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Digital Transformation Journey: a discussion

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Digital Transformation Journey: a discussion

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Introduction

Due to disruptive technology all sectors of the businesses have faced massive change in the last decade or more. There is an evolution in the technology and businesses and industries were the major beneficiary of the disruptive technology. The technological improvement led the way to economic growth globally. The widely usage of Internet and personal computers set the path to the new emerging disruptive technology. Technology can have a far reaching impact is it can transform the business and add value to the operation but with all benefits there will be disruption to each and every function of the business. These disruptive technologies can have far reaching impact across different industries such as manufacturing, retail, finance, education, healthcare and academia. Disruptive technologies such as 3D printing can change the manufacturing industry with new product design, Big Data analytics will allow the detailed and insight view to the data to help the management to make knowledgeable decisions, Internet of things will provide connected and smart world with connection of smart devices. The cloud computing model can allow business to start their operations without wasting anytime with a fraction of the cost and mobile apps will allow people to perform e-commerce from handheld device in the matter of minutes. These technologies can provide a competitive advantage and the decision makers need a better understand these technologies. As these disruptive technologies will have a major magnitude of impact and will change the direction of any business. The following section will discuss initially the disruptive innovation theoretical models and provide comparison of these models followed by the most disruptive innovation technology that are affecting all of us and the society overall.

In order to find the importance of digital transformation and how it can help to achieve business objectives there was a detailed study carried out by IDG that clearly shows that the senior management and decisions makers understand the importance of digital transformation. More than 92% of IT and business leader respondent identified that an organization's competitive strategy requires a comprehensive digital business initiative. 90% of the respondents called digital business as a "top IT priority" for the next three years and whereas 44% identify digital transformation as the number one-priority. The survey also

identified that 87% of respondent called improving the customer experience due to digital business whereas 86% respondent by stating that we can acquire new customers by using digital transformation strategies. According to 85% by incorporating the digital transformation customers are more engaged and remain loyal to the business whereas 82% of respondent agreed that using digital transformation business is more innovative and helps them to make real-time decisions without any delay. The other findings of the study are as follows which shows the importance of business goals that can be achieved due to digital business initiatives.

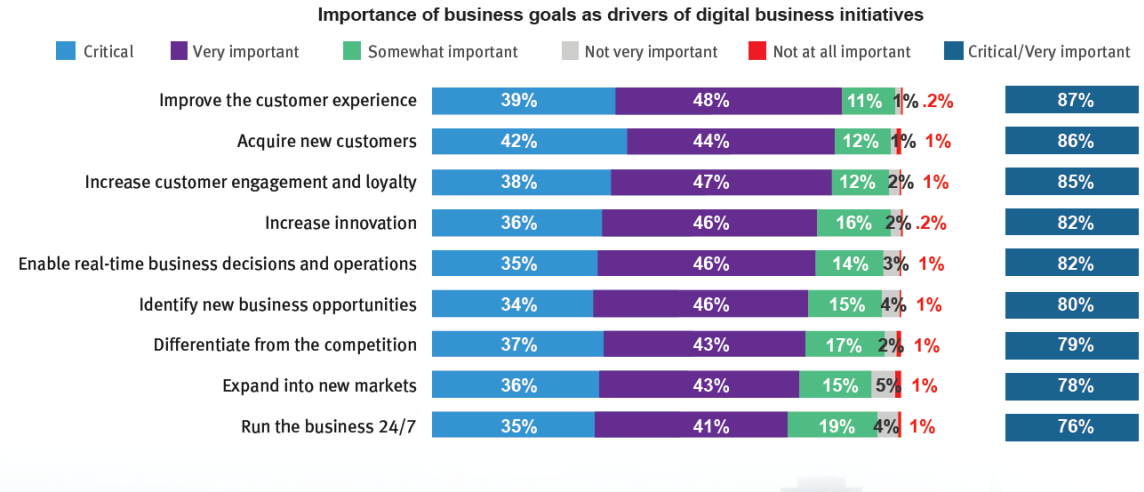

Figure 1: Importance of business goals as drivers of Digital Business Initiative [KPMG,2016]

Christensen & Raynor's Theory on Disruptive Innovation

According to theory presented by Clayton M. Christensen and Raynor, in his book in 1997 "The Innovator's Dilemma", there is a reason for well-respected organization to fail. According to the theory the manager of the particular well respected business is doing everything possible for the business to be successful by listening to their customers, offering unique service, building good relationship with their customers, investing time and money in their business but fails to incorporate the disruptive technologies that have been used by the competitors. The theory is far reaching influence then the business requirements. According to the Christensen theory the proposed disruption framework deals with managing the social problems such as poverty, lack of access to education and health care

facilities, large scale unemployment and dealing with the secondary problems due to these issues. The theory leads the innovation strategy and it is applied in various sectors that was also an issue for the author as reinforced in one of his interview published in Harvard Business Review, where he mentioned “I never thought that the word disruption has so many connotations in the English Language, that people would then flexibly take an idea, twist it, and use it to justify whatever they wanted to do in the first place”. This raises a lot of questions about the real meaning of theory of disruption, where it can be used, under what circumstances it can be used and how effective is the theory in various sectors needs to be investigated further.

The theory was initially used in the hard disk drive industry in 1970s with very few quantitative test that were reported. According to these few results there was no solid evidence that can confirm that full-blown disruption strategy proposed by the author is rare and managers in various sectors responds effectively to any disruptive threat that are emerging. Whereas the author had a different opinion as due to disruptive innovation the leading business have failed to adapt from time to time. The four key elements of the Theory of Disruption Innovation will be discussed valuate the impact of the theory on various industries.

Four Key Elements of the Theory of Disruptive Innovation

Before evaluating the impact of the theory the four key elements of the theory will be discussed.

