

# The world on your Palm: ‘An Implication for the Global Digital Supply Chain Economy’

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**Abstract**— *The emergence of the global corporation and the global supply chain has brought about parallel changes in today’s global economy; however, supply chain management has become ever more complex. In recent years, the ever-increasing technical complexity of standard consumer goods, combined with the ever-increasing size and depth of the global market, indicate that the connection between vendors and consumers is usually the link in the supply chain. The stampede to acquire new technologies and scientific innovations are an imperative. Businesses will have to reorganize and continue to modify their business-model to capture potential benefits on emerging technology with the risk of altering existing ones. Some disruptive Technologies include; mobile internet, internet of things, cloud, advance robotics, autonomous and near-autonomous vehicles, energy storage, and renewable energy, and advanced materials. Some of these technologies do in fact have the potential to disrupt the status quo, alter the way people live and work. Within the nature of things, technology will continue to change, but this will require strong structure and retraining. These changes, will update business models that will lead to truly the next big thing with a new mantra “adapt or perish.”*

**Keywords**— *Digital transformation, internet of things, disruptive technology, cloud computing, mobile technologies.*

## I. INTRODUCTION

The emergence of computers in the 20th century has enabled the evolution of new age technology. Today, advances in information systems, the globalization of markets, and the push toward sustainability (that is, performing activities in a manner that meets the needs of the present without compromising the ability of future generations to meet their own needs) continue to create challenges and opportunities that did not exist just a few years ago.(Bozarth, &Handfield. 2008).

In today’s globally connected and dynamic markets, companies are making every effort to improve their organizational competitiveness to achieve a sustainable

competitive advantage while meeting the changing global market requirement. Improvements in information technology have continuously facilitated business processes by enabling physical, information, and monetary (financial) flows across business organizations and with business partners. (Bozarth& Handfield, 2008). This improvement in information technology (IT) has reduced the cost and time required for business processes, creating competitive advantages for businesses that know how to use it. The increasing scope of business diversification (facilitated by IT) has led to globalization issues such that businesses now have to deal with highly diversified customer groups with different preferences, living within different cultural contexts. (Briggs, 2015).

Technology is the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society and the environment.

Innovations in information technology are radically changing the way people around the globe live, communicate and work. The economic, social, and political benefits of new information technologies, such as internet and wireless telecommunications are by far the most publicly visible forms, are changing the relative competitiveness of nations as access to those technologies spreads rapidly around the globe. (Gaspar et.al 2017). The emergence of information and communication technology (ICT), such as Electronic Data Interchange (EDI), Radio Frequency Identification (RFID), the Internet, World Wide Web (WWW) and other range of related e-business technologies, has created new opportunities and threats to logistics and supply chain performance. The effective use of Information Technology in the supply chain is its ability to share information within the supply chain partners. (Briggs, C.A. 2015).

The term disruptive innovation was introduced originally as ‘*disruptive technology*’ in Christensen’s seminal work ‘The Innovator’s Dilemma’ (1997). Later, in 2003, Christensen and Raynor modified the term to *disruptive innovation* that included several technological innovations in service and business models such as low-cost airlines and discount

stores. Joseph Schumpeter first introduced the phrase disruptive technology in 1942 as “creative destruction, a process where radical innovations create major disruptive changes in a market or in a whole industry.

There are two distinct categories of technology: sustaining and disruptive technologies. According to business dictionary, disruptive technology is the “new ways of doing things that disrupt or overturn the traditional business methods and practices. Disruptive technology is expressed as a completely new technology or new ways of doing things that replaces or disrupts an existing technology or overturns a business traditional methods and practices. While sustaining technologies are technologies that enhance the performance of a product. Bower, J. L., & Christensen, C. M. (1996). Indeed, Bower & Christensen, further posit that, although disruptive technologies are the problems of large companies, most large companies are familiar with sustaining technologies and are inclined in turning sustaining technologies into accomplishments.

The real threat and opportunity in technology’s disruption lies in the evolution of customer and employee behavior, values, and expectations. “A disruptive technology is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry”. (Solas B. 2014). Technology represents new ways of doing things, and, once mastered, creates lasting change, which businesses and cultures do not “unlearn.” Adopted technology becomes embodied in capital, whether physical or human, and it allows economies to create more value with less input. At the same time, technology often disrupts, supplanting older ways of doing things and rendering old skills and organizational approaches irrelevant.

When IT is adopted or implemented correctly, in supporting the supply chain processes, it provides some potential benefit. Firms and or organizations that integrated some IT enablers have enjoyed the benefits of the integration with other supply chain partners, therefore gaining competitive advantages over those who have not incorporated such integration. For the globally connected and competitive market, the use of information technology (IT) is becoming an effective paradigm. Therefore, to coordinate and synchronize supply chain, firms need information and communication technology as an enabler to achieve a higher level of supply chain efficiency. (Briggs, C (2015). Despite the widely accepted use and acknowledgement of the importance of IT for efficient supply chain management (SCM), the actual disruptive nature of IT in specific functions in the supply chain is still not fully explored.

Most of the study is confined to published reviews of relevant literature on disruptive information technology in organizational setting across global supply chain. Indeed, the concepts of information technology in supply chain keep changing due to advances/innovations in technology.

## II. THE ORETICAL FOUNDATION

In today’s information age, to be adaptive, organizations must meet an essential criterion for processing information from an environment; they must be able to translate apparent noise into meaning faster than it arrives. As both noise and potentially meaningful data arrive faster and faster, complex organizations in complex environments need help to sense and interpret event quickly (Haeckel, 1999). Coyle et.al (2009), assert that information must be accessible, relevant, accurate, timely and transferable across the supply chain. Therefore, getting the right information to the right partners, in the right quantity, in the right format at the right place at the right time and the right cost makes information quality valuable to the effective management of the supply chain.

Going beyond how machines, people, processes, and things connect with each other, some businesses are proving that the Digital Economy is flipping the business world upside-down. According to The Economist Intelligence Unit (EIU) study, 59% worldwide cite embracing hyper connectivity as an imperative for keeping pace with changing market demands – and 69% claim that failure to adapt brings considerable risk and lost opportunities. The Economist (2015).

For the globally connected and competitive market, the use of information technology (IT) is becoming an effective paradigm. Therefore, to coordinate and synchronize supply chain, firms need information and communication technology as an enabler to achieve a higher level of supply chain efficiency. The absence of coordination and synchronization across supply chain members could lead to inadequate performance, therefore adopting information and communication technology (ICT) as an enabler will reduce the inadequacies and inefficiencies that relates to poor information processing and sharing. (Briggs, C.A. 2015). Information and communication technology (ICT) is a key enabler of innovation in the transport and logistics service industry. Investment in ICT by logistics providers is usually triggered by specific requests from customers, who are aware that increased performance of their logistics providers will benefit the logistics performance of the entire supply chain Selhofer, et al (2012).

