Unit 4

Society and Technology

Technological society:

Technology and human life cannot be separated; society has a cyclical co-dependence on technology. We use technology; depend on technology in our daily life and our needs and demands for technology keep on rising. Humans use technology to travel, to communicate, to learn, to do business and to live in comfort. However, technology has also caused us concerns. Its poor application has resulted in the pollution of the environment and it has also caused a serious threat to our lives and society. This calls for the proper use of technology. The biggest challenge facing people is to determine the type of future we need to have and then create relevant technologies which will simplify the way we do things.

It is impossible to explore how each new advanced technology has impacted our lives and how it will impact the future. Technology impacts the environment, people and the society as a whole. The way we use technology determines if its impacts are positive to the society or negative. For example, (POSITIVE IMPACT) we can use corn to make ethanol and this ethanol can be used as fuel. Fuel can be used to run machines and cars which will increase the output of manufacturing industries at a lower cost. (NEGATIVE IMPACT) However, if we decide to shift large quantities of corn to fuel production from food production, humans will be left with no food and this will cause world hunger which even is a worse situation.

Basing on the example above, technology by its self is not harmful to the society, but the way society uses technology to achieve specific goals is what results into negative impacts of technology on the society. Humans need to use energy to process products in factories, to run cars, to light homes and also run technological machines like computers, but the only way we can do this without affecting the environment and society is by shifting from exhaustible energy sources to renewable and inexhaustible sources like Solar / Wind energy. There are both positive and negative impacts of technology on our society.

Positive Impacts Of Technology On Society

- ## Technology Has Mechanized Agriculture

Technology has mechanized agriculture: Modern agricultural technology allows a small number of people to grow vast quantities of food in a short period of time with less input which results into high yields and RIO "return on investment". Through government subsidies, small and medium-sized farmers have managed to acquire plowing, sowing, watering and harvesting machines. The use of technology in agriculture has also resulted in the manufacturing of genetic crops which can grow fast and they can be resistant to many pests and diseases. Also, farmers have access to artificial fertilizers which add value to the soil and boost the growth of their crops and enable them to produce high-quality yields. Farmers in dry areas have been in a position to grow healthy crops, they use advanced water pumps and sprinklers which derive water from rivers to the farms, the all process can be automated to save time. A good example is Egypt, this is a desert country which receives little rain, but small and big farmers have used automated sprinklers to irrigate their farms. In Egypt, they grow a lot of rice, yet this crop needs sufficient water to grow well. The water is pumped from River Nile to the rice fields on a daily basis.

- ## Technology Has Improved Transportation

Technology has improved transportation: Transportation is one of the basic areas of technological activity. Both society and businesses have benefited from the new transpiration methods. Transportation provides mobility for people and goods. Transportation, like all other technologies, can be viewed as a system. It is a series of parts that are interrelated. These parts all work together to meet a certain goal. Transportation uses vehicles, trains, airplanes, motorbikes, people, roads, energy, information, materials, finance and time. All these parts I have mentioned work together to move and relocate people and goods. Technology has helped in advancing all the four types of transportation and these include ; (1) road transport used by automobiles ,(2) air transport which is used by airplanes , (3)water transportation which is used by ships and speed boats and (4) space transportation used to go to the moon. The most used of all these is Road transportation, this one facilitates the movement of goods and people. Technologies like automobiles, buses, and trucks have improved the way humans move and how they transport their goods from place to

another. Also, developing countries are getting funds from wealthy countries to improve their road transport which has resulted in the development of rural remote areas.

- ## **Technology Has Improved Communication**

Technology has improved communication: Communication is used for a number of purposes. Both society and organizations depend on communication to transfer information. People use technology to communicate with each other. Electronic media like radios, televisions, internet, social media have improved the way we exchange ideas which can develop our societies. In many countries, radios and televisions are used to voice the concerns of the society, they organize live forums where the community can contribute through mobile phones or text service systems like tweeter. During political elections, leaders use radio, television and internet media to reach the people they want to serve. A good example is the recent presidential election in the USA, "President Barak Obama " has embraced the communication technology to reach and voice out his concerns towards the development of America. Communication technologies like Televisions, radios, and internet can be used to persuade, entertain and inform the society. Small businesses have also used the internet and mobile communication technology to grow and improve their customer service. Learn more about Communication Technology here >>>

- ## **Technology Has Improved Education And Learning Process**

Technology has improved education and learning process: Education is the backbone of every economy. People need well and organized educational infrastructures so that they can learn how to interpret information. Many schools have started integrating educational technologies in their schools with a great aim of improving the way students learn. Technologies like smart whiteboards, computers, mobile phones, iPads, projectors, and internet are being used in classrooms to boost students moral to learn. Visual education is becoming more popular and it has proved to be the best method of learning in many subjects like mathematics, physics, biology, geography, economics and much more. The business community has invested money in various educational technologies which can be used by both teachers and their students. For example, on iTunes, you will find many educational applications which can allow students and teachers exchange academic information at any time, this has made learning mobile. Also, programs like Long distance learning have opened boundaries too so many scholars around the world.

