources. The cloud customer pays only for services that are delivered and used by them. There are models and services that make Cloud Computing accessible to users.

Cloud - Deployment Models

Cloud services are available through various deployment models. These models are:

1. **Public Cloud**

Public Cloud infrastructure is owned by a third party cloud service provider or CSP who makes cloud services available to the general public. In Public Cloud, customers need to pay only for the resources they use. This gives them the flexibility to increase or decrease the resources to meet the market demand.

Examples of Public Cloud are email, social networking sites, and so on.

2. **Private Cloud**

Private Cloud infrastructure is dedicatedly operated for a particular organization, managed by the organization themselves or a third party. This cloud deployment model is popular among enterprises as customers have complete control over security aspects.

3. **Community Cloud**

A Community Cloud is maintained and used by a group of organizations with shared concerns that is they have similar security or compliance requirements.

4. **Hybrid Cloud**

Hybrid Cloud is the composition of two or more clouds, for example, a combination of private, public, or community clouds.

Cloud - Service Models

There are three service models on which Cloud Computing is based, they are:

1. **Infrastructure as a Service (IaaS)**

In IaaS, customers can control the environment as a service by installing their own operating systems, applications, and software. IaaS also delivers a virtual server platform where access to virtual machines or virtual resources is provided.

2. **Platform as a Service (PaaS)**

PaaS provides computational resources through a platform on which applications and services are developed and hosted. Here, the customer is free to build applications and deliver it to other users through Internet and servers.

3. **Software as a Service (SaaS)**

SaaS is a software, which is owned, managed, and delivered by one or more users and is offered in a pay-per-use manner. The service runs on Cloud and serves multiple end users.

Impact of Cloud Computing on Business

The concept of Cloud Computing came into existence in the 1950s with the implementation of mainframe computers. Since then, it has evolved and now it is gaining the attention of the enterprises for its benefits.

The impact of Cloud Computing in terms of benefits for businesses are:

- Cost effective: Moving to Cloud Computing reduces the cost of managing and maintaining IT systems. Since the infrastructure need not be purchased, the initial and recurring expenses are lower than traditional computing
- Flexibility: Cloud Computing offers unlimited storage capacity, therefore storage needs can be scaled up or down according to the situation.
- Business continuity: Protecting data is important for business continuity. In case of crisis, Cloud Computing helps to quickly access data without loss of productivity.
- Efficient collaboration: Collaboration in Cloud gives the business ability to communicate and share information more quickly and easily than through traditional methods.

Emerging Trends in Cloud Computing

The emerging trends in Cloud Computing indicate that this technology is transforming rapidly. The upcoming years hold great potential for innovation in Cloud technology. Some of the emerging trends in Cloud Computing are:

- The rise of **Hybrid Cloud**: This will be an upcoming trend as it encourages many businesses to adopt cloud-based infrastructure so as to perform distinct functions within the same organization. It also provides an advantage of reduced infrastructure cost.
- **Mobile Cloud**: The Bring Your Own Device or BYOD policy is gaining popularity as organizations are understanding its benefits, reflected in increased employee productivity. As a result, organizations are shifting their IT assets to the Personal Cloud through mobile device management.
- **New Cloud Services**: There are new cloud services that are emerging with the development of Cloud Computing.

  Some of the emerging services are:

  - Monitoring as a Service that is MaaS
  - Cloud Migration as a Service that is C-MaaS
  - Communication as a Service that is CaaS
  - Anything as a Service that is XaaS.

Cloud Computing – Challenges

Despite the fact that Cloud Computing leads to innovation, there are some challenges related to it. These challenges are:

- **Data Security**: In the cloud, data management is provided by a third party and data is stored in remote locations that are not disclosed to the enterprise. This is of concern to the enterprise. Although Cloud Computing vendors provide accounts with secure passwords, any security breach that may be deliberate or accidental can lead to the loss of business and clients.

- **Performance and Bandwidth**: Cloud Computing requires high-end servers for providing high-speed Internet and constant connectivity to avoid peak time breakdowns.

- **Availability**: Availability is also a challenge of Cloud Computing. Cloud providers lack round-the-clock service. This result is frequent outages.

- **Regulatory Restrictions**: Governments in some countries do not allow the customer's personal information to be physically located outside their counties. This is further complicated by the fact that some data transit can be regulated in these countries.