Technological advances, especially the mobile platforms and the Internet have pushed the global boundaries of convenience. For example, the number of mobile phones that can access the internet has been growing at a phenomenal rate, especially in the developing world. The potential for mobile Internet service remain enormous. Mobile web-browsing has been growing the fastest in developing countries, including Nigeria, India, and South Africa. Because of market saturation in developed economies, the majority of users will be from developing countries and they will connect to the internet via wireless networks. The evolution of IT has brought about more profound social change in developing economies such as web-banking and web-commerce, which enhances worker productivity and economic efficiency, Gaspar et.al (2017). Indeed getting things done quickly is an imperative and service industries are impacted more and more by the consumer experience.

Digital transformation is no longer an option – it is an imperative. Billions of people are using social and digital communities to provide services, share insights, and engage in commerce. All the while, new channels for engaging with customers are created, and new ways for making better use of resources are emerging. These communities allow companies to not only give customers what they want, but also align efforts across the business network to maximize value potential. To seize the opportunities ahead, businesses must go beyond sensors, Big Data, analytics, and social media. More important, they need to reinvent themselves in a manner that is compatible with an increasingly digital world and its inhabitants (a.k.a. your consumers).

Here are a few companies that understand the importance of digital transformation – and are reaping the rewards:

- Under Armour: Do not just sell shoes and apparel. They are connecting 38 million people on a digital platform. By focusing on this services side of the business, Under Armour is poised to become a lifestyle advisor and health consultant, using his product side as the enabler.
- Port of Hamburg: Europe's second-largest port is keeping carrier trucks and ships productive around the clock. By fusing facility, weather, and traffic conditions with vehicle availability and shipment schedules, the Port increased container-handling capacity by 178% without expanding its physical space.
- Haier Asia: An electronics and home appliances company decided to disrupt itself before someone else did. The company used a two-prong approach to

digital transformation to create a service-based model to seize the potential of changing consumer behaviors and accelerate product development.

- Uber: This startup darling is more than just a taxi service. It is transforming how urban logistics operates through a technology trifecta: Big Data, cloud, and mobile.
- American Society of Clinical Oncologists (ASCO): Nonprofit organizations also benefits from digital transformation. ASCO is transforming care for cancer patients worldwide by consolidating patient information with its CancerLinQ. By unlocking knowledge and value from the 97% of cancer patients who are not involved in clinical trials, healthcare providers can drive better, more data-driven decision making and outcomes. Feldman and Suppal (2015).

Mobile apps and social media have resulted in new levels of accessibility which translates into more achievable success." Hillenmayer & Salapatek, (2012). Social media has influenced the way we communicate. Industries today are feeling the effects of digital disruption and the need to develop innovative ways of adapting to the changes in information technology with strategic plans and management decisions. Digital technologies like the Internet of Things (IoT), Radio-Frequency Identification (RFID), driverless vehicles, drones, mobile technologies and cloud computing technology services are a few areas that will be explored in an effort to describe how technology have affected the development of supply chains. The integration of these tools can be complicated and delicate, but failure to adapt to the digital changes in the technological stage could alter the capabilities of supply chain adversely.

According to the McKinsey Global Institute, disruptive technologies are advances that will transform life, business, and the global economy and estimated that in 2025, the impact of 12 identified disruptive technologies would probably be 14 to 33 trillion dollars. Even though these technologies can work for some firms, it can fail in others. Digital technology is transforming the Supply Chain industry and companies across the globe are developing new ways to adjust to the digital evolution. Companies are beginning to realize that integration into the digital world is imperative for their survival. According to Girn, (2014), Digital Disruption is "about innovating to break the ranks of status quo, it redefines the norm, and changes the markets and competitors around us. This comes through a relentless focus on the customer and offering new business models and new ways of applying technology. Companies with a

digital supply chain are better able to move resources, assets, people and inventory to where they are needed at any given time in order to reduce costs by responding proactively to transportation and manufacturing risks.

Companies today consider information technology (IT) as an effective tool to control and manage the complex supply chains as well as improving efficiency and logistic operations, while remaining responsive to changing customer demands and market situations. Advances in RFID and sensor technologies' ability to communicate with each other in a network environment are redefining the concept of visibility throughout the supply chain. These "sense and respond" networks can help improve the security, quality, and integrity of products moving through the supply chain. (Briggs, 2015).

### III. LITERATURE REVIEW

#### Defining Innovation

According to Tiwari (2008), (based on "Oslo Manual", 3rd edition, 2005), an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. Tiwari (2008), further identified four main types of innovation: product, process, marketing and organizational innovation.

1) A **product innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. Product innovations can utilize new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies.

2) A **process innovation** is the implementation of a new or significantly improved production or delivery

method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.

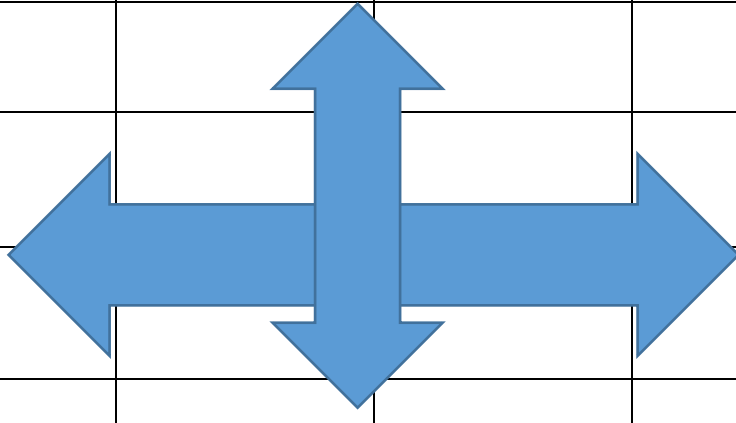
3) A **marketing innovation** is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.

4) An **organizational innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labor productivity), gaining access to non-tradable assets (such as non-codified external knowledge) or reducing cost of supplies. It is therefore possible to classify different innovations in an innovation framework, depending on:

(i) the type of innovation and (ii) the degree of novelty (see figure-1). The arrows in the matrix indicate that the borderlines between the different categories and layers can be blurred. An innovation can lean more towards one end or the other, but it may be difficult to place it exactly into one of the 16 cells. Whether the introduction of a completely new product (level 3 - 'new to the world') has 'disruptive' character (level 4) or not, may be subject to debate and only be fully understood in hindsight. Similarly, the launch of a new product may be linked with the introduction of new processes and marketing techniques, which makes it difficult to precisely place the innovation in the matrix. (Tiwari 2008).