Negative Impacts Of Technology On Society

- ## Resource Depletion

The more demand for new technologies and advancement of current technologies, the more pressure we put on earth's natural resources. Look at the total number of mobile phones and computers being manufactured today, our population is increasing every day and all these billion consumers demand either a mobile phone or a computer in their homes or offices. This is good news for the manufactures, like Apple or Samsung, the demand for their gadgets is high, but to sustain this demand, they have to exploit Mother Nature for resources like aluminum, once these resources are extracted from the earth plates, they will never return back because it took them a billion years to mature. That means that at one time, we shall be left with no natural resource which can be a problem to the future generation and economy. Likewise, the intensive farming practices will deplete the soil. This makes heavy applications of commercial fertilizers necessary to yield healthy harvests, but also these fertilizers have chemicals which are dangerous to the soil and human lives.

- ## Increased Population

Technology has helped us live longer by improving health facilities and aiding in the research for solutions for most health problems which affect humans. This is good news for developed countries but is bad news for developing countries which have not been in a position to access these health care benefits brought by technology. In developed countries population growth is controlled by advanced birth control methods, this has helped them balance their population in relation to natural resources and other opportunities which come with a planned population. This is different in developing countries, the rate at which people produce is very high, the mortality rate is high, food is scarce and health care is poor.

- ## Increased Pollution

Pollution affects the land we grow crops on, the water we drink and the air we breathe. The increased demand for new technologies and advancement of technologies has resulted in many manufacturing and processing factories. As they work so hard to create the best technologies for

both society and business, they release harmful chemicals and gasses which have polluted our environment and this has resulted in climate changes (global warming). So the more technology we enjoy, the more we harm our environment. Experts have tried to implement ways of reducing this impact by encouraging factories to go green, to a small extent, this has been achieved through the development of green technologies like; green cars, green computers, but a great effort is still needed to reduce the pollution of the air and the earth.

Technological changes in third world society:

In the 21st century technology has been an extremely important aspect of every individual and organization in the Western World. Yet, Third World countries struggle in incorporating technology in their policy and culture. In fact, the inability of developing a policy to integrate technology in their system is strongly considered to be one of the primary reasons for the poor economy of those countries. Currently, technology with its advanced features is used as the primary source to keep people connected around the world. Today, Third World countries cease to incorporate technology into their communication, leading to an increasing gap with other parts of the world. As a result, people from all over the globe tend to pay less attention to the poor economic conditions of the Third World countries. By avoiding integration of technology, those countries will instead reach economic stagnation, which might later increase poverty and lead to a higher unemployment rate.

Infusing technology into Third World countries and underdeveloped countries should be strictly considered by the United States and other developed countries. By integrating the World Wide Web and allowing the communication lines, those countries will improve their economy and raise their people's standard of living. The idea of incorporating technology and its effect on improving the economy in those countries seems to be clear and easily applicable. However, determining different ways to infuse technology into Third World countries is considered to be more complicated than it looks like. Most of Third World and underdeveloped countries do not welcome the influence from the United States and other developed countries due to several political factors. Some Third World countries have the belief that bringing technology will lead to an increase in control and influence by the developed country to be used as a way to take over their nations; putting them at a further disadvantage. It is important to have the people living in Third World countries realize that integrating technologies into their system will be used for their own benefit rather than to harm them.

- **Technology causing Economic Growth**

The World Wide Web technology is one of the most popular inventions that support growth theory in economics and is considered to be one of the greatest solutions to increase the Third World countries current economic situation. The United States and other developed countries use all kinds of existing technological devices and practices to help them work on new ideas and implement them into reality (Sandford, 2003). Therefore, marginal productivity rates in those nations are directly related to the technological discoveries their people make that allow them in

gaining a sustainable economic growth over their competitors. On the contrary, Third World countries are typically positioned far from this economic growth that could boost their economy due to lack of available technological resources (Sanford, 2003).

- **Technology & Job Creation**

In many Third World countries the unemployment rate is found to be very high. Driving technology can decrease the unemployment rate by creating more job opportunities in those countries. During recent years the United States and other developed countries have been using advanced technologies to significantly contribute to their market development and increase productivity, which Third World countries can also benefit from. For instance, a project done in West Africa called e-Ghana has created 1,000 job opportunities from integrating technology. The project's main goals were to develop an electronic tax application and create new jobs for West Africans (Woodman & Long, 2014). Additionally, by integrating technology in Third World countries more IT companies will be able to open and this will lead to an increase in job opportunities. With the support of the technological transformation the benefits will be remarkable and it will build upon local technical skills in the Third World countries.