Future of Cloud Computing

Cloud Computing holds promise for new innovations. Over time, the workload of companies is expected to be processed in cloud data centers. Cloud Computing can be considered as an integral part of most businesses in the future. Some predictions for the upcoming years are as follows:

- There will be more apps on the Cloud, while new software will be built on the Cloud to provide faster deployment of the applications. Till 2014, half of the enterprises spent ten percent of their annual budget on cloud services. This share is expected to increase in the future.

- Platform as a Service will be adopted by more companies because it lowers the IT costs and speeds up application development.

- Cloud-based graphics technologies will be in demand and with this technology, future users will be able to run graphically intense applications.

- Increased competition in the Cloud space is likely to result in better innovation and services.

Next, let us find out how Cloud Computing is used in the real-world situation with the help of a case study.

Case Study

In this case study, you will find out how cloud-based services helped an online travel company to decrease the latency time on their website and improve service to its customers.

The travel company was committed to innovation and technology to make a great traveling experience to its customers. However, an error page appearing on their website led to many users abandoning the site.

The travel company switched to a cloud service provided by a third party, with the goal of helping their global users find what they were looking for promptly and without errors.

As a result of using the cloud service, the company was able to improve its travel service to customers by Launching 'Suggest Service' within three months of adopting the cloud service.

Suggest Service used algorithms on the basis of customer location and displayed suggestions in a drop-down menu, whenever any alphabet or words were typed.

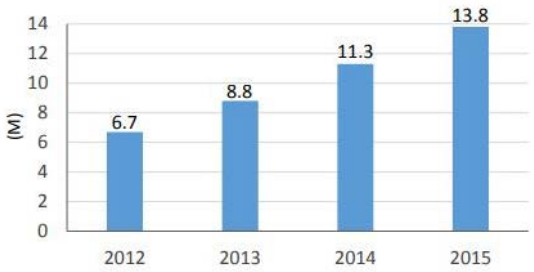
Reducing the network latency time from 700 milliseconds to less than 50 milliseconds.

Cloud Computing - Jobs and Salary

Cloud Computing is known to many people because it provides more benefits in a short time, and with less expenditure and training. It helps in globalizing the work with the help of the Internet.

Because of these benefits, Cloud Computing jobs are in demand across the globe.

An increase in the total cumulative jobs generated by cloud computing across the globe is given in the figure:



According to the survey on average salaries conducted by Dice, a career website, the average salary of a person associated with Cloud is approximately $ 90,000. In the graph shown above, you can compare the total cumulative jobs generated by Cloud Computing across the globe from 2012 till 2015.

Note that these figures are obtained for the years, 2012 to 2015. They are presented here to give an idea of how the number of jobs in the field of Cloud Computing will be generated in the future.

Cloud Computing - Learning Path

This section shows the learning path in order for you to be successful in the in the field of Cloud Computing. At the beginner level, certifications such as 'EXIN Cloud Computing' and 'CompTIA Cloud Essentials' are recommended.

As you acquire on-the-job experience, you can get the advanced level certification to boost your career. The advanced level certification comprises the following courses:

- CompTIA Cloud Plus
- Advanced Cloud Computing with AWS
- Cloud Computing Security'.

Assignment 3.1

- Give at least 10 cloud computing companies and services offered in the Philippines

Supplementary Learning Resource for this topic:

- read Joseph Tsidulko (2017) article, "10 Emerging Cloud Computing Trends To Watch In 2020 " by clicking or opening this webpage https://www.crn.com/news/cloud/10-emerging-cloud-computing-trends-to-watch-in-2020

- read tutorialspoint.com (no date) tutoria "Cloud Computing Tutorial" by clicking or opening this webpage https://www.tutorialspoint.com/cloud_computing/cloud_computing_pdf_version.htm

- **Mobile Environments**

Mobile devices have made their way into all spheres of an individual's life: personal, social, and professional. They are being used for much more than the primary purpose of communication.

Mobile devices offer users the ability to perform a variety of activities such as send and receive media files, access social media platforms, discover places and things, network with colleagues and friends, access online entertainment, bank and shop online, and many others.

The arrival of the smartphone technology has been the starting point of a broader revolution in the way people and businesses communicate within themselves and with each other.

Companies have evolved ways to incorporate the mobile device into their work culture and reach out to their customers, especially those belonging to the Internet generation. Analysts have often pointed out the risks of not keeping up with the changes brought about by the combined force of the smartphone and the Internet.

In this lesson, we will understand the different ways in which mobile technology has changed the way we think, work, communicate, collaborate or spend our leisure time.

To get a better idea of how much mobiles are changing the world around us, let us look at some statistics in the following topic.