Fig.1: Framework for classifying innovations (based on OECD Oslo Manual)

Type of Innovation	Novelty Degree	New to Firm	New to Market	New to World	Disruptive
Product Innovation					
Process Innovation					
Marketing Innovation					
Organizational Innovation					



Source: Adopted from, INNO-Grips – Global Review of Innovation Policy Studies  
<http://www.proinno-europe.eu/innogrips2>.

The point at which disruptive innovations start to challenge existing products is when the marginal utility of further improvements in the traditional performance criteria decreases.

The incumbents, including large companies, may fail to understand the early signals that indicate a technological shift as they are too focused on the current demand pattern of their leading customers. They place all their innovation efforts in continuously improving the performance in terms of the traditional criteria, to the extent that they ‘overachieve’. In the shadow of this race to be top dog, the disruptive technology starts to gain a foothold in other markets or areas of implementation (‘value networks’), often delivered by new entrants. Selhofer, et al (2012).

The functionality of the web has improved immensely since the mid-1990s with innovations (or disruption), driven by firms such as Amazon, eBay, Microsoft, Facebook, Google and Apple Chaffey et al., (2009), and Tapscott (2015). Information on webpages, whether it was a news report, message, blog, advertisement or film, could be disseminated around the world at little or no marginal cost (Tapscott, et.al 2000). The “innovator’s dilemma” is the difficult choice an established company faces when it has to choose between holding onto an existing market by doing the same thing a

bit better, or capturing new markets by embracing new technologies and adopting new business models

#### IV. DIGITAL ECONOMY LITERATURE

A regularly cited definition of digital economy is “The global network of economic and social activities that are enabled by digital technology, such as the internet, mobile and sensor networks” (Australian Government, (2013). The internet for example, from a supply chain perspective, offers potential opportunities for companies to reduce their supply chain costs and improve customer service. While these opportunities span most, if not all, logistics activities, the opportunities that have received the most attention to date include procurement, transportation scheduling, vehicle tracking, and customer services Lancioni R.A. (2000). Of particular interest to international logistics is the possible impact of the internet in terms of disintermediation and reintermediation. (Wood, F.D. et.al (2002). The importance of IT for business has continuously stimulated interest among researchers and business practitioners. The Internet, electronic commerce, electronic supply chain, World Wide Web, etc. is changing the ways firms are required to conduct business. Indeed competing firms are managing the flow of goods through an efficient distribution networks in some form of cost effective manner. Unlike changes



instigated by technological revolutions, such as electricity and the rail-road, which took decades to spread around the globe, the IT revolution has been relatively instantaneous. IT has helped to globalize the production of goods and services and has encouraged a freer flow of those items, including capital, across national boundaries. In fact IT acts as a catalyst in the globalization process by lowering operating cost. Gaspar et.al (2017).

However, Fishenden and Johnson (2014) also, defines digital disruption for government organizations as: “the transformation of the organizational model and culture, radical process change, accountabilities for citizens’ experience, new models of service delivery, real-time feedback, tangible operational efficiencies, measurable business value, and the use of data driven insight to improve and inform policy formulation”. Yet technology advancement continues to drive economic growth and, in some cases, unleash disruptive change. Economically disruptive technologies transforms the way we live and work, enable new business models, and provide an opening for new players to upset the established order. Business leaders and policy makers need to identify potentially disruptive technologies, and carefully consider their potential, before these technologies begin to exert their disruptive powers in the economy and society. Manyika et.al. McKinsey Global Institute (2013).

Studies show that most of the world’s supply chain leaders have embraced some of the key concepts of Digital Technology. They have come to understand that building digital processes and developing management solution process with implementation of new technologies is critical to the endurance of the entire supply chain. It is about being more efficient and doing away with waste while increasing customer satisfaction and profits. Digitization and the Internet of Things (IoT) are changing the world at an unprecedented rate. Companies looking to succeed in the emerging digital economy must transform themselves by reinventing their business models, strategies, processes, and practices. Digital economy is the economic activity that results from billions of everyday online connections among people, businesses, devices, data, and processes. Knowing how to manage, extract value, and make decisions based on those connections may seem daunting, but it’s a crucial executive task. “Success will depend entirely on how companies can transform themselves digitally to harvest the opportunities of this data-driven, hyperconnected environment,” Sharma,(2016).

The digital economy is driving disruption in four areas that business leaders must address:

**1) Employees:** Today’s youngest employees are driving the growing contingent-labor trend because they expect to be able to work remotely or hold multiple jobs simultaneously. Organizations must also develop next-generation digital business processes and train all employees to use them effectively, from anywhere, at any time.

**2) Customers:** Today’s B2B and B2C customers alike want companies to interact with them seamlessly, on demand, whenever and however it’s most convenient. They also crave direct, contextual, personalized experiences. That’s why all employees must be armed with the data they need to make real-time decisions. “The days of just selling a product and counting profits are gone, now, success is measured by customer loyalty, which must be earned every day.

**3) Suppliers:** To enable truly next-generation commerce, enterprises must securely capture, analyze, and share data in real time and at multiple points of contact.

**4) Assets:** The convergence of the physical and digital worlds brings every asset into the digital domain. “Organizations that understand both their physical and digital asset inventories can operate at new levels of precision, allowing them to better serve customers and quickly, effectively collaborate with both internal and external stakeholders,” Sharma (2016).

“Digital natives were all born after 1980 when social digital technologies became widely used; they all have access to networked digital technologies and they have the skills to use these.” (Palfrey and Gasse, 2008). According to a report based on a survey conducted by Global Contact Centre Benchmarking, people born between 1980 and 2000, also known as Generation Y, use their smartphones for texting and using apps more than they use it for talking. This report, which resulted from a survey of 817 organizations in 11 business sectors, and covered 79 countries from the Americas, Australia, Asia-Pacific, Middle East Africa, and Europe, suggests that Generation X (people born between 1960 and 1989) has preference gaps between phone, texting, and apps that are also becoming more narrow. While the Silent Generation (those born before 1944) and the Baby Boomers (those born between 1945 and 1960) still prefer to talk on the phone, the decline in “voice only” methods of communication lends support the use of devices that allow for more non-voice communication methods. Generation Y, whose members are now between 13 and 33 years old, are the biggest demographic group since the Baby Boomers. Generation Y is a group that is extremely social, incessantly connected, and highly demanding. They want to

get things done, and they want to use any device that will help them get it done. (Bremmen, 2013).