As technology continues to advance, creating a sufficient technological environment in different types of organizations where almost every job today requires a certain degree of advanced IT skills. As a result, technology has been increasing job opportunities across the world (Dobush, 2015). With today's technology and its latest features all of its aspects could be utilized in every industry. The emergence of new services is one of the benefits advanced technologies offers to all different kinds of industries. Today, mobile phones and other computer software make those services accessible for everyone online. Third World countries can benefit from those provided services through advanced technologies in different fields such as agriculture, healthcare, and education. For example, in Kenya a project called e-Warehouse uses mobile phone services to help small farmers store their crops (Dobush, 2015). A variety of industries can be advanced through integrating technology in Third World countries. However, indicating the appropriate technological elements in different organizations will be crucial for Third World countries to reach economic success.

- **Globalization is the Key**

One of the main reasons to infuse technology in the Third World countries is that existing technologies developed by other nations can be used; the Third World countries just need to learn how to integrate and operate them. Consequently with all integrated technological advantages, Third World countries will have the opportunity to develop and share the same conditions as the Western World (Wessner, 1999). However, different ways should be determined in order for this phenomenon to occur. One of the possible ways proved by several economic analysts to infuse technology to Third World countries is globalization, which can be reached by advanced technological emergence. Globalization can occur through communication channels, technical and scientific workshops that will allow Third World countries to adopt the existing advanced technologies. Also, the process of globalization will help Third World countries to adjust to technology at a much faster pace (Archibugi & Pietrobelli, 2003).

- **Infrastructure Development to Support Technology**

One of the most common challenges that Third World Countries face when integrating technology is the lack of infrastructure that might interfere with technology. It is crucial prior to infusing technology into Third World Countries to develop a sustainable infrastructure plan that could support advanced technologies. Where technology cannot work by itself. With planning and developing infrastructure technology in the Third World countries can have sustainable economic growth. Continuously improving the infrastructure in those countries will also achieve sustainable development in different fields such as schools, factories, and roads, not only in technology (Ng'ang'a, 2012).

- **Better Education**

While integrating technology in Third World Countries is well thought out for economic development and growth, it is also as important in improving education. As a matter of fact, education is a priority that Third World Countries need today to take them to the next level and even lead them to the status of developed countries. Having better education can benefit the people in many aspects such as improving health, political stability, and even economic growth that will eventually alleviate current conditions of poverty. By integrating advanced technologies education will reach superior outcomes. A lot of students in those countries do not attend school due to lack of resources such as transportation and school supplies. Fortunately, with the emergence of technology in their education system those need for resources will no longer be an issue.

However, providing education systems with existing technologies may not be enough. Therefore, to reach expected outcomes and achieve economic development, Third World Countries will need to train their individuals to develop required technical expertise to be able to perform certain roles (Wilson, 2004). For this to happen, those countries will need institutions that will involve technology experts to help the people adjust to digital technologies. Furthermore, it is extremely valuable for Third World Countries to consider developing their own educational systems that will lead to highly competent graduates in the future.

- **Innovative Curriculum**

When integrating technology into education, specifically in Third World and developing countries, it is important to consider creating a curriculum that will satisfy the students' need in those countries. It is assumed that most of those students have never experienced such advanced technologies before. A non-profit organization in the United States called the Math/Science Nucleus designs curriculums with integrating technology for developing countries. The curriculum provides the teachers with essential training to perform the task. One of their innovative projects was designing a curriculum for a science class in Eritrea. Results have shown that in developing countries students and teachers have adapted to the innovative curriculums positively (Blueford & Rosenbloom, 2003). Also, one of the benefits of cultivating innovative curriculums is that it will be used as a driving force for local teachers to become more qualified in order to undertake roles that will allow them prepare for a more educated generation.

- **Generating Fund Raising**

It would be extremely valuable if all education systems in Third World Countries at least at the bare minimum have an online connection to the rest of the world such as a website or a social media account. These online connections could bridge them to the world and could make them more approachable. A lot of schools in Third World Countries are lacking essential supplies such as printers, pencils, and papers. By having an online connection, the rest of the world will have an insight and perceive in experience of their current situation. Consequently, this bridge will generate online donations and fundraising that will help those schools receive their essential supplies. Furthermore, with the belief that integrating technology is the key for better education, donations will probably also include digital technologies. A donation of only a projector and a laptop computer in a teaching classroom can develop a technological learning experience for students (MacKinnon & MacKinnon, 2013).

- **Political Challenges with Technology**

As the implementation of integrating technology appears to be feasible, various challenges may be encountered along the way that might prevent this strategy. One of the possible challenges is that several people living in Third World Countries do not welcome the influence from the Western World. Most of the citizens will resist these changes and the strategic plan of integrating technology could be negatively perceived. In fact, they find that bringing technology into their countries will be a source of corruption and bad influence to their culture and society. It is really crucial for Western and other developed countries to identify suitable ways to help those countries realize the global benefits they will develop from integrating technology (Sipe-Haesemeyer, 2016). Moreover, a survey conducted by the Pew Research Center on current Internet users in 32 developing countries identified the impact of the Internet. The survey concluded that 42% of the people think that Internet has a bad influence on morality, which is a key principle for people living in Third World Countries (Poushter, 2015). While integrating technology in nations where such cultural heritage is important, various ethical factors must be placed into consideration.