The Mobile Market

The percentage of the global population with mobile subscriptions stood at 96% as of 2013, with total subscriptions touching 7 billion. Mobile broadband subscriptions have leaped ahead in the last few years and reached about 2.1 billion and are set to overtake fixed broadband subscriptions by 2018.

Smartphones are about 50% of all mobile phones sold, and smartphone subscriptions are expected to reach 4.5 billion in 2018. The fact that nearly 1.4 billion smartphones were added in the four years between 2009 and 2013 highlights how fast this market is growing.

Mobile data subscriptions are also increasing for other devices such as PCs, tablets, mobile routers, eBook readers, and cameras. While tablet and smartphone penetration continues to speed, the rate of PC penetration has remained the same.

Note that some of these figures are projections for the year 2013, and would have increased by now. They are presented here to give an idea of how quickly the market for mobile devices is expanding.

Let us also briefly look at the trends in mobile technology in the next section for a better understanding of the mobile market.

Mobile Technology - Growth and Reach

Since the introduction of 1G or first generation systems in 1981, each new generation of mobile technology has been characterized by new frequency bands, higher data rates, and non-backward compatible transmission technology.

You may be aware of the Global System for Mobile Communications or GSM, which is a standard developed by the European Telecommunications Standards Institute to describe protocols for second generation or 2G cellular networks.

As of 2014, GSM has become the default global standard for mobile communications. GSM has expanded to include data communications in Enhanced Data Rates for GSM Evolution or EDGE.

Following this is LTE or Long-Term Evolution, also referred to as 4G LTE. It is a standard for wireless communication of high-speed data for mobile phones and data terminals, which increases the capacity and speed of data networks.

Globally, GSM EDGE is expected to continue leading regarding subscription, due to many users opting for less expensive mobile handsets and mobile phone subscriptions. LTE is being built and deployed around the world and is expected to cover about 60% of the world's population by 2018.

Having looked at the growth and reach of mobile technology, let us talk about mobile platforms and applications or apps in the next section.

Mobile Platforms and Applications

Mobile platforms refer to the hardware-software environment for laptops, tablets, smartphones and other portable devices. Windows and Mac environments lead the field for laptops, while Apple and Android lead in the area of smartphones and tablet, with Windows Phone and Blackberry, also making their presence felt in the area of smartphones.

Mobile apps are computer programs that run in these hardware-software environments, specially designed for smartphones, tablets, and other mobile devices. Originally meant for information retrieval and general activities such as email, calendar, contacts, and so on.

They have become highly popular among users with their markets having exploded to include some other categories such as social media, games, GPS and location-based services, ticket purchases, banking and even health.

Let us take a closer look at the mobile app market in the next section.

Mobile Apps Market

More mobile subscribers prefer using mobile apps to browsing the web with more than a 100 billion apps downloaded in a year (2013). Although most of them are free apps, they still generate revenues worth billions of dollars.

This has resulted in the creation of a booming app industry and a large number of jobs. Apps are available through distribution platforms that are operated by the mobile operating system owners. Examples of distribution platforms are Apple's App Store, Blackberry World, Google Play, Nokia Store, Samsung Apps Store, Windows Phone Store and Amazon App Store.

Apps are downloaded to a target device such as the iPhone, Android or Windows phone. Some apps can also be downloaded to laptops or desktops. Apps can be either free or paid. A part of the price for paid apps goes to the distributor or the owner of the platform, and the remaining goes to the app maker, making app development a profitable business. For the user, this means that an app's cost differs depending on the Operating System of their mobile devices.

With the explosion is the number of apps, users increasingly feel the need for app discovery, review, and cataloging services. It has also become necessary to regulate apps for accuracy and dependability, especially, medical and health-related apps, where incorrect data could risk patients' lives.

Now that we have looked at the Mobile market let us move on to the impact of Mobile on enterprises in the following sections.

Impact of Mobile - Mobility

Mobile devices are becoming multipurpose and easy to use. This impacts on two levels.

First, as employees, people are finding new and ready-to-use channels to interact, negotiate, and collaborate with each other irrespective of time or geography. This shift towards a mobile working culture is termed as 'enterprise mobility.'

Second, as consumers, individuals have access to information about different company products or services at their fingertips. They use their mobile devices to discover, compare, discuss, and choose from a range of options, regarding quality, cost, and make.

Internet on mobile has empowered consumers and brought them closer to brands, both big and small. It has become necessary for organizations to consistently innovate in how they reach out to new customers, and engage with existing customers and build a long-term relationship. Organizations now pay special attention to mobile commerce, as part of their larger e-commerce strategy.