Incumbent are improving along a trajectory of innovation

According to the author the major entity of the disruption innovation theory is that based on various markets and the level of progress or improvement on innovation producing new products or services is different. The major focus should be on sustaining innovation ensuring that every year there will be improvement made to remain competitive and continue to win more market share. With the sustain innovation improvements effective managers or companies will add value or unique features in few value areas that will attract more business due to this feature. The author explains the some companies will improve

their customer service or Auto Company continue to improve on the engine capacity by improving the horsepower. According to the theory this feature will allow to sell products on higher profits and exceed the expectations of the customers as there will be a lot of competition. The customers will be well satisfied as the incumbent have made major innovation improvements in the product or services.

The pace of Sustaining Innovation overshoots customer needs

The next key area that explains the disruptive innovation theory form Christensen and Raynor, was the pace of sustain and continuous innovation that exceed the trajectory of the value proposition. Due to sustain innovation it will exceed the customers' requirements and how much a particular customer can use in the future. To explain the fact clearly Christensen and Raynor provided an example from 1983 computer industry when people initially started using personal computer to formulate a document using a word processor. The typist often used to stop or slow down their typing speed so that the slow Intel 286 chip can catch up with the speed of the typing. Now the industry has seen a major sea change where today's processors provide very high speeds that is more than any customers can use. This example is a clear indication that due to sustain innovation in the last many years now it has exceeded the customer needs and requirement.

Incumbent have the capability to respond but fail to exploit it.

According to the authors companies have the ability and skills to succeed but the problem is that the managers fail to use those capabilities to prevent or respond to the disruption. Due to various disruption it affects the entire operations and have far reaching consequences that will take a long time to recovery. The theory explains the underlying reason for this by stating that major portion of resources are allocated to sustain innovation whereas there is minimal resources left for managing or preventing any disruption. This factor is not preparing the organization to be well prepared for any type of disruption and every organization is focused on sustain innovation rather than the managing of disruption innovation and its overall impact.

Incumbent flounder as a result of the Disruption:

The last key area of the theory is that all major failures in various companies there is single point of failure. This point of failure is due to the new innovative technologies that causes disruption in the normal operations. As simpler, less expensive, convenient and more disruptive technologies come into the market large companies can't adapt quickly to these changes and fail to sustain the continuous pressure of sustain innovation. The companies which are agile and keep improving these new technologies will take over the old market and according to both the authors "the disruption are on a path that will ultimately crush the incumbents".

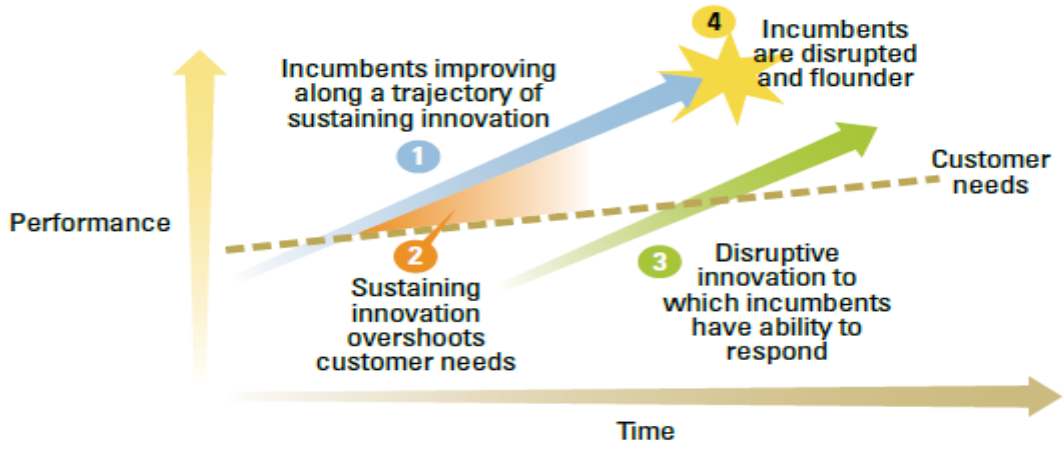

Figure 2: Four Key Elements of Theory of Disruptive Innovation (Christensen & Raynor's Theory, 2000)

The Theory of Innovation Diffusion

The author Everett Rogers presented his theory that is widely known as "Diffusion of Innovation" theory that highlights the idea of adopting the innovation that holds spontaneous or totally new ideas that can initiate the change process across the organization or a particular field. The key focus of the theory is that the new idea should change the way we operate traditionally and the people who are going to adopt this new idea should considered this as an innovation. The author provide reasoning to its theory of innovation diffusion by examining and highlighting various studies such as controlling scurvy in the British Navy, diffusion of

hybrid corn in Iowa, diffusion of the news, bottle feeding of babies in the third world, Xerox PARC and Apple Computer, non-diffusion of the Dvorak Keyboard and causes of the Irish potato famine. In all these case studies examined by the author there were two main factors that were of major importance. The first factor is the speed by which that particular innovation was adopted by the consumers and the second factor was the cause when the innovated was not adopted at all. Apart from the many examples of innovation diffusion studies cited by Rogers (1995), examples by other researchers range across the entire field and include studies of managerial characteristics (Entrialgo, Fernandez et al. 1999), vocational training (Schmidt 1999), creativity (Preiss 1999), information technology outsourcing (Hu, Saunders et al. 1997), the growth of the Internet (Press, Burkhart et al. 1998; Rai, Ravichandran et al. 1998) and information systems innovation (Kwon and Zmud 1987; Kishmore and McLean 1998; Spann-Merchant 1998; Hughes and Sheehan 1999), to mention just a few.