Conclusion

In conclusion, in order to infuse technology into Third World countries it is significant to take social, economic, and political factors into account. Infusing technology into Third World countries can make a positive difference to their nations. With globalization and the help of developed countries such as the United States, Third World countries will achieve economic development and growth. However, it is really important to put infrastructure development plans into consideration in order to support the integration of advanced technologies. Technology will bridge Third World countries to the rest of the world and make them more approachable. A sustainable technology development will offer better opportunities and raise the standard of living of the people living in Third World countries. It will also create more job opportunities and will enhance the education system to achieve a sustainable economic wealth.

#Social and cultural bases of technological changes:

Technology is the application of scientific knowledge to the making of tools to solve specific problems. Technological advances such as automobiles, airplanes, radio, television, cellular phones, computers, modems, and fax machines have brought major advances and changes to the world. Indeed, 20th century technology has completely—and irreversibly—changed the way people meet, interact, learn, work, play, travel, worship, and do business.

Technological information increases exponentially: The entire database of scientific knowledge doubles every several years. This "technological explosion" is due in part to an "Information explosion," as well as to advances in storage, retrieval, and communication of data. In other words, a cycle occurs: Improvements in technology lead to increases in knowledge and information and, thus, to uncovering the means to create better technology. Consequently, sociologists are concerned with how technological societies will be forced to adapt to the social changes that improvements in technology will continue to bring.

- The technology that powered the industrial revolution created the industrial society.
- The mass production of automobiles created a culture of computers, vacationers, and the suburbs.
- Radio created a culture of listeners and spawned jazz, big band, and fireside chats.
- Television created the culture of Hollywood, MTV, always-on news, and reality TV shows.

The Internet is creating a culture that's changing so fast that I'm afraid to give examples that may be out dated by the time you read this.

As much as technology is created from the fabric of our culture, technology also creates the fabric of our culture. If we follow this thread to its extension, technology creates itself. It's this awareness that technology is creating itself that makes movies like *The Terminator* or Marvel's *Avengers: Age of Ultron* work. Truth is indeed stranger than fiction..

Let's take the daily personal view here:

- Every time a notification pops up on your phone or desktop, that's technology influencing culture.
- Every time you're at a table with your friends and are balancing interacting with them and interacting with your phone, that's technology influencing culture.
- Every time you can order something from an online vendor rather than going to a local store, that's technology influencing culture.
- Every time you or your kids log on to have some social time with friends rather than going over to their houses, that's technology influencing culture.
- Every time a teammate or your entire team is so buried under email that they can't think straight, that's technology influencing culture.

The many hundreds of small ways that technology alters our individual and collective behavior on a daily basis add up to the cultural changes the technologists and historians point to. And, of course, for each of those examples, someone's personal behavior can alter the group's behavior. It's just

harder to do so because of how quickly, ubiquitously, and unconsciously so many of those norms are forming.

Though it may sound like it at times, I'm not a pessimist about where these norms are leading us because they're also enabling social change like the Arab Spring, global connectedness, new economic realities and pathways, and better government. Because of technology, we can find or create the communities and relationships that fit our version of thriving, whatever that might be. I'm eternally hopeful that we can lean into the good, minimize the bad, and consciously explore the grey areas, which exactly why I talk so much about how technology is affecting our lives, relationships, communities, and work.

Process and pattern of diffusion of innovation

Diffusion of innovations is a theory that seeks to explain how, why, and at what rate new ideas and technology spread. Everett Rogers, a professor of communication studies, popularized the theory in his book *Diffusion of Innovations*; the book was first published in 1962, and is now in its fifth edition (2003). Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The origins of the diffusion of innovations theory are varied and span multiple disciplines.

Rogers proposes that four main elements influence the spread of a new idea: the innovation itself, communication channels, time, and a social system. This process relies heavily on human capital. The innovation must be widely adopted in order to self-sustain. Within the rate of adoption, there is a point at which an innovation reaches critical mass.