In the following sections, we will look at the twin aspects of enterprise mobility and mobile commerce.

Enterprise Mobility - Bring Your Device

With a growing number of the global workforce gaining access to mobile devices, the demand to allow mobile devices in the workplace has increased steadily. Many organizations have adopted the Bring Your Device or BYOD policy. This shift away from traditional modes of enterprise communication and operation is being increasingly viewed as necessary to:

- Enhance productivity and agility
- Improve employee satisfaction and retention

The implications of enterprise mobility can be understood in three ways: regarding employees, from the business context, and in the context of enterprise IT infrastructure. First, employees use their smartphones, laptops, or tablets to engage with multimedia information from a variety of sources.

Apart from the BYOD phenomenon, and often because of it, there has also been an increase in social media communication within the enterprise. Employees can access and share information and communicate and team up faster. Video-conferences, webinars, instant messaging, micro-blogging, and social networking have become common ways to pool resources and collaborate with colleagues.

In the next section, let us understand enterprise mobility in the business context.

Enterprise Mobility - Business Context

According to studies, mobile technologies can cut costs of a financial transaction by up to 80%. Most enterprises that decided to adopt smart mobile devices report improved productivity as the major reason.

With the adoption of mobile devices and the availability of information anywhere and anytime, more people at the executive level have a say in technology-related decisions. Individuals in charge of Information Technology in the enterprise, such as Chief Information Officers or CIOs, have to strike a balance between user expectations and enterprise requirements.

Let us understand the implications of enterprise IT in the next section.

Enterprise Mobility - Enterprise IT

Employees in the BYOD environment need to be equipped with reliable information in real-time and adequate tools to analyze, store, or share data. The enterprise's IT policy must outline the following:

Integration of employee mobile devices into enterprise Information Systems - This is because employees require access to company databases, email, and collaboration tools on their mobile devices.

Appropriate use of cloud solutions for efficiency and productivity – Powerful mobile technology allows employees to connect to enterprise resources and the Internet. Access to the cloud is required for the success of enterprise mobility as many apps have to connect to databases or search engines that are too large to fit into the mobile device.

Securing of business data through effective governance – Securing business information is of utmost importance as mobile devices play a larger role in the enterprise.

Let us discuss mobile commerce in detail in the next section.

Mobile Commerce

We have already seen how mobile devices have transformed consumer buying habits. Buyers prefer to perform their research, discovering and comparing online to find the best fit for their needs.

While the Internet had already aided in the personalization of e-commerce, smartphones and tablets have added the 'mobile' dimension to it. This has been compounded by the power of social media forums, where consumers posting reviews of products exercise considerable influence on potential buyers.

Digital word-of-mouth means that feedback on new products or services travels faster than ever before. All this has changed the consumer from being a passive recipient to an active participant in online commerce. Manufacturers, distributors, service providers, advertising agencies, and even governments have to find creative ways to promote new products, schemes, or policies.

Mobile marketing and services delivery have to account for context awareness and be customized based on location and other user preferences. Mobile devices have also enabled consumers to: make online purchases from any location, avail group-buying discounts using social networking, locate stores offering special deals while on the move. As online buying gained popularity, it led to the creation of a huge number of mobile commerce apps, for both shopping as well as for making payments.

Let us take a closer look at mobile payments in the next section.

Mobile Payment

Mobile payment, or mobile money transfer, is where payment is made using a mobile device through payment services that are financially regulated. Let us discuss different models of mobile payment.

SMS-based payments: Consumers send a payment request via SMS to a short code that is charged to their phone bill or online wallet. This is mainly used for buying digital goods such as music, ringtones, or wallpapers. Alternatively, a Multimedia Messaging Service or MMS can be used in place of SMS to deliver barcodes, which can later be scanned as electronic tickets or used to collect hard goods.

Direct mobile billing: This mode of payment bypasses both the banks and the credit card companies where the consumer's mobile account is charged for the purchase. This involves a two-factor authentication with a Personal Identification Number or PIN and a one-time password or OTP.

Mobile web payments: This is a common mode of online payment, where the consumer accesses web pages or installs apps on the mobile device to make payments. Near Field Communication or NFC: NFC is used to pay for purchases in brick-and-mortar stores or transportation services.