The diffusion theory highlights that the innovation idea for most of the adopters leads to uncertainty (Berlyne, 1962). This uncertainty promotes unpredictability and can be cause of concern. In order to reduce this concern then the process of diffusion take place where there is a detailed exchange of information among the community or the group of people who are going to adopt this new innovation. This process of exchanging information will minimize the uncertainty and improve understanding (Rogers, 1995). When there is uncertainty various options are perceived and probabilities for each uncertainty or event will be different based on their occurrence. The author explains that those trying to adopt the innovation are motivated to seek more data so that any uncertainty can be reduced. On the other hand diffusion theory consist of technological innovation information and its adoption will reduce uncertainty. The author provided an example to support the opinion by stating that innovation of wind mills or solar panel play a vital role in the reduction of uncertainty and make it clear that future energy cost will be less as compared to now and provide assurance to the energy supply. The latest innovation is shared and communicated between all the stakeholders and as the time passes everyone is aware of the technology. The theory of innovation diffusion is based around four characteristics that will be explained in the previous sections.

Characteristics of innovation itself

According to (Roger, 1995), it is crucial that innovation should contain values, attributes that define the manner of diffusion and well explain the rate of adoption of this new innovation. The author explains that for technological innovation should contain two major components such as hardware that consist of a physical object and a software consist of information and data. To explain further the author states that innovation is just like a camera that has hardware whereas software aspects is a film. The author outlined key characteristics of an innovation that are as follows:

I) **Relative Advantage:** The new innovation that is conceived should be well structured and better than the old idea that was being used. The new innovation should provide a relative advantage that bring economic profitability, value addition, social inclusion and improve productivity and performance. The author is clear that any new innovation that has a relative advantage will improve the rate of adoption and more users will be use the innovation.

II) **Compatibility:** The potential innovation adopters should perceive the new innovation as compatible and offers more predictability by removing any confusion. The new innovation should be less uncertain and provide more familiarity and remove any ambiguity. The adoption rate will be very high if the confusion is removed and innovation matches the needs and inspiration of the adopters.

III) **Complexity:** The new innovation should be easily understood and can be implemented in the organization without any problems. According to the author the rate of adoption of the new innovation is directly linked with the complexity of the innovation. If the innovation is complex and difficult to understand then the adoption rate will be very low whereas if the innovation removes any unnecessary complexity then it will have a major spike in the adoption rate. In order to support this (Roger, Delay and Wu, 1980) explained that in late 1970s for the first six to eight weeks the new home computer users used to face extreme frustration as the technology that time was very complex.

IV) **Trialability:** Every new innovation goes through the testing phase known as trialability (a trial period where both concept and its usage is put into practice). If

this session goes smoothly and user enjoys the experience of using the new innovation then the adoption rate will be directly affected and more use of the innovation is evident.

V) **Observability:** The users will adopt the new innovation in higher numbers if they see that the results are effective. These results can be clearly shown in public places, media, focused group or social media so that users are aware of these facts and will adopt the new innovation in high numbers.

Nature of Communication Channel

The communication channel plays a vital role in ensuring that any change process and innovation can be explained to the target audience in an effective manner (Kaplan, 1991). The communication contains six major elements such as the source of the message, the detail of the message, the communication mode that is used, the precise timing of the message, the objective of the message to be achieved and the desire destination of the message (Spann-Merchant, 1998). For effectively conveying the new innovation to the new adopter it is very crucial to use the right communication channel or the entire effort will be lost. The communication medium such as mass media can play a vital role for spreading the awareness of the innovation and plays a vital role so that the potential adopter can accept new ideas. According to (Roger, 1995), when the potential adopter can identify the change agent then they will define a key term that is known as 'homophily' that explains the interacting individuals having similar attributes. These similar attributes can be socio economic status, education level, spending patterns, hobbies, beliefs and preferences. The author explains that the more homophilious or similar in habits these adopters it will be easy for a particular innovation to be adopted. The early diffusion research will ensure that the innovation is passed directly from the sender to the receiver.

The passage of Time

According to the author the passage of time is involved in three ways for innovation diffusion process that is innovation decision, degree of innovativeness, and an innovation's rate of adoption. There are five main time-dependent steps in the innovation decision process in the knowledge that explains the innovation and detail the knowledge of the information. Persuasion provides favorable and unfavorable attitude towards the innovation

whereas decision is the acceptance or rejection of the choice for the new adoption. The next step is the implementation of innovation so that this can be used by general public and last step will be confirmation that ensure that the innovation will be used and it will not be reversed or changed.

As mentioned by Deutschmann and Fals Borda (1962), the adopters of innovation can be divided into various categories such as innovators that is smallest percentage, early adopters, early majority, late majority and laggards as shown in the following figure. As the time passes more adopters are using the innovation and feel comfortable in its usage.

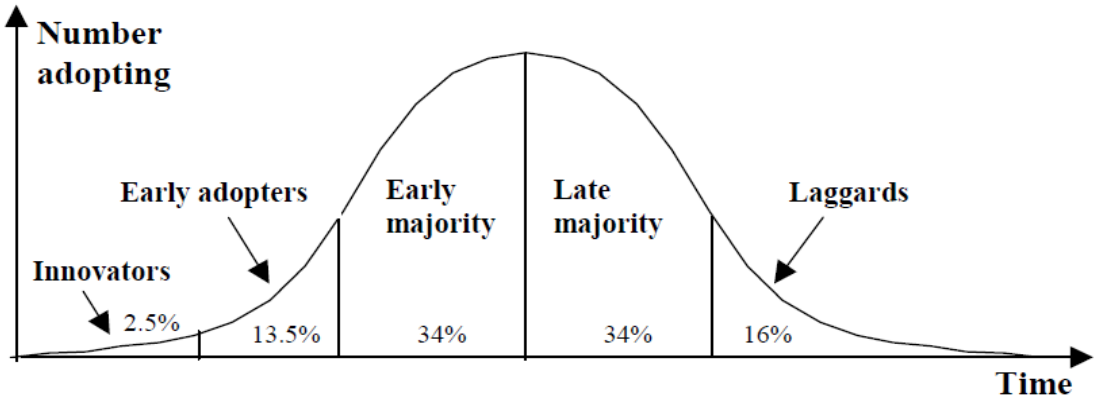

Figure 3: Categories of Adopters for New Innovation – (Roger, 1995)

The Social System

The social system of any society will have a major impact on the adoption and usage of that technology. The social structure will promote and market the adoption of the technology. Each social system consist of boundaries and these boundaries affect the diffusion of ideas and innovations. The social structure that accepts technology innovation will see more adopters to the technology.