The categories of adopters are innovators, early adopters, early majority, late majority, and laggards. Diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process. The criterion for the adopter categorization is innovativeness, defined as the degree to which an individual adopts a new idea.
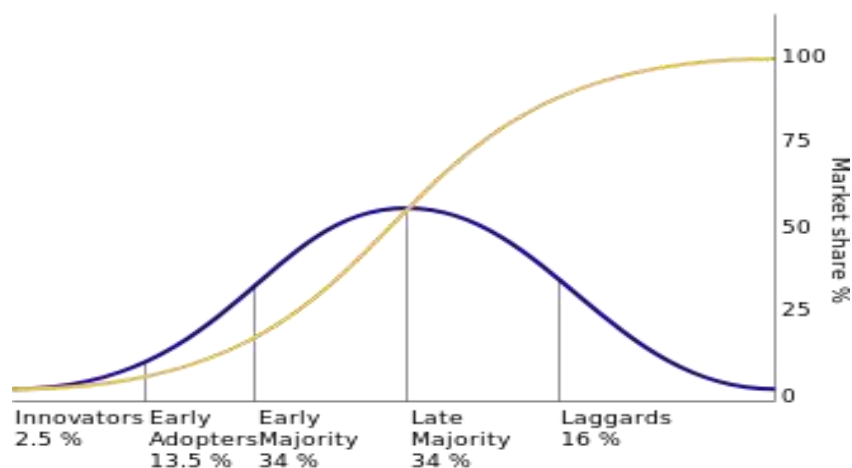
The diffusion of innovations according to Rogers. With successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level. The blue curve is broken into sections of adopters.

the key elements in diffusion research are:

Element	Definition
Innovation	Innovation is a broad category, relative to the current knowledge of the analyzed unit. Any idea, practice, or object that is perceived as new by an individual or other unit of adoption could be considered an innovation available for study.[14]
Adopters	Adopters are the minimal unit of analysis. In most studies, adopters are individuals, but can also be organizations (businesses, schools, hospitals, etc.), clusters within social networks, or countries.[15]
Communication channels	Diffusion, by definition, takes place among people or organizations. Communication channels allow the transfer of information from one unit to the other.[16] Communication patterns or capabilities must be established between parties as a minimum for diffusion to occur.[17]
Time	The passage of time is necessary for innovations to be adopted; they are rarely adopted instantaneously. In fact, in the Ryan and Gross (1943) study on hybrid corn adoption, adoption occurred over more than ten years, and most farmers only dedicated a fraction on their fields to the new corn in the first years after adoption.[5][18]
Social system	The social system is the combination of external influences (mass media, surfactants, organizational or governmental mandates) and internal influences (strong and weak social relationships, distance from opinion leaders).[19] There are many roles in a social system, and their combination represents the total influences on a potential adopter.[20]

The Process for Diffusion of Innovation

Rogers' draws on Ryan and Gross's work to deliver a 5 stage process for the diffusion of innovation.
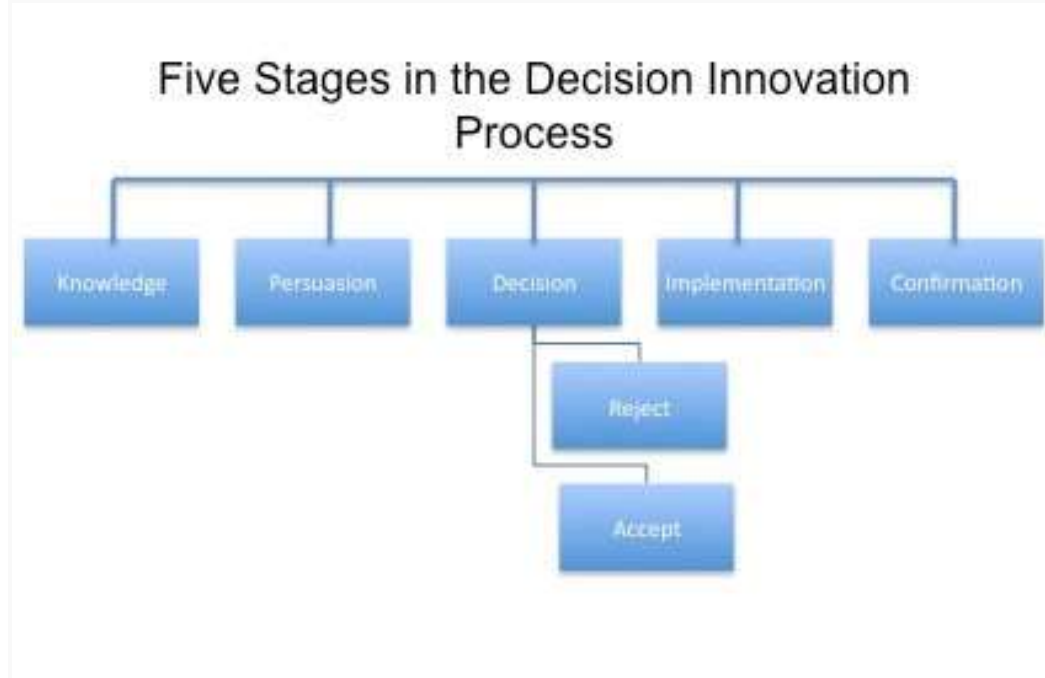
1. Knowledge

The first step in the diffusion of innovation is knowledge. This is the point at which the would-be adopter is first exposed to the innovation itself. They do not have enough information to make a decision to purchase on and have not yet been sufficiently inspired to find out more.