Millions of people around the globe uses internet and smart phones, indeed the user participation and publication on the internet have surged from blogs, podcasts, and interactive wikis to services for sharing photos and video clips. Social networking sites such as Facebook, LinkedIn, MySpace, and instant broadcasting sites such as Twitter, represent additional rapidly developing global frontiers of communication. (Gaspar et.al 2017).

Organizations that have succeeded in engaging with Generation Y know that, as well as accelerating the take-up of new digital technology, this generation poses additional challenges due to their evolving expectations. Generation Y are best thought of not as a uniform group but as an evolving mindset, and the demands and expectations of this group are trending upwards to older generations, which makes them all the more important to take note of. They are today the catalysts

and the incubators of change, but each day their influence is growing in consumer and corporate environments, meaning that organizations must learn to engage effectively now, or risk being shut out of the game. To attract these young people, both as consumers and as employees, a company cannot just look good – it has to be good.

Generation Y want it all, but above all they seek transparency. It is no longer possible to say one thing and be another, as the digital data trail means the new generation has the tools and methods to spread their opinion about a brand virally, and with untold consequences. This has significant implications for brand reputation management and customer loyalty. Generation Y want to

ensure that the organizations they engage with are authentic and not a hologram or mirage with a marketing ‘front’ that belies their reality. Authentic, direct and personal engagements are even more important than advertising to reach this generation. Above all, Generation Y are no longer content with the old corporate and political model. They seek transformational change, and where they cannot find it, they look to invent it themselves.

The proliferation of digital channels, platforms and devices has produced a generation who are born ‘plugged-in’. This ‘Generation Y’ already plays a major role in accelerating the emergence of a new, digital world, and their impact is impossible to ignore. Generation Y’s expectations are being formed by the technologies they surround themselves with. They adapt their lifestyles to each new technological invention and they won’t accept that the brands they interact with or employers they work for don’t do the same. Generation Y already constitutes a new category of consumers, citizens and employees who are digitally, globally and constantly connected. They are networked, collaborative and highly social. It is also Generation Y who are inventing the disruptive business models that challenge the status quo of existing organizations, as Mark Zuckerberg did with the invention of Facebook. In this way they are determining the way digital communication technologies are being used, and are initiating social behaviors that are transmitted to other generations. (Ernst & Young 2011).

Table 1, shows a handful of the most significant digital business model inventions of the last decade and the young minds behind these.

*Table.1: The young minds behind digital business model innovation*

Digital Business Model	Creator/inventor	Year of birth
<b>Facebook</b>	Social networking Mark Zuckerberg	1984
<b>Napster</b>	Peer to peer file sharing. Sean Parker	1979
<b>Spotify</b>	Digital music streaming. Daniel Ek	1983
<b>Skype</b>	VOIP telephone network. Janus Friis	1976
<b>Twitter</b>	Microblogging social network Jack Dorsey Jack Dorsey 1976	1976

Source: Ernst & Young research; *The young minds behind digital business model innovation*

Beginning in the late 1970s, the world began to change—and fast. The first online bulletin board system (or “BBS,” for short) let people with clunky computer equipment and access to telephone lines swap documents, read news online, and send one another messages. Usenet groups organized around topics of interest to communities of users, became popular in the early 1980s. E-mail began to enter

popular usage later in the 1980s. The World Wide Web made its debut in 1991, with easy-to-use browsers widely accessible a few years later. Search engines, portals, and e-commerce sites hit the scene in the late 1990s. By the turn of the millennium, the first social networks and blogs cropped up online. In 2001, Polaroid declared bankruptcy, just as sales of digital cameras started to take off. In 2006,

Tower Records liquidated its stores; by 2008, iTunes had become the largest music retailer in the United States.

In the early 2000's, up to 2006, BlackBerry had a stronghold on the smartphone market. Even with the advent of Apple's iPhone in 2007, at year's end, BlackBerry was comfortable with 10 million subscribers. Hill(2013). Blackberry, which had initially been popular among business people, had begun to reach outside of the business community, and by 2008, Blackberry enjoyed its most profitable year up to that point, at \$30.5 billion, in spite of Android's initial smartphone release that year. But Blackberry became complacent in its ability to keep their subscribers on board; they were, after all, the best when it came to email and messaging. Blackberry was the best at doing what they were known for; however, with the iPhone and Android phones came something that Blackberry failed to adapt to: mobile applications, or apps. Where Apple and Google (makers of the Android operating system) encouraged developers to create apps for their platforms, Blackberry did not. In the early days of iPhone and Android phones, it seemed to some, and especially to die-hard Blackberry loyalists, that apps were gimmicky, unnecessary, and useless (Abeywardena 2013). Blackberry failed to develop partnerships with businesses that could benefit from having their apps at the fingertips of Blackberry's millions of subscribers. They also failed to realize how apps could allow users to personalize their phones to do what they needed them to do. Apple and Android each have over 800,000 free or paid apps available for users to download, while Blackberry has 250,000. The number of available apps is important, but even more important is the number of apps that people purchase, download, and actually use (Warren, 2013).

In 2013, Apple registered its 50 billionth app download, and Android users are downloading 500 million more apps per month than Apple Warman (2013). While Apple and Google enjoy profits from selling wildly popular smartphones and charting billions of app downloads, this quarter Blackberry is reporting losses of \$1 billion, has plans to layoff 4,500 employees, which represents about 40% of its workforce, and is considering a buyout offer made by an insurance and investment company (Austen & Gelles 2013). A big part of the reason that Blackberry is failing is that it did not anticipate that so many people would eventually be using their smartphones to do so many other things besides email and messaging.

Indeed, smartphones have been one of the success stories of the last decade. In a relatively short period of time, smart mobile technology has penetrated significantly into society,

capturing an entire age spectrum of subscribers in western industrialized nations, from school children to senior citizens. Such progress has built upon a long history of the use of communication devices, and a rapid adoption of mobile communication devices that began in the latter part of the last century. According to (Traxler 2008), such rapid uptake in mobile phone ownership has transformed many aspects of our lives, both in the Western world and just about everywhere else around the globe. It is impacting, he suggests, not only on the manner in which we communicate, but also on our sense of culture, community, identity and relationships. Mobile phones appear therefore to be at the vanguard of a cultural shift where users are encouraged to constantly seek out new information and make connections with increasingly dispersed media content. (Jenkins 2006). Whilst the demographic statistics may vary from country to country, the smartphone is a phenomenon that is here to stay, and one which will rapidly progress in its evolution in the years to come. There is therefore great scope to harness the potential of mobile telephony to improve many aspects of society, including healthcare. Whilst the demographic statistics may vary from country to country, the smartphone is a phenomenon that is here to stay, and one which will rapidly progress in its evolution in the years to come.