The Theory of Innovation Translation

According to Law (1992), presents a different point of view for innovation translation by explaining the actor network theory (ANT). The author explains that in this theory one key segment or an entity defines or translates the role to others. The opinion was reinforced by

(Singleton and Michael, 1993), that explains the most used approach to new innovation in the information system is to remain focused on the technical side of the innovation but at the same time consider the social context in which the development and adoption of the new innovation will be used. This approach will select the most convenient and appropriate innovation and adopters who adopt this new innovation will gain benefits due to its technological advancements (Grint and Woolgar, 1997). Also, Law and Callon (1988), explains the other side where the social values and norms dictate any technological changes that are required. Theory of innovation diffusion reinforces that technological innovations contains the quality of information and explains the substance and characteristics of the technology which will have a direct link to the adoption of the new innovation (Roger, 1995). The problem that can arise here is that for some adopters they have different opinion on the key attributes for the specific technological innovation whereas some adopters will have a different list which creates problem for the researchers. The problem in the adoption of essentialist position can be a huge barrier in the adoption of innovation. This problem need to be address and all attributes should have the same level of privilege so that there is no priority for a particular group on other.

Innovation Translation versus Innovation Diffusion

Latour (1986), explained clearly the diffusion and translation models by stating that diffusion model an innovation is linked with a central source which allows it to move quickly and rapidly and continuous to progress until there is an interest group that wants to stop the entire process. Diffusion model has three main elements in the initiation of innovation that is the initial force with it is started, the innovation inertia and the medium that will be used through which the information will be spread across everyone (McMaster, Vidgen et al. 1997). In the diffusion model when the innovation is being informed to the general public then in a matter of time everyone will be familiar with the technology and the rise of adoption rate will be observed. There are instances that the diffusion theory will not be able to make any ground despite their technical superiority. According to Rogers (1995), non-diffusion best example can be seen by Dvorak Keyboard with all its quality superiority over the QWERTY keyboard was not able to succeed due to various pressure groups and vest interest.

The author Bruno Latour (1996) provide a detail difference between innovation diffusion and translation model in which the initial innovating idea hardly counts and there is no need of a great inventor to initiate the idea or promote it to the public. The innovation idea will generate momentum only if there is interest of different actor groups. In the example for innovation translation approach that can be used in the detailed investigation of information system implementation while observing the adoption of Java for web system development project. In this situation the consultant applies innovation diffusion approach then the consultant has to define the boundaries of the language, explain the characteristics of Java and its entire evolution path from the development from C++ and defining the degree of object-orientation, and issues such as portability will be discussed. All the characteristic will be considered to analyze whether it help or create barrier in the adoption of this new language. Then the channel or medium will be investigated to find out how the information about the innovation can be reached the developer or the university. Using the methodology the next step will be to analyze how effective was the communication medium or channel and whether the message was delivered effectively. Also the culture of the organization will be investigated to find out what type of programming languages have been used in the past and what type of experience the staff had using different programming languages. The innovation translation methodology would solely focus on the main area of network formation and considering all human and non-human entities involved in the entire process. The methodology will identify all the actors involved such as the consulting company, programmer, the end-users, testers and all the actors involved in the final implementation and evaluation stage. The methodology will focus around the network configuration that supports the Java Programming and will consider both the human and non-human actors in the entire process. The following table explains both the methodology in-detail (Table 1).

	Innovation Diffusion	Innovation Translation
Innovation	The innovation is considered as to be new and adopters want to acquire it	The technology needs to be tested and 'black-boxed'
Communication	Various communication channels will be used to convey the message to the potential adopters	Detailed translation are carried out by the actor to view the innovation and whether it meets the inspirations of the adopters.
Time	Time plays a key role in the quick adoption of the new innovation	The network connections and linkages play a vital role in the spread or the innovation technology.
Social System	The overall impact on society due to the innovation will have a major factor. The concepts of 'Homophily' versus 'heterophily' that defines the interest of human actors.	The assessment considers human, non-humans and goals to be achieved. The direction of the interest moves in the same direction.
Technology	Based on the experience various modifications are made to the technology so that it can be re-invested and more adopters can use it.	The use of technology is incorporated and it is not affected by any modification.
Socio-Technical	The social and technology are two different entities and they are separate from each other. Diffusion will be used so that the adoption of the new innovation can be raised by bring the social and technological sides together.	The social and technology are same and can't be separated at all. The new innovation successful adoption rate shows that the social and technology are different but they are same.

Table 1: Innovation Diffusion as compared to Innovation Translation (McMaster et al, 1997)

Moore's Technology Adoption Life Cycle

Geoffrey Moore (1991) present the concept on the adoption of technology and innovation that was built around the concept presented by Everett Rogers methodology of diffusion of innovation. Moore observed the boom and adoption of personal computer and other related technological items during the era of 1970s and 80s that was adopted using the same patters as identified by Rogers. Moore's theory was based around the concept of adopter segments that is based around their ability to adapt to the disruption that caused

by the new technology. The following figure explains the Moore's law and various adopter segments to the technology.