At this stage marketers will be looking to increase awareness of the product and provide enough education that the prospective adopter moves to the 2nd stage.

As it was once said (by whom we're not sure); "If the user can't find it, it doesn't exist."

2. Persuasion

Persuasion is the point at which the prospective adopter is open to the idea of purchase. They are actively seeking information which will inform their eventual decision.

This is the point at which marketers will be seeking to convey the benefits of the product in detail. There will be a conscious effort to sell the product to someone at this stage of the diffusion of innovation.

3. Decision

Eventually the would-be adopter must make a decision. They will weigh up the pros and cons of adoption and either accept the innovation or reject it.

It is worth noting that this is the most opaque part of the process. Rogers cites this as the most difficult phase on which to acquire intelligence. This is, at least in part, due to the fact that people do not make rational decisions in many instances. They make a decision based on their underlying perceptions and feelings and following the decision they attempt to rationalize that decision. Thus, obtaining an understanding of the decision making process is challenging – the reasons given following a decision are not likely to be representative of the actual reasons that a decision was made.

4. Implementation

Once a decision to adopt a product has been made the product will, in most cases, be used by the purchaser. This stage is when the adopter makes a decision as to whether or not the product is actually useful to them. They may also seek out further information to either support the use of the product or to better understand the product in context.

This phase is interesting because it suggests that designers and marketers alike need to consider the ownership process in detail. How can a user obtain useful information in the post-sale environment? The quality of the implementation experience is going to be determined, to a lesser or greater extent, by the ease of access to information and the quality of that information.

5. Confirmation

This is the point at which the user evaluates their decision and decides whether they will keep using the product or abandon use of the product. This phase can only be ended by abandonment of a product otherwise it is continual. (For example, you may buy a new car today – you are highly likely to keep using the car for a number of years – eventually, however, you will probably sell the car and buy a new one).

This phase will normally involve a personal examination of the product and also a social one (the user will seek confirmation from their peers, colleagues, friends, etc.)

Consequences of technological development on Nepalese society:

Technology has always been a driver of change. When the first televisions came to Nepal, people gathered round in groups to watch the daily news. Even before that, transistor radios existed. Then, too, people would gather around in groups to listen to the news and hear the latest songs. Televisions and radios changed the way people received their information. Even prior to that time, newspapers were responsible for providing information. When new technology arrives, it brings with it change and convenience.
Presently in Nepal, access to smartphones and the Internet has changed people's lives. Nowadays, one can buy a smartphone for as little as $50. Smartphones are the easiest and cheapest way to access the Internet. The reach of Internet to rural villages has made it easier to disseminate information. The rise in Internet users has also created opportunities for the entertainment industry. Artists and filmmakers now have the opportunity to reach a larger audience. Internet service providers here are also rapidly expanding their services. ISP's are one of the most active companies in terms of marketing and business development. They come up with new schemes for every season.

Development of communications has enabled young people like myself to discover new interests. Today, a video on YouTube can teach anything from playing a guitar to putting on makeup. These videos also can be watched repeatedly to learn the new skill. A post on Facebook can act as a source of news. Even though social media has its disadvantages, it can be beneficial if used for good.

In Nepal, during the earthquake of 2015, when telecommunications were down, the Internet enabled people to communicate with each other. The most impacted areas were identified, and people formed groups to gather resources and send them to people in those areas. We also were able to know the statuses of friends and loved ones during that time. After the earthquake, the fuel crisis hit Nepal. It was then that people started forming groups on social media. A carpool group was formed where vehicle owners and people looking for lifts could connect. This became popular and encouraged people to give lifts to strangers in an effort to overcome the crisis.

Further Planning and Development
The government had established an IT Park just outside of Kathmandu in a town called Dhulikhel about a decade ago but nothing significant has come out of it. Nepal Telecom Limited, which is one of the main telecommunication and Internet providers in the country, is controlled by the government. The company, however, lacks updated services. The Internet service is outdated, and there are much better options in the market provided by private companies.

The city area does not need much development effort as compared to rural areas. What planners should focus on now is the access of reliable and inexpensive communications to villages. Internet has the ability to educate people. Spreading easily accessible Internet throughout the country will help the government manage educational programs.

Impacts:

- **Employment and the Economy:**

Perhaps the most fundamental and direct impact that technology has on the everyday life of most people is economic in nature. The issue of jobs and unemployment is one that strikes a chord of concern in just about every person. While competition between machinery and human labor has long existed in the realm of physical tasks, it has only recently been introduced into the domain of mental work. Much as heavy machinery has eliminated the need for physical exertion on the part of humans, so too does modern technology, in the form of microchips and computers, bring with it the potential to eliminate mental drudgery. Does this mean, however, that humans will no longer have any purpose to serve in the world?