This requires mobile phones built with a smart-card technology that users can wave near a reader module installed by the seller. Payment is deducted from the user's mobile or bank account. This payment method is not adopted as easily as others as NFC requires investment in supporting infrastructure and in upgrading to technology that allows it, requires cooperation between merchants, banks, and other stakeholders, and requires implementation of regulatory standards.

In the next section, we will look at mobile wallets and their use in mobile payments.

Mobile Wallets

A digital wallet is an electronic device that allows individuals to make electronic commerce transactions. Digital wallets have been used to for smoother and faster e-commerce transactions. A famous example of a digital wallet is PayPal. Today, a single mobile device app can be used to: make mobile payments, and store payment details, bank account details, and credit card and loyalty card information.

The information can be stored either in the device or in the cloud. Mobile wallet apps can also use the NFC technology to make payments in stores. Popular mobile wallets are Google Wallet, Apple's Passbook, Lemon Wallet, and Square Wallet.

In the following sections, we will understand the importance of securing data on mobile devices and how this can be achieved.

Threats to Mobile Data

With mobile computing becoming common, mobile security has acquired greater importance. Mobile data is as susceptible to attacks or breaches as online data

or any data in general. Mobile devices are used to store personal information, some of which can be sensitive. This creates a channel for identity theft, where the thief can use the information on the device to impersonate the victim.

Data and identity theft can, in turn, be used for misappropriation of funds, espionage, or other illegal and malicious activities. Smart mobile devices, like other computing devices, can also be hacked affecting data security and device functionality. Safeguards are necessary to prevent theft or misuse of data.

In the next section, we will discuss the consequences of a data breach to an enterprise.

Consequences of Data Breaches

Enterprises have to secure corporate data as well as customer data. This is especially important for financial organizations such as banks. In general, the increased use of mobile payment channels has put the responsibility on enterprises world over to tighten mobile data security.

Corporate data leaks impact business by giving competitors, or antisocial elements access to confidential information. This can lead to the company losing its competitive edge or receiving negative publicity. Customer data breaches also have serious repercussions such as the negative impact on the brand, loss of brand loyalty, decreased revenue and profits, and high litigation and remediation costs that can run into millions of dollars.

Let us look at security measures that can be adopted to protect mobile data and prevent data breaches.

Securing Mobile Data

Enterprises can employ the following measures to protect applications and data on mobile devices:

- Mobile Device Management or MDM – MDM represents activities to secure, monitor and manage enterprise mobile devices.
- Secure Application Container – Corporate data can be encrypted within a secure application firewalled from the rest of the Operating System in the mobile device. Data transfer between the mobile device and the server occurs through an encrypted channel.
- Device Virtualization – Virtualization technology can be applied to mobile devices as well, separating the hardware layer and the software running on it. This allows segregation of personal and corporate information in the mobile device.
- Antivirus – Antivirus installed on the mobile device can scan file attachments and shared media for viruses or malware.
- Online security – This can be achieved by using solutions such as encryption, reviewing application code for vulnerabilities, and strong authentication.

Enterprises can also educate employees on mobile device protection and encourage them to password protect their devices. So far we have understood the impact of mobile on business and the enterprise.

In the following section, we will see an example of how mobile technology can be leveraged in other industries by describing Machine to Machine communication.

Machine to Machine

Machine to Machine, also known as M2M refers to the communication between multiple devices through wireless or wired systems. M2M has a wide range of applications in different sectors such as Health, Defense, Logistics and Smart Cities. M2M is mostly used for monitoring and control.

The key components of M2M systems include:

- Radio-frequency Identification or RFID
- Sensors
- Cellular or Wi-Fi networks
- Computing software to analyze data and make decisions.

Reduced costs of mobile manufacturing and mobile data technologies are one of the main drivers of M2M. The semiconductor industry's increased efficiency to attain an improved yield reduces the power consumption and chipset manufacturing cost.

Also, wireless and wired networks are advanced enough to deliver data services at a lower cost. These factors have played an important role in the increased application of M2M technologies in different sectors.

Let us look at some examples in the following sections.

M2M in Healthcare

Mobile Health or MHealth is aimed at reducing the cost of healthcare and quality of patient care. One of the most prominent MHealth services in healthcare is Telemedicine which is monitoring of the patient remotely and providing the requisite care.

The patient is fitted with multiple sensors to record various factors such as blood pressure, heart rate, and so on. The data is gathered to an M2M device, most often on the patient's mobile phone. The data is uploaded to an M2M server which alerts the patient's doctor to provide necessary medical aid.

In emergency situations, all the necessary data about the patient's condition is delivered on the way to the hospital allowing the doctor to be prepared to treat the patient.