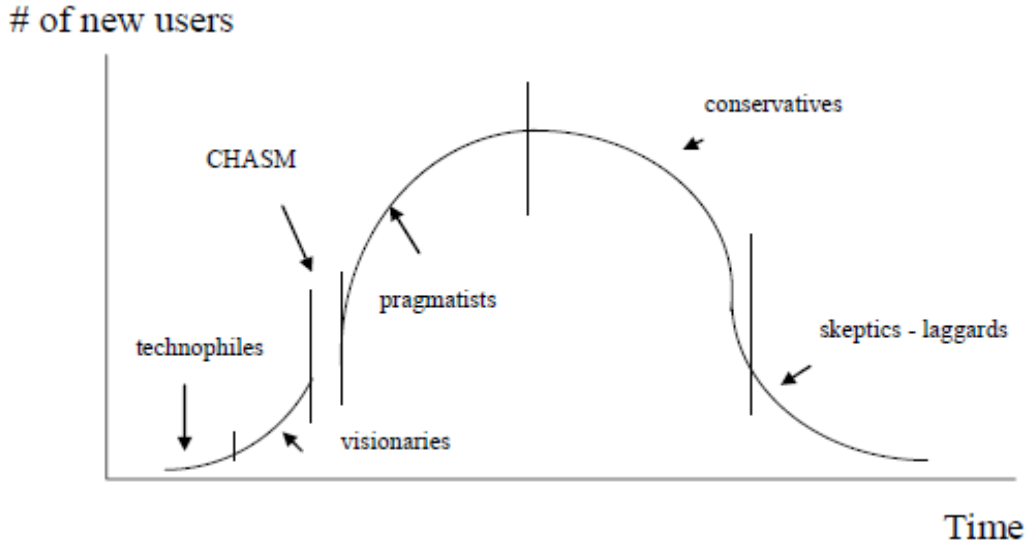

Figure 4: Moore's technology adoption life cycle (Moore, 1991)

The adopters of technology were divided into various segments as explained in the following section:

Technophiles: This segment according to Moore's law represent those individuals how like the new technology and always will be the first one to adopt the technology.

Visionaries: This segment of technology adopters see the use of technology to given them and their business competitive advantage. They are the first one to adapt to the new changes and are ready to accept any new challenge and implement it in their organization to have an advantage over their competitors.

Pragmatists: The process of the adoption of the technology should be simple, easy and without any hassle. This new innovation should ensure the improvement of productivity and performance of that particular business by improving day to day operations.

Conservatives: This segment according to the law are a group of people who will always wait and evaluate whether the technology will bring desired benefits. This group will never

adopt the new technology until it is easy to be incorporated and already brought benefits to the existing adopters. This group of people want to assess whether the use of technology will reduce cost, improve efficiency and productivity until then they will wait and assess the situation.

Skeptics: This group of segment will always have reservations about the technology. They will always be the last one to adopt the technology when they have no other choice left. This group feel comfortable in using the old technology and feel uncomfortable to any change process.

According to Moore's law the main difference between the visionary and pragmatist is very big and it is so critical that is the reason it is known as "chasm" as the difference are not repairable. Due to chasm there can be a very serious decrease the adoption of the technology as new customers are not using the technology as the new visionary are not using the technology. The pragmatist will adopt the new technology without any other pragmatist use the technology. This group sees the benefits of the technology for the business and ready to use the technology. Followed by conservative group they think wait and don't adopt the technology until they are sure that the technology is easy to use and will bring no problems to the organization. The laggards or also knowns as skeptics who will be worried with the adoption of the technology. They don't like the change process and want to stay with the old technology and old ways. They are forced to adapt to this new technology when left with no other options.

Identifying the Disruptive Technologies and its impact

The disruptive technology will have a far reaching impact economically, socially and all relevant fields. These disruptive technologies will have impact on scientific discipline, commerce, health, education and all other sectors. These disruptive technologies have four characteristics such as high rate of technological change, wide scope of impact on all sectors and society, large economic values and major potential for disruptive economic impact. In the following section the focus will be on the characteristic of disruptive technologies that will drive significant changes and bring economic development at a very large scale.

Technology is rapidly advancing

The disruptive technologies shows a rapid and fast rate of change in terms of capabilities, price, performance and its use. The technology initiates growth and rapid rate of change and adds value to the process. The disruptive technology that is rapid advancing can be Gene-sequencing technology that is more advancing then the computer processing power and can become very cheap desktop machines. These advanced material technology is experiencing a major breakthrough such as the first artificial production of graphene in 2004 and then IBM making the first ever graphene-based integrated circuit in 2011.

Potential Scope of Broad Impact

The innovation technology can only be disruptive in nature and be economically disruptive it should have a far reaching impact across various industries, organizations and influence range of machines, services and people. The mobile Internet is the best example which has a far reaching impact more than 5 billion people around the world and these people lives will be changed as using the mobile phone they can become innovators and entrepreneurs using the technology. The other technology that will have disruption and have impact on all industries is known as Internet of Things technology which will be able to integrate smart intelligence in billions of these electronic devices that will affect all sectors such as health, manufacturing industry and safety of billions of people.

Major Economic Value

The technology can only be disruptive if it brings economic impact at a very large scale. The value of the disruption has massive impact on the profit value of the project, For example the use of advanced robotics the potential impact is more than $6.3 trillion dollar whereas Cloud Computing industry can improve productivity and efficiency more than $3 trillion dollars. These technology have a major economic impact and are considered as disruptive technology.

Economic Impact Creates Disruption

These technologies can change the lives of people who they do work, live or perform day to day activities. Next-generation genomics has the potential to change how doctors diagnose and treat cancer treatments that will extend lives give cure to various disease. The advanced oil and gas exploration techniques will change the traditional methods of oil and gas explorations and will generate economic development at a very large scale. These technologies are considered as disruptive technologies have far reaching impact.

Disruptive Digital Innovation and its Impact on Society

The following section will discuss in-detail the twelve most disruptive innovation technologies and its impact on the societies across the world. The section will discussed in-detail the speed, scope and economic value for these twelve potentially economic disruptive technologies and its global impact.