To gain some perspective on the issue, we can take a look at the past. At the beginning of the 20th century in the United States, jobs in factories and agriculture were disappearing at a rapid rate. But with the loss of those jobs came the potential for millions of new jobs and economic development in new industries. Indeed the macroeconomic trend of the past century has been overwhelmingly positive. Jobs have grown 10-fold in the United States (from 12 million in 1870 to 116 million in 1985) and the percentage of people employed has grown from 21 percent to 48 percent. Per-capita gross national product, as well as the average earning power of jobs, has increased 600 percent in constant dollars during the same period. Today, new manufacturing technologies are rapidly reducing the number of production jobs. The advent of new technology is projected to rapidly decrease the demand for clerical workers and other such semiskilled and unskilled workers.

How will the development of more advanced software affect our economy? Is technology bound to provide for economic growth? Is it possible for computers and technology to truly replace humanity?

- **Society:**

Computers, which have revolutionized the workplace, are similarly infiltrating society. They have brought about innumerable advances in education and personal communication.

Slowly but surely, computers have begun to infiltrate the classroom. Though not yet optimized for education, the personal computer has much potential in this arena. Wireless networks can allow for the easy sharing of courseware, submissions by students of papers, exams, courseware responses, and other creations. The networking of information can provide students with instant access to vast amounts of information and knowledge.

The realm of communications has likewise seen immense change. We are provided with new ways to communicate with each other, such as email and instant messaging. Documents placed on the internet are sources of information for the rest of the world. Vast databases allow for the easy storage of information. Global positioning satellites allow us to track our exact location and find our way to various destinations.

But what social problems will arise with such progress? Will we become increasingly dependent on our computers to the point of social breakdown? As Theodore Kaczynski wrote, "technology is a more powerful social force than the aspiration for freedom, …while technological progress AS A WHOLE continually narrows our sphere of freedom, each new technical advance CONSIDERED BY ITSELF appears to be desirable." Will technology be so ingrained in society as to destroy it and imprison humanity?

- **Military:**

The potential applications of technology to warfare are well known. But is this application positive or negative?

One might argue that the military application of science is undoubtedly negative in that it has led to the creation of the atomic bomb and other such weapons of mass destruction. Technology has made the complete destruction of humanity possible. That capacity continues to grow, as more nations develop nuclear technology and the proliferation of nuclear warheads continues.

On the other hand, it is also possible to argue that science has made it possible for the more accurate destruction of enemy targets and, in doing so, has lessened unintended damage to civilian populations. Smart bombs and cruise missiles have lessened the human component of war at least to some degree.

But what will the effect of future technology be? Will it lessen the amount of destruction and death? Or will it be our ultimate undoing?

Accountability of computer professionals towards society :

All segment of society have moral and social responsibilities toward people within the vicinity of their house, work place and society at large. Those responsibilities are determined by an unwritten contract between the person and society which is bound by morale values and the acceptance of the individual's duty toward humanity. Those responsibilities start by understanding our obligations toward ourselves. We have the responsibility to drive ourselves to survive, flourish and prosper. By doing that, we are flourishing our society. Computing professionals, as part of society, have social and morale responsibilities.

Computer Professionals for Social Responsibility (CPSR) endorses the CIVIL SOCIETY COORDINATION GROUP Civil Society Statement to Prepcom 2 on Vision, Principles, Themes and Process for WSIS (Document WSIS/CSCG/5 18 December 2002). CPSR is an international, non-profit, non-governmental organization (NGO) founded in 1981, out of concern for the potentially negative impacts on society of information technology and policies that govern their development and use. Given CPSR's mandate, it emphasizes here those aspects of the Civil Society Statement to Prepcom 2 that address support for socially responsible development and use of computer-based systems. CPSR's primary and historic interest has been to ensure that the public and policymakers are able to make realistic assessments of not only the power and promise of information technologies, but also their limitations. Toward these ends, CPSR adheres to five principles in the work that it performs:

1. We must foster and support public discussion of, and public responsibility for decisions involving the use of computers in systems critical to society.

2. We must work to dispel popular myths about the infallibility of technological systems.

3 . We must challenge the assumption that technology alone can solve political and social problems.

4. We must critically examine social and technical issues within the computer profession, both nationally and internationally.

5. We must encourage the use of information technology to improve the quality of life. I

Computing professionals perform a variety of tasks: They write specifications for new computer systems, they design instruction pipelines for superscalar processors, they diagnose timing anomalies in embedded systems, they test and validate software systems, they restructure the back-end databases of inventory systems, they analyze packet traffic in local area networks, and they recommend security policies for medical information systems. Computing professionals are obligated to perform these tasks conscientiously because their decisions affect the performance and functionality of computer systems, which in turn affect the welfare of the systems' users directly and that of other people less directly. For example, the software that controls the automatic transmission of an automobile should minimize gasoline consumption and, more important, ensure the safety of the driver, any passengers, other drivers, and pedestrians.