Let us look at M2M usage in the automobile sector in the next section.

M2M in Automobiles

In the automotive sector, M2M has multiple applications such as entertainment, safety and security, navigation, and diagnostics. Safety and security are one of the most beneficial applications in the automotive industry.

One example is Automatic Crash Notification application. This service utilizes various sensors on the vehicle to report the location of the crash site along with the extent of damage to the vehicle. It also initiates and facilitates accident reporting to emergency services in the region. M2M presents both opportunities and challenges to the industry.

Although there is huge potential in the utilization of M2M in various sectors, the fragmented market remains a hurdle, which is a risk for forecasting the growth of M2M.

SAQ 3.2

•How do mobile phones help us?

Synthesis

Information technology has driven change on a global scale. As documented by Castells and Friedman, technology has given us the ability to integrate with people all over the world using digital tools. These tools have allowed businesses to broaden their labor pools, their markets, and even their operating hours. But they have also brought many new complications for businesses, which now must understand regulations, preferences, and cultures from many different nations. This new globalization has also exacerbated the digital divide. Nielsen has suggested that the digital divide consists of three stages (economic, usability, and empowerment), of which the economic stage is virtually solved.

Cloud Computing uses large groups of remote servers hosted on the Internet to store and access applications and computer data. Public, Private, Community, and Hybrid comprise the Cloud Deployment Models. Infrastructure as a service, Platform as a service and software as a service are the three Cloud Service Models. In Cloud, the infrastructure is not purchased. Therefore, the initial and the recurring expenses are lower than in traditional computing. Monitoring as a Service, Cloud Migration as a Service, Communication as a Service, and Anything as a Service are some of the emerging cloud services

Mobile devices offer users the ability to perform a range of activities such as send and receive media, access social media platforms, bank, shop and many others. Billions of mobile apps are downloaded every year, giving rise to a thriving app industry. Many organizations have adopted a BYOD policy to enhance employee productivity and cut business costs. Businesses have to remember that mobile and social media have transformed how consumers make decisions and have to find new channels of engaging with them. Businesses also have to enable secure mobile payments by cooperating with banks and other stakeholders.. Mobile technology is one of the main drivers of M2M and has wide applications in different sectors such as health, urban planning and architecture, and transportation.

Post-Test

I. MULTIPLE CHOICE

Direction: Write the LETTER only to the following questions by selecting the best answer.

_____ 1. It is the process of expanding globalism and refers to the increasing integration of economics, communications and culture across national boundries.
a. Digital divide
b. globalization
c. cloud computing
d. mobile environment

_____ 2. Globalization represents an increasing integration of all of the following except
a. Culture
b. Morals
c. Communications
d. Economics

_____ 3. The growth in global communication has
a. Been limited to international phone calls
b. Meant people now rely on different sources for the news
c. Decreased the need for the internet
d. Brought information to more people from the same sources

_____ 4. Students directly affected the most by the Digital Divide are:
a. Students in rural areas
b. Students from low income, minority families
c. Students in sub-urban areas
d. Students in rural and urban areas

_____ 5. It is more concerned with the fact that “technology remains so complicated that many people couldn’t use a computer even if they got one for free”, is it know as:
a. empowerment divide
b. Equality Divide
c. Economic Divide
d. usability divide

_____ 6. What is Cloud Computing replacing?
a. Corporate data centers
b. Expensive personal computer hardware
c. Expensive software upgrades
d. All of the above

_____ 7. What is the number one concern about cloud computing?
a. Too expensive
b. Security concerns
c. Too many platforms
d. Accessibility

_____ 8. Google Docs is a type of cloud computing.
a. True
b. False

_____ 9. The key components of M2M systems include:
a. RFID
b. Sensors
c. Wi-Fi networks
d. All of the above.

_____ 10. To protect applications and data on mobile devices the following measures must utilize:
a. Mobile Device Management.
b. Antivirus
c. Online security
d. All of the above

Answers to SAQs

3.1

a. Which technologies have had the biggest effect on globalization?

Answer:

There are several answers to this. Probably the most obvious are the Internet, the graphical interface of Windows and the World Wide Web, and workflow software.

b. What are Jakob Nielsen's three stages of the digital divide?

Answer:

economic, usability, and empowerment

3.1 How do mobile phones help us?

Answer:

Mobile phones are very advantageous. They help us in making our lives easy and convenient. They help us communicate with our loved ones and carry out our work efficiently. Furthermore, they also do the work of the computer, calculator, and cameras.

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