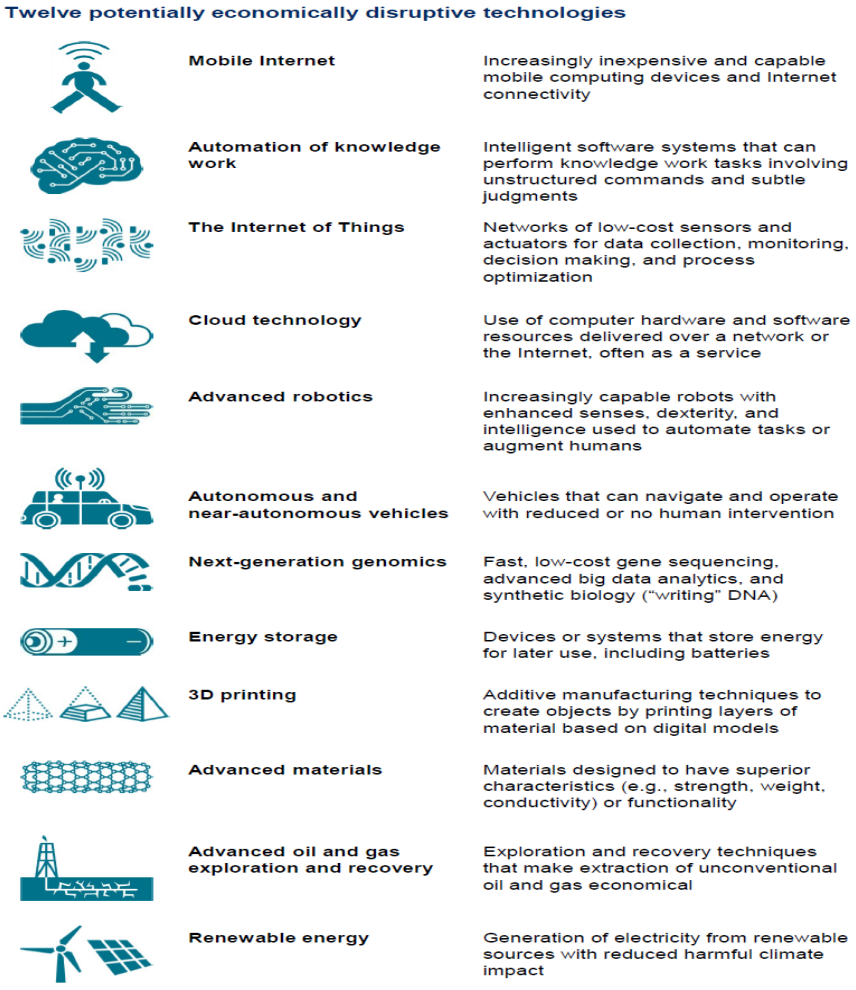

Figure 5: Disruptive Technologies (Mckinsey Global Institute Analysis, 2016)

Mobile Internet

In the last decade, the Internet connected devices have seen a massive growth and became an essential part of life. These devices has allowed people and business to remain connected to each other across the world. According to Mckinsey Global Institution, 2013, in US alone 30 percent of web browsing and more than 40 percent of social media will be access by mobile devices. According to the report produced the wireless access using mobile will exceed in numbers as compared to the wired access. The mobile Internet has seen massive rate of technology improvements and diffusion according to the report produced by the Mckinsey. The price of the fastest supercomputers in 1975 was nearly $5 million as compared to iPhone 5 that is $400 but they have the same level of performance. The growth and sales of smartphones since there launched in 2007 has seen more than 6 times growth. More than 4.3 billion people around the world are connected using mobile Internet and nearly 40% of global workforce that is 1 billion workers are using mobile Internet for daily transactions. The economic value that is related to Internet is $1.7 trillion GDP is related to the Internet.

Cloud Technology

The cloud technology provides an alternative mode of communication that is delivered of the Internet. The IT resources such as computation and storage are provisioned according to the client's requirements. Whenever extra resources are required they are added without the client knowing anything. Due to cloud there is an explosive growth of Internet-based services from searching to streaming media and allow more business to startup without investing any major upfront investment. The cloud is improving the economics of IT companies and saving large amount of money and at the same time provides greater flexibility and responsiveness. The technology relates to pay as you go model that provides an additional advantage and flexibility to the businesses. The cloud technology has seen massive technological improvement and diffusion where in 18 months' time the server performance per dollar is doubled. The cost of owning a server is 3 times more than rent it in cloud according to the report produced by Mckiney, 2013. More than 2 billion global users are using cloud based email services like Gmail, Yahoo and Hotmail. According to the

survey more than 80% of North American institutions are hosting or planning to host critical application on the cloud.

Cloud-based digital transformation can positively impact and shape the strategic objectives and position the organization with a competitive advantage. Cloud computing represents an innovative technological advancement which offer solutions to complex challenges these businesses are facing today (Ward, 2012; Lyer ad Henderson, 2012). The cloud computing concept is a collection of the existing and new advanced technologies which differentiate itself from the existing technologies by offering essential features such as rapid elasticity, measured service, broad network access, resource pooling and on-demand-self-service (Mell and Grance, 2017).

Cloud computing provides digital transformation by virtualizing the computational resources and concurrently provide them using various service model based on the client requirements (Lie et al., 2017). Business can securely modernize and mobilize their infrastructures to advance strategic missions. Businesses are using VMware (virtual machine software) solutions to move away from legacy IT systems to modernize infrastructure and cloud computing technology by consolidating data centers, reduce time-consuming operations and management tasks. The cloud technology is assisting the organizations to accelerate the digital transformation journey by enabling new modes of digital engagement and transform cybersecurity as shown in the following figure 6.