The potential for the creation of simple and easy to download apps for smartphones has created a vibrant new industry. There is now an app for just about every social, entertainment and educational requirement (Mobile futures 2010). Some smartphones, such as the Blackberry, also incorporate small internal keyboards in their designs. Recently, Apple's iPhone and Google's Android touch screen devices have increased smartphone ownership. They are popular because of their intuitive and tactile graphical user interfaces and natural gesture control. The latest generation of smartphones are increasingly viewed as handheld computers rather than as phones, due to their powerful on-board computing capability, capacious memories, large screens and open operating systems that encourage application development. The existence of mobile phone had provided an essential 'any time, any place' portal into the entire world wide web of knowledge. Such continuous and pervasive social connectivity has important implications for society, and holds a lot of potential in particular for use in education, healthcare and medicine (Boulos, et.al. 2011).

In the global market, there are over 1.1 billion subscriptions. As more countries upgrade their wireless networks, consumers are spending much more time using their mobile devices. One main reason for this increase in



usage is the proliferation of mobile apps (Garg & Telang, 2013). Mobile applications, or apps, are software applications designed for use on smart phones, tablets, and other mobile devices that have operating systems that support standalone software. The owners of the various mobile operating systems typically manage and operate mobile distribution platforms. Apple has its App Store, Google has Google Play, Windows has the Windows Phone Store, and Blackberry has App World. Some apps may come preloaded on a mobile device, and many more are available for download from the app stores and sometimes from the Internet. Many mobile apps provide a means for consumers to connect to Internet services that would otherwise need a desktop or notebook computer to access. (Hsiu-Yu, et.al (2013).

In 2002 Research in Motion (RIM) produced the first smartphone that put wireless email at the fingertips of its users. The BlackBerry brand became the desire of many businessmen and businesswoman because it optimized the process of sending and receiving emails and scheduling appointments. In 2006 the BlackBerry Pearl was introduced. The Pearl had a sleeker look than the previous models, but what made it extremely popular among the general population was that it was the first BlackBerry that had a camera and media player. ("The Evolution of Smartphones," 2013). It wasn't until the introduction of Apple's iPhone in 2007, however, that smartphones became the desire of the mass market. The first generation iPhone was a phone, mp3 player, and all around computing device with the first multi-touch screen. With the introduction of the iPhone 3G, the operating system (Apple's iOS) starting supporting third party applications, better known as apps, had better connectivity, and had a longer battery life. ("Evolution of the iPhone: from iPhone to iPhone 5," 2012). In 2008, the HTC was released as the first smartphone having Google's Android operating system. Both Apple and Google opened their application distribution platforms in 2008, the App Store and the Android Market, respectively. The Android Market has changed from simply a place to buy apps to a full entertainment hub, much like Apple's iTunes, and in 2012 was launched as Google Play. If success is measured as the number of apps downloaded from a particular distribution platform, then Google wins. But if the measure of success is the dollars in revenue, then Apple wins. Put succinctly, Apple offers more apps than Google offers, but Google offers more free apps than Apple offers. (Yackulic, 2013). Consumers are often frustrated with the in-app-purchases in free apps because many times the in-app-purchases cost more than the consumer would

have been willing to pay for the app if the app had come with a price. App developers and the app stores do make money from free apps through the sale of in-app-purchases. (Tucker, 2013). Mobile apps have revolutionized the way that people communicate and interact with each other. Also, because of mobile apps, some companies have marketed themselves and have obtained new streams of revenue for themselves and for software developers who build businesses by developing apps. ("Mobile apps for business grow as smartphones and apps influence the ways consumers shop", 2013). A 2012 study by Comscore found that people used the apps on their phone more than they used their phone to browse the web online. The most popular apps are for games, entertainment, and education, but consumers and businesses have not used apps to their full capabilities.

According to a global study by business consultancy firm CapGemini, only 8% of companies are using mobile technologies to engage their customers and improve the customer experience, while about 14% use apps as part of their operations Mochiko, (2013). Although relatively few companies offer an app as part of their mobile service portfolio, more and more the consumers are expecting such offerings because they are spending more and more time on their mobile devices for such activities as: sharing information, shopping, communicating with friends and family, and sharing through social media. ("How can mobile apps evolve to remain an effective tool for brand building?" 2013).

Major brands and small businesses that create an app presence must do so by creating relevant and useful mobile experiences that give consumers reasons to keep coming back. ("How can mobile apps evolve to remain an effective tool for brand building?" 2013). Grocery shopping is another activity that lends itself to a mobile app. As the number of working parents increases, more people are using mobile apps for grocery shopping. Mobile apps by big brand companies such as E-Mart, Lotte Mart, and Homeplus have had 3.02 million downloads. For example, between January and July 2013, E-Mart experienced a 13-fold increase in its user base, and Homeplus has had a 20-fold increase. The fact that a consumer cannot physically check the items purchased through a grocery app is a downside, but for items that are purchased often, mobile shopping is very handy. (Kim, 2013)

To be successful, an app must meet specific user needs or solve user problems in ways that make life easier. Even businesses use other businesses' mobile apps in their daily operations. According to an AT&T Small Business

Technology Poll, one-third of small businesses have found that using apps saves time, increases productivity, and reduces costs. ("Small Business: apps put the office in your pocket," 2013). These small businesses are using mobile apps for such activities as navigation, document management, and accepting mobile payments in the field. Also, because more than two-thirds of the surveyed small businesses use tablet computers, more and more they are in need of applications that help them run their businesses. ("Small Business: apps put the office in your pocket," 2013).

But what should small businesses consider before investing in the creation of an app for their own business. Companies that wish to provide an app presence for their users would do better to create mobile apps that focus their dollars on creating apps that do the following:

- Add convenience - such as banks, who have apps that allow customers to access account information and even conduct some transactions; most airlines also offer apps for allowing customers to monitor flight statuses and perform mobile check-ins;
- Offer unique value - for instance, by offering capabilities that are not offered by a desktop computer, like using QR codes for scanning items when shopping; Nike has its Nike+ app that works along with a special computer chip in a runner's shoes to monitor distance, speed, and the number of calories burned;
- Provide social value - like Facebook, which registered its billionth user in October 2012, and which is one of the most used apps in the world; some companies offer social gifting (the purchase of gift cards) through their apps and through connecting their apps to social media;
- Offer incentives - such as using promotions to entice mobile users to try their product;
- Entertain - by building games, competitions, and giveaways around their brand. After all, more than 40% of the app time used by smartphone owners is spent playing games, and an even greater percentage of time for tablet users. (Gupta, 2013).