WHAT IS A PROFESSION?

Computing professionals include hardware designers, software engineers, database administrators, system analysts, and computer scientists. In what ways do these occupations resemble recognized professions such as medicine, law, engineering, counseling, and accounting? In what ways do computing professions resemble occupations that are not thought of traditionally as professions, such as plumbers, fashion models, and sales clerks?

Responsibilities :

Causal Responsibility

Responsibility can be attributed to causes: For example, ''the tornado was responsible for damaging the house.'' In the Therac-25 case, the proximate cause of each accident was the operator, who started the radiation treatment. But just as the weather cannot be blamed for a moral failing, the 2 ETHICS AND PROFESSIONAL RESPONSIBILITY IN COMPUTING Therac-25 operators cannot be blamed because they followed standard procedures, and the information displayed on the computer monitors was cryptic and misleading.

Role Responsibility

An individual who is assigned a task or function is considered the responsible person for that role. In this sense, a foreman in a chemical plant may be responsible for disposing of drums of toxic waste, even if a forklift operator actually transfers the drums from the plant to the truck. In the Therac-25 case, the software developers and system engineers were assigned the responsibility of

designing the software and hardware of the machine. Insofar as their designs were deficient, they were responsible for those deficiencies because of their roles. Even if they had completed their assigned tasks, however, their role responsibility may not encompass the full extent of their professional responsibilities.

Legal Responsibility

An individual or an organization can be legally responsible, or liable, for a problem. That is, the individual could be charged with a crime, or the organization could be liable for damages in a civil lawsuit. Similarly, a physician can be sued for malpractice. In the Therac-25 case, AECL could have been sued. One kind of legal responsibility is strict liability: If a product injures someone, then the manufacturer of the product can be found liable for damages in a lawsuit, even if the product met all applicable safety standards and the manufacturer did nothing wrong. The principle of strict liability encourages manufacturers to be careful, and it provides a way to compensate victims of accidents.

Moral Responsibility

Causal, role, and legal responsibilities tend to be exclusive: If one individual is responsible, then another is not. In contrast, moral responsibility tends to be shared: many engineers are responsible for the safety of the products that they design, not just a designated safety engineer. Furthermore, rather than assign blame for a past event, moral responsibility focuses on what individuals should do in the future. In the moral sense, responsibility is a virtue: A ''responsible person'' is careful, considerate, and trustworthy; an ''irresponsible person'' is reckless, inconsiderate, and untrustworthy.

Responsibilities to Clients and Users

Whether a computing professional works as a consultant to an individual or as an employee in a large organization, the professional is obligated to perform assigned tasks competently, according to professional standards. These professional standards include not only attention to technical excellence but also concern for the social effects of computers on operators, users, and the public. When assessing the capabilities and risks of computer systems, the professional must be candid: The professional must report all relevant findings honestly and accurately. When designing a new computer system, the professional must consider not only the specifications of the client but also how the system might affect the quality of life of users and others. For example, a computing professional who designs an information system for a hospital and should allow speedy access ETHICS AND PROFESSIONAL RESPONSIBILITY IN COMPUTING 3 by physicians and nurses and yet protect patients' medical records from unauthorized access; the technical requirement to provide fast access may conflict with the social obligation to ensure patients' privacy.

Responsibilities to Employers

Most computing professionals work for employers. The employment relationship is contractual: The professional promises to work for the employer in return for a salary and benefits. Professionals often have access to the employer's proprietary information such as trade secrets,

and the professional must keep this information confidential. Besides trade secrets, the professional must also honor other forms of intellectual property owned by the employer: The professional does not have the right to profit from independent sale or use of this intellectual property, including software developed with the employer's resources.

Responsibilities to Other Professionals

Although everyone deserves respect from everyone else, when professionals interact with each other, they should demonstrate a kind of respect called collegiality. For example, when one professional uses the ideas of a second professional, the first should credit the second. In a research article, an author gives credit by properly citing the sources of ideas from other authors in previously published articles. Using these ideas without attribution constitutes plagiarism. Academics consider plagiarism unethical because it represents the theft of ideas and the misrepresentation of those ideas as the plagiarist's own.

Responsibilities to the Public

According to engineering codes of ethics, the engineer's most important obligation is to ensure the safety, health, and welfare of the public. Although everyone must avoid endangering others, engineers have a special obligation to ensure the safety of the objects that they produce. Computing professionals share this special obligation to guarantee the safety of the public and to improve the quality of life of those who use computers and information systems. As part of this obligation, computing professionals should enhance the public's understanding of computing. The responsibility to educate the public is a collective responsibility of the computing profession as a whole; individual professionals might fulfill this responsibility in their own ways. Examples of such public service include advising a church on the purchase of computing equipment and writing a letter to the editor of a newspaper about technical issues related to proposed legislation to regulate the Internet.