Figure 6: Digital Transformation in Government (McKinney, 2016)

Digital Transformation Journey with Cloud Technology

Businesses around the world are moving towards the digital transformation with the assistance of cloud technology. In U.S Federal data centers have large legacy assets have decided to explore different cloud computing approaches. The directive issued with the government in 2010 is directed to close inefficient and underutilized Federal data centers and many U.S government agencies have moved to server virtualization and VMware to reduce the infrastructure cost and improve the services offered. With the use of cloud technology the U.S government is successfully adapting the digital transformation by meeting the optimization goals, cost saving targets, maintaining the service level agreement, protecting the sensitive information and increasing he end-user mobility. Due to integration of cloud technology in the U.S Federal data centers, the optimization initiative was successful which automated monitoring, efficient management and achieved the cost reduction goals. The integration of cloud technology in a business is leading to digital transformation. The following section will explain how this digital transformation is taking place due to the integration of cloud computing technology.

Running Modern Apps

By using the cloud technology and virtualization businesses can modernize the applications and respond to any change in an effective manner. Using VMware, businesses can build, test and run modern application through container-optimized platform purpose-built for cloud-native applications or deploy on production-grade OpenStack while retaining security, control and performance of the data center. Using the VMware any business can execute any strategy without wasting any time using critical tested business application with high reliability, reduced cost resulting in improve productivity and efficiency.

Hybrid Cloud for Digital Transformation

Business have different requirements and sometime one cloud service delivery model doesn't fulfil the requirement to meet the digital transformational challenges. The Hybrid cloud environment involves two or more delivery models such as traditional data center and/or private cloud, a managed private cloud and a public cloud to meet the requirements. The hybrid cloud can automate the administrative tasks, provide self-service access to the

infrastructure and applications, and increase the scalability, availability and utilization of IT resources. This will transform the traditional IT into a services model that delivers flexibility and speed to market while lowering the operational costs. The hybrid cloud will help the business to digital transformation by reducing the operational cost and save more resources for digital reinvention. It ensures that the business is more agile, streamlines their operations and frees up the budget so corporations can focus on acquiring new customers, improving customer experiences and driving innovation. VMware will support hybrid cloud architecture, follow data protection regulations and provide flexibility and freedom from vendor lock-in. The cross-cloud architecture as shown from the following figure can enable consistent deployment model, enhance security policies, visibility and provide a comprehensive governance for all applications.

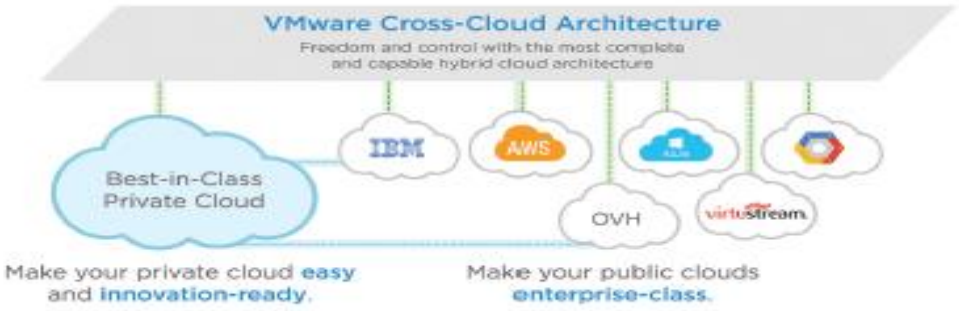

Figure 7: VMware Cross-Cloud Architecture

Increasing IT Automation

With the use of cloud computing technology business can automate IT tasks across various operational departments that will result in saving time and removing any complexities. VMware vRealize suite can provide comprehensive visibility through the dashboard which can allow to indicate any issues and prevent these before it becomes severe. The cloud technology will enable the cost metrics easily accessible so that the management can make their decisions about where to run specific workloads at maximum efficiency. VMware management solution will enable the IT teams to continuously monitor IT assets to enhance security, governance and compliance as well as better manage the life cycle infrastructure.

Securing Digital Workplace

The using of cloud technology is a major enabler to the digital transformation journey of any business as it provides data security, ensures Continuity of Operations (COOP), and allow secure exchange and manipulation of data. The cloud technology will allow secure desktops to prevent the any data breaches at the client side, secure apps and adhere by the data protection requirements. The cloud technology provides a secure workplace which brings more confidence in the technology and help to transform the business.

Anywhere, Anytime Accessibility

The use of cloud technology is helping the business to digitally transform and provide them with the opportunity to access resources and remain connected with each other anytime or anywhere they are. The business agility is increased by building an elastic cloud-based infrastructure with build intelligence to continuously re-invent to meet the ever-changing expectations and needs of the customers. The agility provided by the cloud computing technology will allow enterprise to be more resilient and adapt to the operational changes as a routine matter. The cloud technology provides more scalability to support on-demand capacity to meet the challenging demand of the market. For example Netflix, scalability provided by the cloud technology will meet the constantly varying subscriber demands for its movie streaming service and manage large capacity surges at the peak times without any issues. Digitization of businesses through cloud computing technology will provider easier anytime anywhere accessibility option. Mobile users can be on the move but using the cloud technology they can access important file, collaborate with other users and perform tasks real-time. For e.g. Xerox Cloud print solution enables workers to print any tasks using its cloud to access printers even if they are outside the organization. The other benefit of digitization using the cloud technology is the cost which is helping many businesses such as Etsy an online marketplace which compares data from billions of website monthly and offer personalized products recommendations to its users. The digital transformation was only possible due to integration of cloud computing technology. So the digitization through cloud technology is a key enabler for business to achieve a competitive advantage over their competitors. The cloud technology provide digital transformation on the run without any delay. It delivers the solution in real-time and helping businesses to expect long-term returns after successfully launching a product or services.