According to Diamandis and Kotler (2016), when something is digitized it begins to behave like an information technology. The structure of organizations is changing. Instead of thousands of employees and large physical plants, modern start-ups are small organizations focused on information technologies. They dematerialize what was once physical and create new products and revenue streams in months, sometimes weeks. It no longer

takes a huge corporation to have a huge impact. The secret to positively impacting the lives of millions of people is understanding and internalizing the growth cycle of digital technologies. Diamandis and Kotler, six key steps of the growth cycle (the Six D's of exponentials) are: digitization, deception, disruption, demonetization, dematerialization, and democratization.

- Digitization: Anything that becomes digitized enters the same exponential growth in computing. Digital information is easy to access, share, and distribute. Once something can be represented in ones and zeros—from music to biotechnology—it becomes an information-based technology and enters exponential growth.
- Deceptive: When something starts being digitized, its initial period of growth is deceptive because exponential trends don't seem to grow fast at first.
- Disruptive: The existing market for a product or service is disrupted by the new market the exponential technology creates because digital technologies outperform in effectiveness and cost. Once you can stream music on your phone, why buy CD's? If you can also snap, store, and share photographs, why buy a camera and film.
- Money is increasingly removed from the equation as technology becomes cheaper. Software is less expensive to produce than hardware and copies are virtually free. You can now download any number of apps on your phone to access terabytes of information and enjoy a multitude of services at cost approaching zero.
- Dematerialized: Separate physical products are removed from the equation. Technologies that were once bulky or expensive, such as radio, camera, GPS, video, phones, and maps are now all in a smartphone that fits in your pocket.
- Democratized: Once something is digitized, more people can have access to it. Powerful technologies are no longer only for governments, large organizations, or the wealthy.

These Diamandis's 6Ds are critical to understanding and planning for this disruption.

Today, most young people in many societies around the world carry mobile devices—cell phones, Sidekicks, iPhones—at all times, and these devices don't just make phone calls; they also send text messages, surf the Internet, and download music. For these young people, new digital technologies—computers, cell phones, Sidekicks—are

primary mediators of human-to-human connections. They have created a 24/7 network that blends the human with the technical to a degree we haven't experienced before, and it is transforming human relationships in fundamental ways. (Palfree, and Gasser. 2008).

## V. CONCEPT OF DISRUPTIVE INNOVATION & TECHNOLOGY

Invisible technology is not a technology that we can see but use it without realizing you are using it, while disruptive technologies mean new technologies that still lack refinement, often have performance problems, are just known to a limited public, and might not yet have a proven practical application. "Technology is disrupting traditional industrial processes, and they're never going back. This disruption is filled with opportunity for forward-thinking entrepreneurs. Ramirez(2016).

With the introduction of the first commonly used commercial websites in the 1990s, digital technology brought a new level of convenience to customers. However, digital convenience came at the expense of meaningful engagement as digital transactions substituted physical interactions. In addition, digital channels developed in isolation, results in inconsistency and dislocation between digital and physical channels. Table 2 below, specifies the existence of new technologies that make it easier than ever before for companies to bring channels together, and to deliver a consistent engagement model whether customers choose to 'tweet' or to take their feet to the street. Innovative companies are taking the elements of each channel that their customers value most, and combining them to deliver a more valuable experience overall. (Ernst and Young 2011).

*Table.2:How emerging technologies can be used for physical/digital channel integration*

Example technology	Use for channel integration
Location based services	Services to digitally identify a physical location of a person or object (e.g nearest ATM). Also used to replace coupons for advertising to customers based on their actual physical location.
QR Coding	Allows users to scan a physical object (paper or building wall) and access further information in a digital fashion on their mobile.
Augmented reality	Information about the surrounding real world of the user becomes interactive when viewed through a digital screen. Often used to make sports spectatorship interactive.
Electronic paper	A computer that feels and operates like a thin sheet of paper which can interpret text written directly onto it.

*Adopted from Ernst and Young. (2011). The Digitization of Everything: How Organizations must adapt to changing customer behavior.*

Digital transformation is the calculated efforts to adjust to disruptive technologies and how it's affecting consumer and employee performance. Companies have to adapt to the technological advances as the world evolves and they have to integrate that with past ideologies to remain in business. Business transformation with technology is a constant chase. Companies are reversing engineering investments, processes, and other system to better support with the market and its changes (Rouse, 2014). Digital transformation is making businesses become more human-like and interacting with its audience. Indeed, most businesses today are doing this through mobile social site,

mapping and understanding customer experience, vision and supportive leadership. Interestingly, these companies are being more cooperative and engaging more in consumer engagement to give great customer service and to eliminate gaps and overlaps in consumer needs. (Solis, 2015).

Figure 2, shows how the engagement model has changed to date, and how it may evolve in the future. To get this right will require an agile strategy that means incorporating the latest technology as it is released, and adopting a test and learn approach. Companies should adopt a continuous improvement strategy, launching new digital channels early and iterating based on customer feedback.

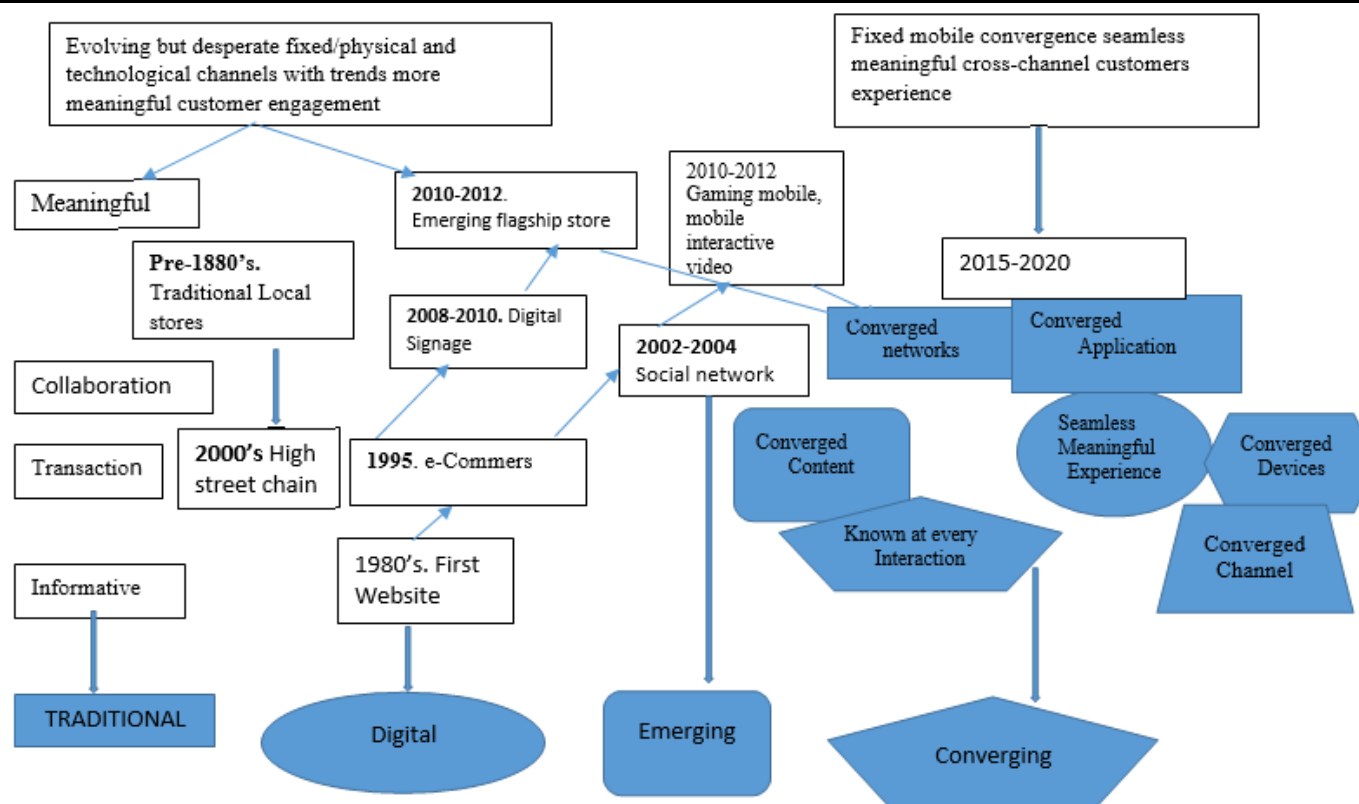


Figure.2: How engagement is changing over time

Source: Ernst & Young (2011). *The Digitization of Everything: How Organizations must adapt to changing customer behavior.*

Most companies understand the need to respond and adapt to the evolving use of technology by their customers and other key stakeholders. What they do not realize is how little time they have to address these changes. Indeed, the rate of technology adoption should continue to accelerate so that each new technology outpaces the adoption of its predecessor, and the future will see adoption rates measured in weeks and days rather than years. Google+, the new social media tool from Google took only 16 days to reach 10 million users, compared with 780 days for Twitter and 852 days for Facebook. It took 10 years for the internet to become a basic and essential part of daily life. The future will happen much faster than that. (Ernst & Young 2011). To succeed in the digital world requires embracing innovation and identifying new engagement models and new business models. It requires grasping new opportunities that exist outside traditional markets and looking for the tools that will differentiate between the mere suppliers and the 'lifestyle partners' of the digital age (Ernst & Young 2011).

Partly because of disruptive innovation, the average job tenure for the CEO of a Fortune 500 company has halved from ten years in 2000 to less than five years today. There is good reason to think that the pace of change will increase, as computer power increases and more things are attached to the internet, expanding its disruptive influence into new realms. Google promises to reinvent cars as autonomous vehicles; Amazon promises to reinvent shopping (again) using drones; 3D printing could disrupt manufacturing. But perhaps the most surprising disruptive innovations will come from bottom-of-the-pyramid entrepreneurs who are inventing new ways of delivering education and health-care for a fraction of the cost of current market leaders. (The Economist 2015). McKinsey Global Institute, in its May 2013 publication estimate that, by the year 2025 the global economic impact of disruptive technology will be between \$14 to \$33 trillion.

Twelve potentially disruptive technologies as identified by McKinsey Global Institute are shown in table 3.

Table.3: Twelve potentially economically disruptive technology.

<b>Mobile Internet</b>	Increasingly inexpensive and capable mobile computing devices and Internet connectivity
<b>Automation of knowledge work</b>	Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments
<b>The Internet of Things</b>	Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization
<b>Cloud technology</b>	Use of computer hardware and software resources delivered over a network or the Internet, often as a service
<b>Advanced robotics</b>	Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans
<b>Autonomous and near-autonomous vehicles</b>	Vehicles that can navigate and operate with reduced or no human intervention
<b>Next-generation genomics</b>	Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology ("writing" DNA
<b>Energy storage</b>	Devices or systems that store energy for later use, including batteries
<b>3D printing</b>	Additive manufacturing techniques to create objects by printing layers of material based on digital models
<b>Advanced materials</b>	Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality
<b>Advanced oil and gas exploration and recovery</b>	Exploration and recovery techniques that make extraction of unconventional oil and gas economical
<b>Renewable energy</b>	Generation of electricity from renewable sources with reduced harmful climate impact

SOURCE: McKinsey Global Institute analysis; (2013). "Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy." Technology | Digital McKinsey.

There are many types of disruptive technologies. Emails have transformed the way to communicate and substitute for letter-writing, and have caused a disruption to the postal and greeting card industries. Cell phones have disrupted the telecom industries and made it possible for people to make calls to anyone, anywhere at any time. Laptop and mobile computing has made it easier to for people to connect to corporate networks and work together from anywhere, replacing desktops. Smartphones have replaced PDAs and cell phones because of the applications; they are also replaced MP3 players, calculators and GPS devices. Traditionally hosted services have been disrupted by Cloud computing. Cloud computing has taken the business world by storm(Rouse, 2014).Several recent innovations in the consumer market today include: wearables, driverless

vehicles and drones, and exponential energy. Wearables such as Fit bit and June bracelet are body worn devices that enables sensing, collection and transmission of data to and from the body of the user; to some network through the internet, sometimes referred to as the 'internet of you'. Table 4 below highlight some wireless electronic devices use to gathering useful data about people. They range from fitness products to connected eyewear. Wearables are becoming a disruptive technology to the healthcare industry. Fit Bits and the June bracelet are disrupting the healthcare industry as they helping people become more concerned with their health while having fun with the wearables. Most of the data from these devices can be saved onto a PDF data file and printed out for use during medical checkups.

Table.4: Some Wearable Wireless Device; "Internet of you"

Types	Uses
OMSignal	OMShirt--- (gathers biometric data)
Jawbone	Up24 wireless wrist-band activity tracker
OMG Life	Autographer—wearable camera
Google research stage	Glucose-sensing wireless contact lens
Proteus Biomedical research stage	Battery-powered drugs.