Internet of Things

The technology was a great innovation has changed the way we live our lives. The technology uses embedding sensors and actuator in machines and other physical objects to connect all devices together that will improve productivity, efficiency and improve human lives. The technology will enable to monitor the machines, flow or products, measuring the moisture in a field of crops and controlling the flow of water through the pipes. The remote monitoring can help to monitor the patient health with chronic illness. The rate of technology improvement and diffusion has seen 300% increase in connection from machine to machine in the last 5 years and there is around 80-90% price reduction of MEMS (Micro electromechanical systems) which is allowing more interconnection. The impact on various groups and products is immense as there are more than 1 trillion machines can be connected to the Internet across various industries such as manufacturing, healthcare and mining. There are more than 100 million machines to machines (M2M) devices connected across the transportation, security and utilities sectors according to the Mckinsey report.

Next-generation genomics

The next disruptive technology that is having a huge impact is next generation genomics that is trying to link the advances in science of sequencing and modifying the genetic material with the use of latest big data analytics capabilities. The technology has seen massive development and improvement as nowadays the genome can be designed in few hours for thousand dollars whereas it took 13 years and nearly $2.7 billion to achieve during the Human Genome Project. The rapid sequencing and advanced computing power is allowing the scientist to design the genetic variation with specific diseases without any error. The rate of technology improvement and diffusion is seen massive growth as in every 10 months' time it is doubling the sequence speed per dollar and overall seen 100% increase in genetically modified crops between 1996 and 2012, according to the Mckinsey Global Institute report.

Automation of Knowledge Work

There is advances in the artificial intelligence, machine learning and natural user interfaces that will allow automation of knowledge worker tasks that were impossible to think before. For example some computers can answer unstructured questions have sophisticated analytics tools to think, analyze and use knowledge to answer these questions. The rate of technology improvement and diffusion has seen 100 times increase computing power as compared to IBM's Deep Blue (chess champion in 1997) to Watson (Jeopardy winner in 2011). The technology is being used by more than 400 million users such as intelligent digital assistance such as Siri and Google in last 5 years. The impact of the technology is forecasted at $9+ trillion as the knowledge worker employment cost is 27% of global employment costs as mentioned by the Mckinsey Global Institute Report.

3D Printing

The use of 3D printing was a major innovation that has changed how the product can be designed. The 3D printing allows to go directly from the design to the finished project as ignoring a lot of traditional steps in the middle. It allows on-demand production and provide on-demand production. The rate of technology improvement and diffusion has seen 90% of lower prices for 3D printing as compared to 4 years ago and the use of technology has seen 4 times more revenue in the additive manufacturing in the past 10 years. The technology is used to produce 8 billion annual workers in Toys manufacturing globally and 320 million manufacturing workers that is 12% of global workforce is affected with the use of technology.

Renewable Energy

The renewable energy such as solar, wind and ocean wave can produce so much of power that is end-less and provide a consistent source of energy without the use of fossil fuels. In the last few decades the solar cell technology has been advanced as the cost of power produced by using the solar cells has reduce to $8 per watt. These renewable energy sources such as solar, wind are used in large scale in every big economy. There is 85% of lower prices in terms of solar photovoltaic cell per watt since 2000 and we have experienced

19 times growth in solar photovoltaic and wind generation capacity since 2000 according to the report produce by Mckinsey Global Institute.

Autonomous and near-autonomous vehicles

With the new innovation that is taking place it is possible for car, trucks, and boats to be completely autonomous. The drone aircraft, driverless cars and self-driven boats have reduce the cost and improve the ground transportation. The technology has having a far reaching impact as more 3 hundred thousand miles were driven by Google autonomous cars that is changing our lives.

Big Data Analytics

The cloud technology can be extremely useful technology in order to support big data processing for complex research as it provides compute resources that are based on demand of the end-users. In order to meet these demands the Newcastle University in UK has adopted cloud computing technology to support the research projects. The University has more than (20 Million Pound) research projects and it requires processing and transferring of large bulk of data from lab to the cloud to carry out detail analysis. For big data analysis the cloud technology provides the platform that can process and analyze the data effectively and support the research that are data intensive.

Advanced Robotics

The advanced robots are gaining more popularity in the business world as they are equipped with senses, dexterity, sensors, actuator and intelligence and this is due to advancements in the artificial intelligence and machine to machine communication. These robots can be easier for workers to program and interact with. They can be more compact and adaptable, making it possible to deploy them safely alongside workers. There is 170% growth in the sales of advanced robotics between 2009 and 2011. The cost is 75-85% lower, of industrial robots. These robots can be used in millions of surgeries that are taken place and also help in manufacturing jobs.

Final remarks

The digital transformational journey of a business and its relationship with technology is evident. The main focus of digital transformation is concerned with the changes that digital technologies can bring about in a company's business model which will improve products or revamp the organizational structures and offer better productivity and efficiency.

Digital transformation providing a digital business leads to deeper and durable customer relationships, enhance flexibility, lower cost and higher profits. Due to disruptive technology all sectors of the businesses have faced massive change in the last decade or more. There is an evolution in the technology and businesses and industries were the major beneficiary of the disruptive technology.

The technological improvement led the way to economic growth globally. The widely usage of Internet and personal computers set the path to the new emerging disruptive technology. Technology can have a far reaching impact is it can transform the business and add value to the operation but with all benefits there will be disruption to each and every function of the business.

These disruptive technologies can have far reaching impact across different industries such as manufacturing, retail, finance, education, healthcare and academia. Disruptive technologies such as 3D printing can change the manufacturing industry with new product design, Big Data analytics will allow the detailed and insight view to the data to help the management to make knowledgeable decisions, Internet of things will provide connected and smart world with connection of smart devices.

The cloud computing model can allow business to start their operations without wasting anytime with a fraction of the cost and mobile apps will allow people to perform e-commerce from handheld device in the matter of minutes. These technologies can provide a competitive advantage and the decision makers need a better understand these technologies.

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