Source: Rachel Metz (2014). Some wireless electronic devices are gathering useful data about people. MIT Technology Review.

<https://www.technologyreview.com/s/527386/the-internet-of-you/>



In the automotive industry, innovation trends are determined and driven by global macroeconomic forces of development that impacts business, economy, society, culture and personal lives. For example, the shortage of raw materials and possible climate change creates challenges for the automobile industry's technological innovation and the supply-chain.

Driverless vehicles and drones may be beneficial in reducing traffic, greater energy efficiency, benefits law enforcement, and oil companies. These technologies may provide a network that manages the transportation of goods around the globe with smaller and less specialized personnel and will allow companies in a supply chain to increase customer demands and provide faster response time at a lower cost. Driverless vehicles for example, are disruptive not only because of the engineering concept but also safety on the road.

Since global warming, climate change, rise in oil price and pollution has been a regularly discussed topic, scientist and proponent are becoming more concerned with, exponential energy. As a result, inventors and the general public are becoming more innovative in their pursuit for better carbon free environment. To tackle this challenge, car manufacturers are finding ways to switch completely from internal combustion engines (ICE) to solar powered and electric engines.

Consumers want cheaper and better alternatives to gas and fuel. Inevitably, the chemical industry tend to plays an important role in industrial innovation and competitiveness as a whole. Research and Development (R&D) and innovation are profoundly important in chemical problem solving in addressing the global challenges of global warming and climate change.

Today, solar powered and storage batteries are becoming the norm for charging devices that do not need cables or outlets to function. Many car companies such as Toyota have built cars fueled only by liquid hydrogen tanks. However, Toyota had also built C-MAX Solar Energi Concept car. Recently, Ford also built C-MAX Solar Energi Concept car with a solar panel roof that draws power from a special solar concentrator lens similar to a magnifying glass. By using renewable power, Ford C-MAX Solar Energi Concept is estimated to reduce the annual greenhouse gas emissions a typical owner would produce by four metric tons (Ford Motors 2014).

Recently, exponential energy is becoming popular in the mobile business. Companies are starting to embed mobile rechargers to prolong the battery life of mobile devices. Many of this mobile rechargers are solar powered.

Evidently, these technological advances are disruptive to the petroleum and energy business. People are finding ways to foster clean and safer environment.

## VI. LIMITATIONS OF THE STUDY

The cornerstone of this study is the lack of adequate or measurable definition of the distinction between disruptive innovations from others that are non-disruptive. Although, there are several limitations of this study the paper presents strong validity in terms of subject matter content based on literature review, the reliability of the research is somewhat difficult to measure.

Despite the widely accepted use and acknowledgement of the importance of IT for efficient supply chain management (SCM), the actual uses of IT in specific functions in the supply chain is still not fully explored. Most of the study is confined to published reviews of relevant literature on disruptive information technology and its use in global organizational setting across the supply chain, but the concepts of information technology in supply chain keep changing due to advances in technology. Due to this limitation, the objective of the study is to explore and illustrate the importance and benefits of information technology (IT) and the implementations of the digitally enabled global supply chain.

## VII. CONCLUSION

An imperative for digital innovation and engagement has emerged: businesses have already realized that they must use digital channels to engage with their key stakeholders to maintain relevance and drive the conversation. However, few realize how fast the change needs to happen, or how transformational it needs to be. The real imperative in a world where 'everything' is digitized is that businesses need to pursue innovation to disrupt their own business model before the competition does. Without innovation strategies, companies will lose their competitive advantage in an increasingly commoditized world. There is no time to lose, as technology change accelerates exponentially and new digital platforms and devices are emerging. Furthermore, the expectations of the new 'generation Y' or 'digital natives' mean that companies must keep up with the pace of change or lose relevance. (Ernst & Young 2011).

Several authors distinguished between high-end and low-end disruptive innovation, arguing that low-end disruption starts their life-cycle at low cost segments of the market while high-end disruptions are radical and therefore tend to compete with existing products and services by offering features that are distinctive. Markides (2006) suggests that a

distinction should be made between disruptive *business model innovations* and *product innovations*, as they are completely different in their impact on established firms. He also argues that the disruptive and the traditional model can coexist in some markets.

According to Selhofer, et al (2012), there is a controversial discussion about the right business strategy to address disruptive innovation, for instance whether first-movers are always those to benefit most, and how incumbents should deal with potentially disruptive technologies. Yet technology advancement continues to drive economic growth and, in some cases, unleash disruptive change. Economically disruptive technologies—like the semiconductor microchip, the Internet, or steam power in the Industrial Revolution—transform the way we live and work, enable new business models, and provide an opening for new players to upset the established order. Business leaders and policy makers need to identify potentially disruptive technologies, and carefully consider their potential, before these technologies begin to exert their disruptive powers in the economy and society. Digitization is a step change even greater than the internet. Exponential technology advances, greater consumer power and increased competition mean all industries face the threat of commoditization. The winners will act now, and build a strategic advantage that leaves their counterparts wondering what happened (Ernst & Young 2011).

Business leaders and policy makers need to identify potentially disruptive technologies, and carefully consider their potential, before these technologies begin to exert their disruptive powers in the economy and society. Manyika et.al. McKinsey Global Institute (2013). Disruptions are very hard to predict. Even with careful analysis it is really hard for industries to see trends in disruptions. They can happen at the business level, the process level, or the everyday life level. Either way, disruptive technology is here to stay. It could replace a person job, but it can also eliminate daily hardships in life and business. The challenge for businesses is to face the implications of digital change: in particular, the loss of control over the customer relationship, increased competition and threat of commoditization, and the need to engage digitally with suppliers, partners and employees in addition to customers. Digital disruption is ever changing, but it is very motivating and pushes the boundaries to better product and customer experience (Solis, 2014).

Technology disruption will change the traditional hierarchical nature of commoditized integrated industries, with modulation taking over the integrated business model at the latter stages of sustainable innovation. The businesses

that will profit are providers of modulated content in a mature market and the providers of new markets in the early stage of the product lifecycle. The nature of modulation will lead to a ‘dumb bell’ effect in the size of organizations, as medium sized enterprises and middle managers are replaced by efficiency innovations. This effect will create unemployment and a structural shift to businesses and organizations alike. (Sullivan 2015).

Companies today consider information technology (IT) as an effective tool to control and manage the complex supply chains as well as improving efficiency and logistic operations, while remaining responsive to changing customer demands and market situations. Advances in RFID and sensor technologies’ ability to communicate with each other in a network environment are redefining the concept of visibility throughout the supply chain. These “sense and respond” networks can help improve the security, quality, and integrity of products moving through the supply chain. Briggs, (2015).

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